

# UNEP Handbook for Drafting Laws on Energy Efficiency and Renewable Energy Resources

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# PREFACE

The UNEP Handbook for Drafting Laws on Energy Efficiency and Renewable Energy Resources is written in response to needs expressed by developing country energy law draftsmen to UNEP for assistance in drafting legislative provisions for promotion of energy efficiency and renewable energy, and particularly their environmental dimensions.

The Handbook is designed to be a user-friendly guide rather than a technical compendium or comprehensive collection of relevant legislation. The focus is on national legislation, but encompasses national constitutional provisions, regulations and state and local laws where they are the key determinants of the promotion of efficiency and renewable resources. Emphasis is placed on adaptation to local country needs and conditions.

The Handbook describes the key environmental and implementation issues associated with efficiency and renewable energy resources and presents legislative options from both developed and developing countries for dealing with them, including sample excerpts from legislation. Reference to the full text of legislation is provided.

The Handbook is not judgmental as to what is good or bad legislation, but rather identifies for each issue legislative options that frequently have been used to address the issue, leaving the draftsman to evaluate the usefulness and effectiveness of the presented options for his or her venue or situation. There often is an indication of how provisions worked in the jurisdictions where adopted.

The Handbook is divided into five sections. Section One sets forth the framework for energy resource management, placing energy efficiency and renewable energy in context among other available energy resources. This section also describes the materials covered in the Handbook. Section Two contains legislative information on issues of general application, pertinent to both efficiency and renewables. Section Three deals with energy efficiency laws in the various sectors of the economy. Section Four addresses legislation for each type of renewable energy. And Section Five deals with the special legal needs for bringing useful energy to rural areas in developing countries. The reader interested primarily in any of these topics can look them up in the Table of Contents and go to these materials in the Handbook.

It is the premise of the Handbook that the prime goal of most developing countries is to provide for their people adequate food supplies, housing, health care, clothing, education and jobs to foster economic development and that affordable, clean energy supplies are essential to accomplishing these goals.

# FOREWORD

Energy is essential for development. No developing society can hope to achieve economic sustainability without adequate energy supplies. Energy is needed for cooking, providing light, refrigerating food and medicine, supplying fresh water, eliminating household wastes and heating and cooling buildings. Education, health care, manufacturing goods, providing services, all require energy, as do transporting goods and people and every aspect of agriculture, from seeding and making and applying fertilizers and pesticides, to irrigation, crop collection and delivery to markets. Virtually every aspect of economic and social activity demands energy.

The unavailability of modern forms of energy to some two billion of the world's population, and inadequate supplies to an estimated additional two billion more people, is a major challenge to the achievement of the poverty, gender and health objectives of the UN Millennium Development Goals and the Plan of Implementation of the World Summit on Sustainable Development.

At the same time, energy generation using fossil fuels is the principal source of greenhouse gas emissions that are causing global warming. The mining and processing of fossil fuels can also endanger the lives of miners, cause severe land disruption and pollute land, air and waters. Furthermore, burning fossil fuels emits nitrogen and sulphuric oxides that are themselves toxic and are the precursors of urban smog and acid rain, while coal burning power stations are responsible for mercury emissions that bio accumulate in ecosystems, presenting a threat to human health as well as the environment.

Providing the energy essential for development while minimizing environmental hazards is one of the principal challenges of the twenty-first century. Energy efficiency offers perhaps the greatest potential to greatly reduce the amount of polluting energy needed to achieve current and future development targets. By eliminating waste, efficiency can often be accomplished at a profit or with a very short payback period of a year or two. Renewable energy, in the form of energy produced from solar, wind, sustainably managed hydro, geothermal and biomass resources, offers the potential to significantly displace the need for polluting fuels. These renewable resources are emphasized in the Plan of Implementation of the World Summit on Sustainable Development. It is on these resources of energy efficiency and renewables that this Handbook focuses.

Much has been written about the science, technology and policies for promoting energy efficiency and renewable energy. Little has been written about the legislation necessary to implement these technologies and policies that make them a reality in practice. This Handbook responds to the needs expressed by legislative draftsmen in developing countries for assistance in drafting legislative provisions for achieving these objectives. It will also be useful to decision makers in the energy sector who are the initiators of policies that will eventually translate into law. By promoting clean and efficient energy use at the legislative level, governments can ensure that all stakeholders have the opportunity and incentive to adopt new practices that will help to mitigate climate change and reduce pollution while keeping to the path of economic and social development.

Mr. Achim Steiner

EXECUTIVE DIRECTOR

UNITED NATIONS ENVIRONMENT PROGRAMME



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# SECTION ONE

## FRAMEWORK FOR ENERGY RESOURCE MANAGEMENT

**Richard L. Ottinger\***

### **A. Traditional Energy Resources**

Energy is essential for economic development. Its value is not intrinsic, however. Its value is in the services it can provide. In rural areas, these services consist primarily of creating heat for cooking food and warming homes in cold climates. It also can provide electricity for lighting homes and community centers, permitting nighttime reading and study for students; refrigeration to keep foods fresh and to permit safe storage of medicines; radios that can transmit educational and entertainment programs; transportation to bring agricultural goods to market and permit access to urban areas; and for agricultural irrigation. In more developed areas, energy services include electricity and direct use of fuels for running factories and businesses, electricity for home appliances, fuels for modern transport, etc.

Energy also is an essential ingredient in meeting the Millennium Development Goals of lifting the standard of living for the billions of the earth's population that now suffer abject poverty, live in unhealthy environments, lack basic health services, suffer gender inequality, and whose children lack primary education. Indeed, energy is required as the engine to support all economic and social development. Yet some two billion people today lack modern energy services and an additional two billion have grossly inadequate energy.

No form of energy is free from monetary and environmental costs. These costs may make certain energy supplies prohibitively costly or environmentally unacceptable. The challenge for achieving sustainable development is to select energy media and end-use technologies that are best suited to community needs, most affordable and least environmentally damaging. A brief discussion of prevailing energy resources (other than renewable and efficiency resources covered in Section B below), follows.<sup>1</sup>

1. **Firewood and Dung:** Poor rural areas generally do not have electricity today. The primary source of energy in these areas is animal dung and firewood for cooking, usually collected by women and children at great cost to their time, severely limiting the opportunity for women

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<sup>1</sup> Note that electricity is not an energy resource, but rather a product derived from energy resources. Electricity is produced through use of some of the various energy sources mentioned in paragraphs A and B



to perform more useful economic roles in society and for children to have the opportunity for education. The collection and burning of firewood and dung also has grave environmental consequences in depletion of forests and in pollution, particularly where the firewood or dung is burned in confined housing areas. Night lighting, if available at all, is provided through expensive, inefficient and polluting use of kerosene lamps. Plowing of land and pumping of drinking water generally utilizes inefficient human or animal power, and animal wastes are used as fertilizers.

2. **Coal:** Coal is available and widely used for energy in many developing and developed countries. Its widest use is for production of electricity and to power industrial production. In some countries, such as China, it is also used for cooking of food and heating homes. Where coal is available in a country, the high costs of importing other fuels are avoided. But coal also is the most environmentally hazardous of energy fuels. The burning of coal emits large quantities of sulfuric oxide pollutants that pose human health hazards and acid rain that destroys aquatic life; it emits nitrous oxides, also hazardous to health, that combine with solvents in the air to form urban smog, a principal cause of lung diseases; it emits mercury that when discharged into waters accumulate in fish and cause human brain damage; and it emits the largest quantities of carbon dioxide that is the principal cause of global warming. Also, the mining of coal is environmentally damaging. Deep mining of coal veins is very hazardous to the health and safety of miners. Mountain top mining devastates the land and ecology of affected areas. The pollutants from burning coal can be mitigated somewhat by washing the pollutants from the coal before burning. Much research is being done in developed countries to find ways to economically gasify coal, using the coal gas as a less polluting energy fuel and to remove and sequester the carbon dioxide from coal combustion.
3. **Oil:** Oil is used today primarily as a vehicle fuel, though in some places it also is used for production of electricity and as an industrial fuel. Oil combustion produces substantial emissions of sulfuric and nitrous oxides and carbon dioxide, though less than coal. As vehicle transportation increases, its pollutants have become a prime source of environmental and health hazards in much of the world. As the demand for oil increases in both developed and developing countries, the price of oil has increased dramatically in recent years, causing many non-producing developing countries to have to devote a large proportion of their hard currency to its importation. Recent studies indicate the supply of affordable oil has peaked and will continue to decline. Much of the world's remaining oil reserves are found in unstable Mid-Eastern countries, creating concerns about the security of future supplies. Oil production, pipeline and ship transportation also are vulnerable to terrorist interruptions.
4. **Natural Gas:** Natural gas, often found in conjunction with the exploration for oil, is a fossil fuel that has the pollution emissions of coal and oil, except to a lesser degree. Natural gas now is the fuel of choice in developed countries for production of electricity because of its relative economy and lower pollution problems. Natural gas also has begun to be used in bus fleets as a vehicle fuel. There has been some speculation in the trade press whether supplies of natural gas, though greater than oil, will be sufficient to fulfill the growing demand, and it is predicted that much of the supply in the future will have to come from liquefied natural gas (LNG) delivered by ship. Natural gas pipelines and ship terminals for liquefied natural gas are vulnerable to terrorist attacks. Indeed there is an active debate going on in the U.S. about the acceptability to port communities of establishing LNG delivery terminals because of the high risks involved.

5. **Nuclear:** Nuclear power is used primarily today for production of electricity. Its main advantage is that no carbon dioxide or other air pollutants are emitted from the operation of reactors, though a great deal of energy, generally from coal or oil with all their pollutants, is used to refine raw uranium into usable uranium oxides. The central environmental problem with nuclear plants is the lack of economical and safe disposal of radioactive nuclear wastes that are a bi-product of plant operations; they mostly are sequestered in spent nuclear waste pools of water maintained on the plant site. A relatively new way of storing the wastes in cement air-cooled dry casks above ground, after the spent fuel radioactivity has been somewhat reduced in pools, is now being widely adopted. A great deal of research, so far unsuccessful, has been devoted to permanent storage of the wastes. Also, nuclear plants are highly vulnerable to terrorist attacks. While the plants themselves are generally protected by vast cement domes, said by the industry to be able to protect them from a plane crash, the spent fuel pools, which contain much more radioactive material than the plants themselves, and the control rooms that can be used to shut down a plant, both are outside these containment vessels. Since most nuclear plants are built near population centers, the exposure to them of deadly terrorist attacks is great. Nevertheless, several countries, most notably France and Japan, are heavily dependent on nuclear power. A further environmental problem with the plants is that the huge amount of water they require is sucked in at rates that kill large numbers of fish and larvae; closed loop cooling towers need to be required to prevent this phenomenon. Yet another problem is the limited world supply of uranium. A revival of nuclear power plants is being discussed internationally because of their relative freedom from carbon dioxide emissions, but studies have shown that the supply of uranium may not be sufficient to support much of an expansion. Breeder reactors that reprocess the spent fuel into plutonium for use in further power production are operated in France, but they have not been shown to be economic and pose great weapons proliferation risks; the International Atomic Energy Agency has stated that there is no way to protect plutonium from weapons' diversion. Non-breeder nuclear reactors also run the risk of being used for the production of nuclear weapons, an active issue presently with Iran. Lastly, nuclear power plants usually are very large and expensive, thus beyond the means of many developing countries. Even in developed countries, nuclear plants are more expensive to operate than coal or gas-fired plants, the main reason that no new plants have been built in the United States for decades. And the plants require high levels of technical expertise to run safely, not usually available in developing countries.
6. **Hydrogen:** Hydrogen is a derived energy resource, obtained by the separation of hydrogen from water or natural gas. It is a completely clean fuel if used in a fuel cell and a very low polluting fuel if burned directly in an internal combustion engine. Much research presently is being done, primarily in Europe, on finding economical ways to produce hydrogen from renewable sources like solar or wind – an ideal combination since it would eliminate the problems of the intermittent nature of solar and wind power (what do when the wind or solar energy is insufficient). In the U.S., the automobile industry and the government are conducting considerable research on producing an effective and economic fuel cell system (which involves a chemical reaction and no combustion or related pollutants at all), but present predictions are that conclusion of this research will take around 20 years. It is surprising that so little attention is being paid to direct combustion of hydrogen for which the technology already exists. Hydrogen atoms are much lighter than those in gasoline, and thus vehicles would have

to carry greater quantities of hydrogen to go the same distance as they can on gasoline. An expensive delivery system would have to be established before a hydrogen economy for vehicles could be established. Such a system would be vulnerable to terrorist attacks the same as oil and gas pipelines are now. There is the possibility, however, that hydrogen could be produced on board vehicles. Hydrogen also could be used as a stationary source fuel.

Energy thus is essential for sustainable development. But at the same time, employment of traditional energy resources is the cause of the severe pollution that is asphyxiating city residents, particularly in the developing countries, killing their forests and lakes, poisoning their water supplies, and facing the world with the prospective catastrophes associated with global warming. Furthermore, these traditional energy sources are very expensive and are eroding the capital needed in developing countries to provide essential social services.

## B. Energy Efficiency and Renewable Energy

The Handbook focuses on Renewable Energy and Energy Efficiency because these are the most environmentally benign resources and often the most economic for developing countries. While still supplying only a small fraction of the world's energy service needs, they are by far the fastest growing energy resources. If selected at the outset, they can avoid the payment of duplicate costs of expensive traditional resources and then expensive cleanup of the pollution caused by these resources.

**Energy Efficiency.** Energy efficiency measures are a proven means to reduce dependence on traditional energy resources by using them more efficiently. With respect to electricity supply, for example, the typical power plant uses only 30% of its fuel for producing electricity; the remaining 70% of the fuel produces heat that generally is exhausted through tall stacks into the atmosphere. If the waste heat is used instead for additional power production, for industrial processes or for heating buildings, the efficiency of the fuel use can be more than doubled, often to as much as 70%. Similarly, an industry that uses large amounts of heat in its processing often can produce very low cost electricity in conjunction therewith. The technology for achieving these savings is called "combined heat and power" or "cogeneration." Building efficiency and appliance efficiency measures can save a large percentage of the fuel required for these large-consuming applications. Legislation dealing with these topics is covered in depth in the Handbook.

**Renewable Energy.** Energy from the light of the sun (photovoltaics) can be used to produce electricity. While the equipment is expensive, maintenance requirements are minimal and there are no fuel costs. They are far less costly for rural areas not covered by grid electricity than building new power plants and grid distribution systems. Energy from the heat of the sun (solar thermal) can be used economically to heat water and homes. Both these forms of solar energy also can be used in large arrays to produce central station power.

Energy from biomass (agricultural and wood wastes) is particularly advantageous for developing countries because local products and labor can be employed. Energy crops can be grown, as demonstrated in Brazil, to produce ethanol to fuel vehicles and industrial processes, avoiding the need to import oil.

Hydroelectric energy for electricity is the most widely used renewable energy resource today with many developing country applications. Construction of large hydroelectric dams has substantial problems of displacement of populations and agriculture and of siltation that diminish their usefulness over time. Decay of plant life in the dam reservoirs produces significant amounts of carbon dioxide. The effectiveness of the dams can be seriously impaired by droughts, leaving insufficient flows to produce expected electricity outputs, as demonstrated recently in Brazil where electricity had to be rationed because of drought-related water shortages. Still, hydropower produces no other pollutants, requires little maintenance and is often economically advantageous. Small dams and installation of turbines in fast-flowing rivers without the use of dams can be very advantageous, minimizing environmental problems. Where dams already exist, adding power generation also is attractive.

Geothermal energy from the heat of the earth, where available, can be used economically to produce hot water and steam for electricity.

Other more exotic forms of renewable energy still are in the research stage and are not yet economic. Examples are energy from ocean waves, tides and the temperature differential between deep and shallow ocean waters.

## **C. Handbook Organization**

The Handbook starts with a discussion of issues of general application, applying to all energy resources. While the market place will influence much of the transition required for adoption of efficiency measures and the use of renewable energy resources, government regulations are needed to accelerate this transition and to assure against economic disruptions during the transition. And the market place generally is inadequate to provide for the environmental, safety and health needs of society deriving from energy resources. The following is a summary of the issues covered in the Handbook. More specific information on requirements and legislative examples are included in the Handbook text.

### **Environmental Assessments.**

Environmental assessments (EAs), also referred by many countries as Environmental Impact Statements/Assessments, are an extremely valuable regulatory tool for requiring thorough evaluation of environmental impacts of energy projects that may have significant environmental consequences. Most countries have some requirement for them. EA legislative provisions for major projects usually require a preliminary assessment at the outset of a project and a final assessment before construction is permitted. The EA legislation generally requires performance of the EA by the entity proposing a project or sometimes by the government-permitting agency. Professional environmental engineers usually perform them. Consideration of alternatives to the proposed project and of measures to mitigate environmental impacts is included. Some provision for public hearings on the EAs also usually is required.

## 1. Disclosure and Public Participation

Consultation by the sponsor of an energy project or by the permitting government agency with the communities that will be affected often is required, as well as with all government agencies that may have responsibilities affecting the project. Community consultation is particularly important to assure that there will be public acceptance and cooperation with the project, especially important if the community will be expected to pay some or all of the costs of the project. Hearings on EAs provide a good vehicle for educating the public and eliciting community concerns.

Meaningful public participation requires access by the public to all information concerning the specifications, benefits and costs of a project. Many jurisdictions have legislative requirements for access to all pertinent information, often through petition to the permitting agency with judicial review of any information denial.

## 2. Enforcement

The best environmental and safety codes and standards are ineffective if a means of enforcement of them is not provided. Enforcement provisions may include the ability of the relevant agencies to grant, deny or specify conditions for granting permits for the project, to examine the project site during and after construction and to issue stop orders for projects found not to be complying with relevant laws. Provision for citizen suits to challenge allegedly illegal actions are particularly valuable because there often is political pressure to advance projects not meeting requirements that inhibits the relevant government agencies from taking enforcement actions. Allowance of attorney fees and court costs for meritorious citizen suit actions is helpful and can be legislatively provided.

## 3. Pricing

In jurisdictions where governments own and operate the energy facilities, energy prices are set by the relevant agency. In privatized systems, the relevant companies set their own prices in accordance with market conditions, but often subject to government regulation. In either case, it is important that, in making the decisions on selection of resources, accurate pricing systems be employed.

The pricing regulations discussed in the Handbook include most importantly the removal of subsidies. Subsidies distort the marketplace and make it impossible to make accurate price comparisons among resources. Legislative measures also have been adopted to require life-cycle costing (the cost of a resource over its useful lifetime). Use of life-cycle costing is particularly important for renewable resources like solar, wind and hydro where the initial capital cost tends to be large, but the lack of fuel costs and low maintenance costs make these resources more competitive over their useful life. Inclusion of externality costs (e.g. the costs to society of early deaths and of illnesses and the costs of environmental degradation) also can be mandated. These costs can be large, particularly for coal and oil, and ignoring them also distorts accurate cost comparisons. Some jurisdictions require what is known as "integrated resource planning (IRP)," where the appropriate government agency requires that before resources are acquired, competing resources be evaluated based on the costs and benefits of each, including life-cycle costs and externalities. Under privatization, measures need to be adopted to prevent fraud, collusion, corruption and monopolization.

#### 4. Education and Training

In the introduction of new energy technologies and the regulation of all technologies, legislation providing for the education and training of personnel making energy decisions at all levels needs to be provided. Governments usually provide these services either themselves or by contract with private experts. Sometimes the technology providers are required to provide education and training for operators and users.

#### 5. Regulatory Frameworks

In some jurisdictions, national, state, government agencies own and operate energy facilities, production, transmission and distribution. In these situations, legislation will be needed to impose environmental, safety, performance and pricing requirements on the relevant agencies. In countries providing for private ownership and operation of energy facilities, there are two principal methodologies for regulation: 1) command and control and 2) market-based regulations. Often a combination of both methodologies is used.

Command and control regulations require that certain energy equipment, performance, safety and environmental conditions be met, subject to penalties for failure to meet them. Examples covered include requirements for EAs, environmental regulations (e.g. providing limits on power plant pollution emissions), miles per gallon specifications for all vehicles sold within a jurisdiction, appliance efficiency standards, lighting standards motor standards and building efficiency codes.

Market-based provisions covered at the national level include taxes on pollution or carbon emissions (that can account for externalities of polluting fuels), incentives for renewable and efficiency resources, and emission trading "cap and trade" regulations under which a cap is placed on the level of emissions of specified pollutants and each polluting facility is allocated a specified emission allotment; then if a facility lowers its emission of the pollutant below its allocation, it can sell the resulting pollution allowances, or if its emissions exceed its allotment, it can purchase allowances from another facility that has available excess allotments. This cap and trade system permits pollution reductions at lower costs to the emitters.

Usually at the state or municipal level, regulation of electric energy is handled by a statutorily created Utility Regulatory Commission empowered to set rates where utilities are regulated and to set conditions for electricity sales where the utility system has been privatized. Some municipal governments have Energy Commissions that also set local energy policies.

#### 6. Energy Efficiency

More efficient utilization of existing energy resources can save energy and money. The energy savings reduce pollution. Standards have been adopted to achieve significant savings in industrial processes, most significantly through requirements for use of more efficient electric motors and through combined heat and power or cogeneration, utilizing the heat emissions from power plants either to produce additional electricity or for industrial hot water uses and domestic heating purposes; home appliances such as refrigerators, heating boilers, cook stoves

and computers; buildings through improved insulation, use of energy-efficient windows, and use of light-colored surfaces that reflect sunlight and heat; and in vehicles through requirements restricting vehicle sales to those achieving greater miles per gallon. Incentives also can be enacted to encourage sales of low-emission vehicles such hybrids propelled in part by electricity. Vehicle manufacturers can receive incentives to do research on new technologies such as hydrogen-propelled vehicles. Car-pooling incentives at factories and office buildings can save substantial energy, as can legislatively required subsidies for worker use of mass transportation and required payments for parking. Legislation to provide restricting specified highway lanes for use only by multi-occupant vehicles is another measure often adopted.

## **7. Renewable Energy**

Measures are covered to promote the use of hydroelectric energy, particularly small dams on rivers and turbines placed in fast-flowing rivers; solar energy both from use of the light of the sun to create electricity and from the heat of the sun to create hot water; biomass, the use of energy crops and agricultural wastes to produce fuels for both stationery sources and vehicles; and geothermal energy to tap the heat of the earth to produce steam for electricity production. Regulations to protect these sources, e.g. from building structures that may block sunlight from solar energy collectors also are discussed. Last, measures are covered to require utility accommodation of distributed generation resources

## **8. Rural Applications**

Rural areas without electricity grids have particular problems that are addressed. Measures are covered to promote the use of efficient cook stoves; rural applications of renewable energy resources to provide basic electricity services to communities that otherwise would not be served; rural electrification provisions to bring grid electricity to rural areas; use of agricultural wastes for energy. The importance of adopting firm regulatory goals for addressing rural energy needs is emphasized.

The chapters of the Handbook that follow provide a good deal of detail about the legislative measures outlined above, together with examples of and citations to laws from both developed and developing countries around the world. It is expected that this material will assist the drafters of energy laws in developing countries to strengthen their legal and institutional framework in this field.

# SECTION TWO

## Issues Of General Application

**Richard L. Ottinger\***

There are a number of legislative requirements important for environmental management of the energy sector that apply to all energy media, and these are particularly important for promotion of energy efficiency and renewable energy. The most significant of these requirements are provisions for Environmental Assessments (EAs, also sometimes called Environmental Impact Statements). EAs may include requirements for disclosure, community and public involvement and enforcement (though these requirements sometimes are contained in separate legislation). Other issues of general application important to energy efficiency and renewable energy are education and training and accurate pricing.

### A. Environmental Assessments

#### **What are the options for Environmental Assessment (EA) coverage and requirements?**

Environmental assessments (EAs) provide information to all parties with an interest on project impacts on the environment, including alternatives that may achieve the project objectives while alleviating or eliminating such impacts, and means of mitigating impacts. Done well, EAs offer objective comparisons of the costs and benefits of energy resources capable of meeting developmental and social needs. For energy efficiency and renewables, they take account of the fact that these resources require no fuel for their functioning over their lifetime and produce no operational pollutants. See an example here:

**United States:** National Environmental Policy Act (NEPA) (1982), CEQ Regulations, Sec. 1502.1: Purpose. -The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses.

Statute and regulations at <http://ceq.eh.doe.gov/nepa/nepanet.html>.

\* See bio sketch in Section One.



EAs are very important to the determination of whether traditional fuels or renewable or efficiency resources will be used. The decision on whether to build a new coal-fired power plant or instead to invest in efficiency and renewable energy measures may often be greatly influenced by the comparative environmental impacts as disclosed by and EA.

EAs may be required in national, state or municipal legislation for their own projects and/or private projects that may have a significant effect on the environment. They may be required only for “major” projects or projects over a stated dollar amount. More restrictive requirements result in fewer projects that will be covered by EAs. On the other hand, less restrictive requirements may result in proliferation of expensive EAs for small projects.

### **Belize Environmental Law, PART V Environmental Impact Assessment**

20. -1 Any person intending to undertake any project, program or activity that may significantly affect the environment shall cause an environmental impact assessment to be carried out by a suitably qualified person, and shall submit the same to the Department for evaluation and recommendations.
- (2) An environmental impact assessment shall identify and evaluate the effects of specified developments on-
- (a) human beings;(b) flora and fauna; (
  - (c) soil;
  - (d) water;
  - (e) air and climatic factors;
  - (f) material assets, including the cultural heritage and the landscape;
  - (g) natural resources;
  - (h) the ecological balance;
  - (i) any other environmental factor which needs to be taken into account.
- (3) An environmental impact assessment shall include measures that a proposed developer intends to take to mitigate any adverse environmental effects and a statement of reasonable alternative sites (if any), and reasons for their rejection.
- (4) Every project, program or activity shall be assessed with a view to the need to protect and improve human health and living conditions and the need to preserve the reproductive capacity of ecosystems as well a the diversity of species.
- (5) When making an environmental impact assessment, a proposed developer shall consult with public and other interested bodies or organizations.

- 6) The Department may make its own environmental impact assessment and synthesize the views of the public and interested bodies.
  - (7) A decision by the Department to approve an environmental impact assessment may be subject to conditions which are reasonably required for environmental purposes.
  - (8) Any exercise of the powers of the Department under subsections (6) and (7) is an exercise of a disaster preparedness related power within the meaning of § 13 (1) of the Disaster Preparedness and Response Act.
21. The Minister may make regulations prescribing the types of projects, programs or activities for which an environmental impact assessment is required and prescribing the procedures, contents, guidelines and other matters relevant to such an assessment.

Full text at: <http://www.belizeaw.org/lawadmin/index2.html>.

See also:

**Brazil - Constitution of the Federal Republic of Brazil, Article 225.**

All have the right to an ecologically balanced environment, which is an asset of common use and essential to a healthy quality of life, and both the Government and the community shall have the duty to defend and preserve it for present and future generations.

Paragraph 1, section IV - in the manner prescribed by law, for the installation of works and activities which may potentially cause significant degradation of the environment, a prior environmental impact study, which shall be made public;

Full text at <http://www.senado.gov.br/bdtextual/const88/const88i.pdf>

**United States:** National Environmental Policy Act (NEPA) (1982), CEQ Regulations, Sec. 1502.1: Purpose. -The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that the policies and goals defined in the Act are infused into the ongoing programs and actions of the Federal Government. It shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives that would avoid or minimize adverse impacts or enhance the quality of the human environment. Agencies shall focus on significant environmental issues and alternatives and shall reduce paperwork and the accumulation of extraneous background data. Statements shall be concise, clear, and to the point, and shall be supported by evidence that the agency has made the necessary environmental analyses.

Statute and regulations at <http://ceq.eh.doe.gov/nepa/nepanet.html>.

For other country examples of EA requirements See:

- Philippines: <http://www.denr.gov.ph/policy/2003/dao2003-30.pdf>.
- European Union: <http://europa.eu.int/comm/environment/eia/eia-legalcontext.html#legalcontext>
- South Africa: <http://www.polity.org.za/html/govdocs/legislation/1998/act98-107.html>; amended: [http://www.environment.gov.za/Polleg/Legislation/2004Jun23\\_1/Amended%20Bio%20Bill%20Act%202004\\_1.pdf](http://www.environment.gov.za/Polleg/Legislation/2004Jun23_1/Amended%20Bio%20Bill%20Act%202004_1.pdf)

### **Uganda Petroleum Supply Act (2003)**

Supplement No. 8 to The Uganda Gazette No. 51 Volume XCVI, 20th October, 2003. PART VIII—PROTECTION OF PUBLIC SAFETY AND THE ENVIRONMENT.

33. Environmental impact assessments.

- (1) The Commissioner shall act as the “lead agency” within the meaning of the National Environment Statute, 1995, in the process of conducting environmental impact assessments and audits and implement other requirements for environmental protection in the supply chain, in accordance with the applicable laws.
- (2) The Commissioner shall prepare a classification of petroleum operations and projects and, in consultation with the National Environment Management Authority, prepare guidelines for environmental impact assessments and audits, but where appropriate, may continue with the guidelines for the time being in force.
- (3) The Commissioner shall, periodically, inform the Committee and seek its opinion about the preparation of, or changes in, the classifications and guidelines referred to in subsection (2).
- (4) Where environmental impact assessments or audits are performed or required or other conditions are to be met by the holder of a permit or license in accordance with the laws applicable to public health, public safety and the environment, the Commissioner shall co-ordinate with the National Environment Management Authority and other appropriate authorities under the relevant laws and assist the holder in the fulfillment of those requirements.

Some jurisdictions require different levels of assessments depending on the significance of the environmental impacts.

See: Australia’s hierarchy of requirements:

**ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999 - SECT 87**

Minister must decide on approach for assessment, Minister must choose one assessment approach

The Minister must decide which one of the following approaches must be used for assessment of the relevant impacts of the action: (a) assessment by an accredited assessment process; (b) assessment on preliminary documentation under Division 4; (c) assessment by public environment report under Division 5; (d) assessment by environmental impact statement under Division 6; e) assessment by inquiry under Division 7.

Full text at <http://www.deh.gov.au/epbc>.

EA legislation may require that the assessments be performed by the sponsoring agency, a government agency, or by a private consultant independent of the project sponsor. If performed by the sponsoring agency, it may be legislatively required to employ an independent consultant who may have to be approved by an applicable regulatory agency. The objectivity of an EA will be affected by the selection requirements.

EA legislation may require assessment of whether pollution resulting from the project will meet applicable pollution standards and the extent and precise nature of damage that the project may cause to human health and the environment.

In some jurisdictions, the laws provide that the impacts on certain segments of the population be considered, or even the impacts on population itself. Thus, in the Philippines, specific consideration is required of the impact on indigenous communities, on women and on population growth as follows:

**Philippines: DENR Administrative Order No. 96-37 December 02, 1996****A. Environmentally Critical Projects****Section. 1.0 Objectives of Scoping**

- j. For projects located in ancestral lands or domains, as defined under DAO No. 2, series of 1993, or subsequently by law, of indigenous communities, a specific chapter in the socioeconomic impact assessment shall be devoted to a discussion of indigenous peoples' concerns and possible socio-economic, political and cultural impacts of the proposed project on such people.
- k. For projects or undertakings with significant impact on women, a specific chapter in the socio-economic impact assessment shall be devoted to a discussion and consideration of gender issues.
- l. For projects or undertakings with significant impact on population, a specific chapter on the socio-economic impact assessment shall be devoted to a discussion of the relationship among population, development, and the environment. Some or all of the foregoing items may, when appropriate, be presented in a format using the checklist approach.

Full text at: [http://www.oneocean.org/download/db\\_files/denr\\_ao\\_96-37.pdf](http://www.oneocean.org/download/db_files/denr_ao_96-37.pdf).

EA legislation may require consideration of the cumulative impacts of the project combined with the impacts of other projects in the geographical area (e.g. a number of industrial or power projects on the same stretch of a river)

EA legislation may require consideration of and comparisons to alternatives to the project (e.g. different site locations or use of different technologies). They may require the assessment of measures to mitigate the impacts of a project. More extensive scope requirements provide greater assurance that all environmental impacts will be covered, but they also can add considerably to the cost of and delays of a project.

## B. Disclosure and Public Participation

### How can full disclosure and meaningful public participation be assured?

Public participation in projects is essential. For example, If a project is proposed to put a solar collector in a community with the expectation that the community will pay for the whole or part of the costs of it over some period of time, the project will be doomed to failure if the people in the community have not been thoroughly informed of the costs, benefits and operation of the device. They must have agreed that the project will satisfy their perceived needs and that they will participate, contribute to payment of the costs and perhaps perform simple maintenance.

Public participation may be achieved through legislation requiring public educational meetings and hearings before, during and/or after the project is initiated. It also is usual for Environmental Assessment legislation to include requirements for public hearings and that the sponsoring agency publishes the EA results and permits public comments on them for a given period of time. See: the U.S. regulations with respect to public comments and public involvement:

#### United States CEQ Regulations

##### Section. 1503.1 Inviting comments.

(a) After preparing a draft environmental impact statement and before preparing a final environmental impact statement the agency shall:

Obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved or which is authorized to develop and enforce environmental standards.

##### Request the comments of:

- (i) Appropriate State and local agencies which are authorized to develop and enforce environmental standards;
- (ii) Indian tribes, when the effects may be on a reservation; and
- (iii) Any agency that has requested that it receive statements on actions of the kind proposed.

Request comments from the applicant, if any.

Request comments from the public, affirmatively soliciting comments from those persons or organizations that may be interested or affected.

Sec. 1506.6 Public involvement.

**Agencies shall:**

- (a) Make diligent efforts to involve the public in preparing and implementing their NEPA procedures.
- (b) Provide public notice of NEPA-related hearings, public meetings, and the availability of environmental documents so as to inform those persons and agencies who may be interested or affected.

Full text of laws and regulations at: <http://ceq.eh.doe.gov/nepa/nepanet.html>

Some jurisdictions require that the sponsoring agency address these comments, see: the Netherlands' requirement:

**Netherlands Environmental Law**

**§7.6 Section 7.24** - Any person may make comments on an environmental impact statement during a public hearing, which shall be held at a time and place fixed by the competent authority for that purpose. The competent authority shall publish the time and place of the public hearing at least two weeks beforehand.

**Section 7.26** - The Committee shall take the comments and Recommendations submitted in accordance with Sections 7.23, 7.24 and 7.25 into consideration in its report.

Full text at <http://www.minvrom.nl/international>.

Similarly the City of Shenyang, China passed an ENVIRONMENTAL PUBLIC PARTICIPATION LAW in 2004 requiring a transparent public EA process. The law requires the solicitation of public comments and responses thereto. Other cities in China are now considering similar provisions.

See: <http://www.cecc.gov/pages/roundtables/012703/rohanShenyang.php>.

The Ukraine passed a particularly stringent public participation law. The Ukraine Law on Protection of Natural Environment (1991) provides for procedural rights of access to information, public participation and judicial review. The public can participate by sending written comments, proposals and recommendations and even by including public experts on expert commissions. With the aim of taking public opinion into account, the developer or responsible state body must conduct public hearings and the conclusions of the agency must take into account public opinion and must be made publicly available. See: <http://faolex.fao.org/docs/texts/ukr45101.doc>.

And in some jurisdictions, the agency may even require remediation of the impacts revealed by the EA. See:

### **Netherlands Environmental Law**

**§7.9 Section 7.39** - The competent authority that has taken a decision, in the preparation of which an environmental impact statement was drawn up, shall investigate the effects of the activity concerned on the environment, either during or after its completion.

**Section 7.42(1)** - If it appears from the investigation referred to in Section 7.39 that the effects of the activity are considerably more damaging to the environment than was anticipated when the decision was taken, the competent authority shall take such measures at its disposal as it sees fit in order to limit the said effects as much as possible or to remedy them.

Full text at <http://www.minvrom.nl/international>.

In order to have meaningful public participation, the public needs full access to all available information concerning the project. Legislation thus can provide a right for any person to access government information concerning a project, including records and communications and private contracts with government agencies, subject to the exclusion of proprietary information. The right may be accessed by petition and denial of any information can be subject to judicial review. State and local governments may have similar legislation. The scope of the access to information may be limited to exclude matters relating to national security and personnel. For U.S. Freedom of Information Act, see [www.usgs.gov/foia/](http://www.usgs.gov/foia/).

There even is an international treaty declaring a right to access of government information, The Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention). The Aarhus Convention is a new kind of environmental agreement that links environmental rights and human rights. The Aarhus Convention declares the relationship between people and governments in environmental matters, especially access to information, public participation in decision-making and access to justice.

See: Aarhus Convention:

### **AARHUS CONVENTION ON ACCESS TO INFORMATION, PUBLIC PARTICIPATION IN DECISION-MAKING AND ACCESS TO JUSTICE IN ENVIRONMENTAL MATTERS (EU June 1998)**

#### **Article 1 - OBJECTIVE**

In order to contribute to the protection of the right of every person of present and future generations to live in an environment adequate to his or her health and well-being, each Party shall guarantee the rights of access to Information, public participation in decision-making, and access to justice in environmental matters in accordance with the provisions of this Convention.

Full text at: <http://www.unece.org/env/pp/documents/cep43e.pdf>

See also: <http://www.participate.org/convention/Arhus-convention.pdf>.

## C. Enforcement

### How can environmental requirements be enforced?

In some jurisdictions sponsors are required to remedy environmental problems revealed by EAs, as indicated in the Netherlands' statute cited above. Most often, however, environmental requirements and enforcement provisions are found in specific legislation providing standards for emissions of air, water, toxic and other pollutants, storage and cleanup requirements, etc. Legislation can require inspection of project facilities, monitoring of compliance by the appropriate government agency and meaningful fines for violations or even criminal sanctions for intentional infractions that endanger people's lives. Requirements of periodic publication of the nature and quantity of toxic emissions can be included. It is important that sufficiency of government agency action is reviewable in the courts and that legislation provide for injunctive relief as well as penalties. Authorization for citizens to sue government agencies to enforce compliance with environmental laws has been very effective in the United States.

#### **Belize Environmental Law, Part V. Environmental Assessments**

22. Every person who fails to carry out an environmental impact assessment as required under this Act or any regulations made there under, commits an offence and shall be liable on summary conviction to a fine not exceeding twenty five thousand dollars or to imprisonment for a term not less than six months and not exceeding five years, or to both such fine and imprisonment. Full text at: <http://www.belizelaw.org/lawadmin/index2.html>.

#### **Ukraine LAW OF UKRAINE ON ENERGY SAVING (Enacted by the Resolution of the Supreme Council of Ukraine N 75/94 of July 7, 1994)**

**Article 17.** Economic sanctions for wasteful fuels and energy use Economic sanctions shall be imposed on legal and physical entities for: (a) wasteful use and direct fuels and energy losses; (b) ill-timed conducting expert examination of fuels and energy use; (c) non-fulfillment or ill-timed fulfillment of state management bodies' directives aimed at improving situation with wasteful and careless fuels and energy use. Amounts of economic sanctions shall be fixed in keeping with the legislation of Ukraine.

#### **Part IV. ENERGY SAVING EXPERT EXAMINATION**

**Article 21.** Compulsory state energy saving expert examination. State energy saving expert examination shall be compulsory in the process of legislative, investment, management and other activities connected with extraction, processing, transportation, storage, production and use of fuels and energy.

**Article 22.** Objects of state energy saving expert examination. Objects of state energy saving expert examination shall be as follows: (a) draft plan for development and productive forces distribution, draft projects for development of national economy branches, local plans for



**Contd...**

energy supplying, other pre-plan and pre-design documents; (b) energy technological part of feasibility study and design for building of new and expansion (reconstruction, technical equipment, modernization) of existing objects and enterprises with annual fuels and energy consumption evaluated in conventional fuel equal to 1000 and more tones.

**Article 23.** State energy saving expert examination. Main tasks of the state energy saving expert examination shall be as follows: (a) study of suitability of management, investment and other activities to energy saving aims; (b) study of suitability of pre-plan, pre-design, design and other decisions to terms stipulated in the legislation on the energy saving, current energy standards and norms; (c) making expert decisions as to energy consumption and energy saving programs and projects.

**Article 24.** Compulsory fulfillment of orders and decisions of the state energy saving expert examination. Full text available at: <http://www.munee.org/go.idecs?c=12>

See: re enforcement:

Citizen suit authorization for enforcement environmental laws including EAs can be a very effective means of enforcement, particularly since sometimes government regulators are often reluctant to bring actions against regulated parties with whom the regulating agency develops close relationships. In these statutes, affected citizens or citizen groups may be extended the right to sue and be allowed to collect attorney's fees either for successful actions against a project or in some jurisdictions just for raising substantial environmental, health and/or safety issues in a litigation even if they do not prevail.

See: re the citizen suit provision in the United States Clean Water Act:

## **United States – Clean Water Act**

### **Section 505, 33 U.S.C. 1365**

Except as provided in subsection (b) of this section and section 309(g)(6), any citizen may commence a civil action on his own behalf- (1) against any person (including (i) the United States, and (ii) any other governmental instrumentality or agency to the extent permitted by the eleventh amendment to the constitution) who is alleged to be in violation of (A) an effluent standard or limitation under this Act or (b) an order issued by the Administrator or a State with respect to such a standard or limitation, or (2) against the Administrator where there is alleged a failure of the Administrator to perform any act of duty under this Act which is not discretionary with the Administrator. The district courts shall have jurisdiction, without regard to the amount in controversy or the citizenship of the parties, to enforce such an effluent standard or limitation, or such an order, or to order the Administrator to perform such act or duty, as the case may be, and to apply any appropriate civil penalties under section 309(d) of this Act.

(d) The court, in issuing any final order in any action brought pursuant to this section, may award costs of litigation (including reasonable attorney and expert witness fees) to any prevailing or substantially prevailing party, whenever the court determines such award is appropriate. The court may, if a temporary restraining order or preliminary injunction is sought, require the filing of a bond or equivalent security in accordance with the Federal Rules of Civil Procedure

Full text at: <http://www.assembler.law.cornell.edu/uscode/33/ch26.html>.

See judicial review provisions:

### **United States: Administrative Procedures Act, 5 USC Sec. 552:<sup>2</sup>**

#### § 702. Right of review

A person suffering legal wrong because of agency action, or adversely affected or aggrieved by agency action within the meaning of a relevant statute, is entitled to judicial review thereof. An action in a court of the United States seeking relief other than money damages and stating a claim that an agency or an officer or employee thereof acted or failed to act in an official capacity or under color of legal authority shall not be dismissed nor relief therein be denied on the ground that it is against the United States or that the United States is an indispensable party. The United States may be named as a defendant in any such action, and a judgment or decree may be entered against the United States: Provided, That any mandatory or injunctive decree shall specify the Federal officer or officers (by name or by title), and their successors in office, personally responsible for compliance. Nothing herein (1) affects other limitations on judicial review or the power or duty of the court to dismiss any action or deny relief on any other appropriate legal or equitable ground; or (2) confers authority to grant relief if any other statute that grants consent to suit expressly or impliedly forbids the relief which is sought.

#### **§ 706. Scope of review**

To the extent necessary to decision and when presented, the reviewing court shall decide all relevant questions of law, interpret constitutional and statutory provisions, and determine the meaning or applicability of the terms of an agency action. The reviewing court shall -

- (1) compel agency action unlawfully withheld or unreasonably delayed; and
- (2) hold unlawful and set aside agency action, findings, and conclusions found to be - (A) arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law; (B) contrary to constitutional right, power, privilege, or immunity; (C) in excess of statutory

<sup>2</sup> The Administrative Procedure Act authorizes judicial review of an agency action such as failure to perform a mandatory EIS/EIA.

jurisdiction, authority, or limitations, or short of statutory right; (D) without observance of procedure required by law; (E) unsupported by substantial evidence in a case subject to sections 556 and 557 of this title or otherwise reviewed on the record of an agency hearing provided by statute; or (F) unwarranted by the facts to the extent that the facts are subject to trial de novo by the reviewing court. In making the foregoing determinations, the court shall review the whole record or those parts of it cited by a party, and due account shall be taken of the rule of prejudicial error.

Full text at: [http://www.lawlibrary.rutgers.edu/libguide/8\\_admin.html](http://www.lawlibrary.rutgers.edu/libguide/8_admin.html).

## D. Pricing

### How should the prices of energy resources be accurately assessed?

To be accurately assessed and compared, the full cycle costs of each resource should be compared including costs of extraction and equipment manufacture, fuel cost, operational costs and waste disposal and land restoration where applicable.

Subsidies that lower the true price of the resource should be added back in.

Life-cycle costs should be utilized, not just initial costs. Thus the lack of fuel costs over the life of a renewable energy or energy efficiency projects should be considered when comparing them to the costs of projects using traditional fuels.

EAs may mandate that the entire cycle of project impacts be considered from the impacts of equipment production to the impacts of waste disposal at the end of a project. The United Nations and its World Bank now require full cost accounting of proposals and projects, as do a number of U.S. states. The State of Maine's requirement is a good example.

#### **Maine Statutes, Title 5, §1764, Life-cycle costs**

1. Bureau of General Services to adopt rules and procedures. The Bureau of General Services shall adopt rules, including energy conservation guidelines that conform as a minimum to the energy efficiency building performance standards adopted by the Department of Economic and Community Development for conducting an energy-related life-cycle costs analysis of alternative architectural or engineering designs, or both, and shall evaluate the efficiency of energy utilization for designs in the construction and lease of public improvements and public school facilities.
2. Life-cycle costs. Any life-cycle costs must include:
  - A. The reasonably expected energy costs over the life of the building, as determined by the designer, that are required to maintain illumination, power, temperature, humidity and ventilation and all other energy-consuming equipment in a facility.

- B. The reasonable energy-related costs of probable maintenance, including labor and materials and operation of the building, replacement costs over the expected life of the facility and any other ownership cost issues identified by the Bureau of General Services; and
  - C. A comparison of energy-related and economic-related design alternatives. The Bureau of General Services may direct the designer to select, include and develop life-cycle costs for any viable alternatives that should be considered.
3. Determination of life cycle costs. To determine the life-cycle costs, the Bureau of General Services shall adopt rules that include but are not limited to:
- A. The orientation and integration of the facility with respect to its physical site;
  - B. The amount and type of glass employed in the facility and the directions of exposure;
  - C. The effect of insulation incorporated into the facility design and the effect on solar utilization to the properties of external surfaces;
  - D. The variable occupancy and operating conditions of the facility and subportions of the facility; and
  - E. Energy consumption analysis of the major equipment of the facility's heating, ventilating and cooling system, lighting system, hot water system and all other major energy-consuming equipment and systems as appropriate. This analysis must include:
    - (1) The comparison of alternative systems;
    - (2) A projection of the annual energy consumption of major energy-consuming equipment and systems for a range of operations of the facility over the life of the facility; and
    - (3) The evaluation of the energy consumption of component equipment in each system, considering operation of the components at other than full or rated outputs.

Full text at <http://janus.state.me.us/legis/statutes/5/title5sec1764.pdf>

See: Re life cycle cost requirement: Externality costs should be included for the full cycle from extraction to waste disposal for each resource. Recent studies have estimated the costs to society from power plant pollution. While these figures lack absolute precision, they are far better than ignoring the costs altogether which has the effect of allotting them a clearly inaccurate zero value. Tariffs on import of technologies and materials need to be eliminated from calculations.

## E. Education and Training

### How can education and training be provided for?

Education of the public is vital to let the people affected know the costs and benefits of energy efficiency and renewable energy measures proposed for adoption, to build the political support necessary for enactment of appropriate legislative measures; and to inform them of the options available to them, such as residential energy audits, insulation, purchase of compact fluorescent light bulbs and efficient appliances, and the financial mechanisms available to make these measures affordable. This educational process really should start at the primary and secondary school level and continue as a part of professional and technical training for those whose jobs will involve energy related-decisions.

Education is particularly important for architects<sup>3</sup>, engineers, builders, commercial enterprise managers, trades people, and government officials at all levels, to inform them of the requirements of laws that have been adopted to promote carbon dioxide reductions and the costs and benefits of the measures they can take either voluntarily or pursuant to legal requirements. It is important that retail sales staff, contractor installers and maintenance/service personnel understand the benefits of efficient products and processes and can personally benefit from promoting these products to end users.

Much of this education must be conducted or contracted by governments, creating a legislative framework for this task and appropriating the funds for appropriate staff to do mailings, conduct workshops and conferences, and use the media to educate the relevant stakeholders and the public. As commercial enterprises learn of the economic advantages of measures that can be profitable for them, they also will participate in the educational efforts. NGOs advocating for the clean energy measures available also perform an important part of the educational efforts. Many NGOs have created Internet sites and list services to inform advocates and the public of renewable and efficiency resource opportunities and advantages. Political leaders can play an important educational role as well.

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<sup>3</sup> The usual means of compensating architects and engineers worldwide, as a percentage of building and equipment costs, has the perverse incentive of discouraging least cost solutions. It has been estimated that this incentive design has led the U.S. to misallocate about \$1 trillion in air conditioning equipment and the energy needed to operate it than had the buildings been optimally designed to produce the same or better comfort at least cost. Lovins, A. & L.H., *Making Sense and Making Money*, Rocky Mountain Institute (November 13, 1997) at p. 18.

### **Armenia's law on Energy Saving and Renewable Energy**

#### **Article 10. Training and Education in the Area of Energy Saving and Renewable Energy**

For the purposes of organization of education and training in the area of energy saving and renewable energy, the responsible Government department in the area of education shall:

- a. Incorporate energy saving and renewable energy classes in the curricula of elementary, secondary, graduate, supplementary and post-graduate education institutions, plan appropriate research-methodical activities;
- b. Develop educational programs for the training of engineering staff on energy saving and renewable energy basics and technologies.

#### **Article 11. Energy Saving And Renewable Energy Propaganda**

Information dissemination on the energy saving and renewable energy by the authorized bodies of the government shall be implemented through:

- a. Public hearings/discussions on energy saving and renewable energy area objectives; and broadcasting and propaganda of their environmental, economic and social benefits;
- b. Information on the existing energy efficient energy devices and energy efficiency pilot/model projects;
- c. Organization of exhibitions of energy saving technologies, machinery and energy devices;
- d. Propaganda of the national requirement for and purposefulness of the efficient use of energy resources and development of renewable energy.

Source: [http://www.munee.org/media\\_center/files/Eng\\_ES&RE\\_Law\\_041204.doc](http://www.munee.org/media_center/files/Eng_ES&RE_Law_041204.doc)

## **F. Conclusion**

Environmental Assessments are crucial for identifying the environmental impacts of any project and for obtaining public participation in the approval process. This chapter describes the options for the requirement, scope and implementation of such assessments.

# SECTION THREE

## ENERGY EFFICIENCY

### CHAPTER A. INTRODUCTION TO ENERGY EFFICIENCY

**Richard L. Ottinger\***

Energy efficiency is assuredly the most effective and economically advantageous means to provide the services desired by energy users. Energy efficiency is the ability to provide the same (or higher) level of energy services, such as thermal comfort, high-quality lighting, etc. at lower energy consumption and cost. Energy efficiency measures in the end use, manufacturing and transmission of electricity replace the need for fossil fuel resources and virtually always produce a net economic benefit, which is often substantial. Efficiency measures also can reduce the great costs and risks of dependence on oil imports.

Many of the products required for efficiency measures can be produced domestically and have the potential for substantial export marketing. Moreover, by improving the efficiency of industrial processes, such measures often result in enhanced competitiveness of domestic production in our global economy.

This section will deal with energy efficiency legislation to save energy use in industry, transport and commerce; consumer products and buildings.

It has been calculated that 60% of all primary energy used is lost in various stages of conversion and use, and that over 60% again is lost or wasted at the end-use stage.<sup>4</sup> The IPCC in 1998 made a similar calculation, finding that almost 71% of all primary energy used is wasted.<sup>5</sup> Energy efficiency measures can economically avoid a large percentage of this waste.

For example, cogeneration, also called combined heat and power (CHP), capturing the waste heat from power or industrial boilers to meet other energy needs or using industrial waste heat to generate electricity, can economically double plant efficiency, thus saving substantial amounts of both energy and money. The overall efficiency of energy use in CHP can be up to 80% as compared to only 30-40% of a fossil fuel fired conventional power plant. Along with the saving of fossil fuels, cogeneration also allows for significant reduction of greenhouse gas emissions, particularly carbon dioxide, and other harmful air pollutants.

In terms of reducing the need for developing countries to import oil, however, by far the greatest savings can be achieved in the transport sector. And perhaps the most dramatic example of the potential of transport efficiency occurred in the United States, where vehicles consume 70% of the

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\* See bio sketch in Section One.

<sup>4</sup> Nakicenovic, N. et al (Eds.), *Global Energy Perspectives*, Cambridge University Press for IASA, Luxembourg and World Energy Council (London 1998).

<sup>5</sup> <http://www.ipcc.ch/pub/reports.html>; <http://www.ciesin.org/TG/HDP/ipcc.html>

oil, in response to the 1973 Arab boycott of oil exports to the United States that caused soaring gasoline prices and long lines at the gas station pumps. The U.S. Congress then passed legislation mandating corporate average fuel efficiency (“CAFÉ”) standards for all vehicles sold in the United States. The CAFÉ standards required that the corporate average fuel efficiency of all passenger cars produced by any manufacturer for sale in the U.S. be no less than 27.5 miles per gallon, and for light trucks, 20.7 miles per gallon, with heavy penalties for compliance failure.

The results from 1977-1985, were that, while U.S. GDP rose 27%, oil use fell 17%, net oil imports fell 50% (by 4.28 million barrels a day – 72% greater than US imports from the Persian Gulf), and gross imports from the Persian Gulf fell by 87%. That saving took away from OPEC one-seventh of its market. The entire world oil market shrank by one-tenth. OPEC’s output fell by 48%, breaking its pricing power for a decade. If the U.S. had continued to achieve such rapid oil savings starting in 2000, then Persian Gulf net imports (at the 2000 rate), would have been entirely displaced in 28 months – in other words, the U.S. could have been free of Persian Gulf imports by now. The most important part of these 1977-85 oil savings came from a 7.6-mpg improvement in new domestically sold cars. On average, each new car used 20% fewer gallons, achieving 96% of that efficiency from smarter design and only 4% from smaller size. Contrary to fears expressed by the automobile industry, neither auto safety nor auto prices were affected.

And those results can readily be duplicated now. In the U.S. If 27% of cars in 2000 were the popular 48-49-mpg hybrid-electric models, or 15% were ultra-light hybrid SUVs, they could displace Gulf imports. By giving the owner of an average 1990 car (23mpg) a \$4,900 rebate – 4 times on average the trade-in value – for scrapping it and replacing it with a new \$21,000, 48-mpg, 5-seat compact hybrid car, its owner would save enough gasoline to repay the rebate over its life at \$1.25 a gallon. And since Lovins wrote in 2003, the second generation Toyota hybrid cars now achieve 61-mpg, and the cost of gasoline is above \$2.00 per gallon, making the economic return that much quicker.

Similar savings to scale in vehicle fuel use can be achieved by adopting vehicle fuel efficiency standards in any country. China recently legislated fuel efficiency standards far more stringent than the U.S. CAFÉ standards. Countries, such as South Korea and Australia, also have used fuel consumption labeling programs as a way to enable consumers to make informed efficiency and savings vehicle purchase choices. At the state level, California adopted a first-of-its-kind law requiring labeling and fuel efficiency standards for all replacement tires sold in the state to help cars run further on less fuel<sup>6</sup>.

While vehicle efficiency standards can be the quickest method of reducing our dependence on traditional fuels with proven technology, they are not by any means the only proven energy efficiency measure. Appliance efficiency is a good example. Furnaces, boilers, air conditioners, heat pumps, refrigerators, water heaters, clothes washers and dryers, ranges and dishwashers consume 85% of energy consumption in the residential sector. 65% of energy use in the commercial sector is used for heating, cooling, lighting, water heating, refrigeration and office equipment. In the industrial sector, lighting equipment and electric motors account for more than 75% of electricity consumption<sup>7</sup>. The tasks desired from these appliances can be furnished by more efficient appliances, often using a

<sup>6</sup> California Assembly Bill 844, Replacement Tire Efficiency Program. [www.ciwmb.ca.gov/agendas/mtgdocs/2004/01/00013275.doc](http://www.ciwmb.ca.gov/agendas/mtgdocs/2004/01/00013275.doc)

<sup>7</sup> Note 2, *supra*.



fraction of the electricity used by less efficient, widely used models, and offering substantial savings to companies, consumers and society, including emission reductions of carbon dioxide and other health-damaging pollutants. These efficiencies and savings can be achieved through appliance efficiency standards and labeling legislation and regulations.

The chapters below in this section will explore in detail these efficiency opportunities and the legislation that has been passed to achieve them.

## CHAPTER B. INDUSTRY & COMMERCE

**Ernst Worrell, Lynn Price, Michael Brown, and Jeff Bell\***

### I. INTRODUCTION

Industrial production is the backbone for economic output in almost all countries. Over the past decades, industrial production has been growing in most economies. Industrial energy use can be broken down into that of the energy-intensive industries (e.g. primary metals, pulp and paper, primary chemicals, oil refining, building materials) and the non-energy intensive industries (e.g. services, electronics and food). Energy use in the industrial sector is dominated by the production of a few major energy-intensive commodities such as steel, paper, cement, and chemicals. Markets in the industrialized countries show a shift towards more service oriented activities, and hence non-energy intensive industries. Still, energy-intensive industries will remain the largest energy consumers in the next decades.

In 2001, manufacturing industry accounted for 36% of global energy use, while the energy use of services is more difficult to estimate. A common breakdown of industrial energy use distinguishes energy use for processes (called process-specific) and other services like energy use for buildings, utilities and boilers (called cross-cutting). The wide variety of processes makes it difficult for the policymaker to design policies and regulations to manage all aspects of industrial energy use. Hence, industrial energy policies are often directed at overall goals, or at specific process and elements of the industrial production and energy consumption process.

In this chapter we will first provide a background to characterize energy efficiency policies and regulations in industry and commerce. This is followed by a discussion of key examples of legislation, e.g. standards, combined heat and power production and a set of policies described as voluntary or negotiated agreements.

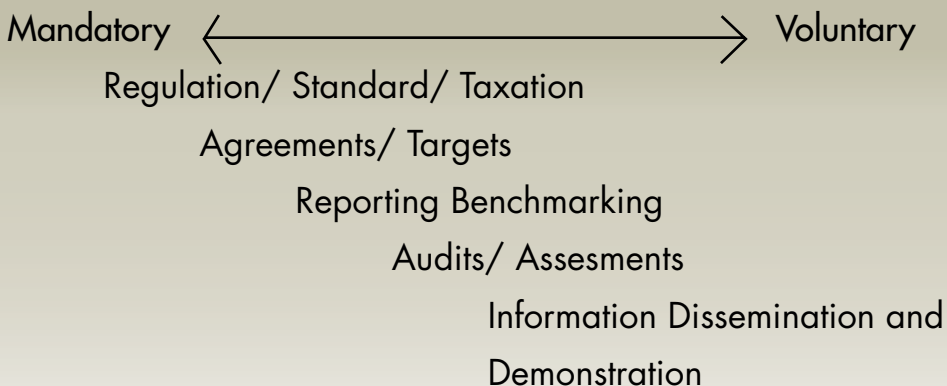
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## II. CHARACTERIZATION OF POLICIES AND REGULATIONS

Policies in the industrial area often focus on the removal of barriers that impede the uptake of energy efficient practices and technologies. There are many barriers to the implementation of energy efficiency improvement measures. Empirical quantitative research on the size of the barriers, while limited, underlines the large diversity between individual investors. More than one of the described measures applies, more or less, to an investor. The target group has large implications for policy formation aimed at increasing the implementation of energy-efficient measures and equipment. Although most of the empirical research has studied industrialized countries, similar barriers can be found in all countries. Developing countries suffer from all the factors that inhibit market acceptance of energy efficient technologies in industrialized countries, plus a multitude of other institutional problems.

Policies and regulations try to overcome or reduce the barriers to energy-efficiency improvement. Many policies have been used to accelerate the implementation of energy efficiency improvement measures. Although most of the empirical research has studied industrialized countries, examples of successful policies can be found in all countries. Based on the literature and case studies, we present several examples of successful policies and programs in developing countries.

Figure 1 provides a characterization of the main types of policy efforts for industry, based on varying degrees of compulsion. While compulsory or mandatory programs are regulations, in the strict sense of the word, to which all participants have to comply, there are also a wide variety of policies approaches that use more voluntary approaches to achieve a policy target.



*Figure 1. Characterization of industrial energy-efficiency policies.*

Based on experiences in many countries it is stressed that any successful industrial energy-efficiency policy approach integrates a variety of programs (including regulation) to manage the diversity of industrial energy uses and stakeholders.

Several countries have passed broad, comprehensive industrial efficiency promotion legislation:

**Thailand:** Energy Conservation Promotion Act 1992(ECP)

Thailand has implemented a number of measures to increase energy efficiency in the industrial sector, most of which are contained within the above Act. The measures include demand management programs, specific financial measures, minimum efficiency standards for machinery and the provision of support structures.

See generally [http://www.aseanenergy.org/energy\\_organisations/eecssn/thailand/eec\\_ssn\\_th.html](http://www.aseanenergy.org/energy_organisations/eecssn/thailand/eec_ssn_th.html) and <http://www.eppo.go.th/doc/>.<sup>8</sup>

China passed a comprehensive Cleaner Production Promotion Law. See generally <http://www.chinacp.com/eng/cnenvleg.html>. The terms of the law are fairly broad, leaving the implementation of the policy to administrative bodies.

See also Energy Conservation Law 1997 at <http://www.unescap.org/esd/energy/publications/compnd/ceccpart4chapter4.html#Chapter%203>

## **A. What are the regulatory requirements for industry energy efficiency?**

### **1. Information Dissemination**

Information dissemination is often a task of the public sector. Information programs are designed to assist energy consumers in understanding and employing technologies and practices to use energy more efficiently. These programs aim to increase consumers' awareness, acceptance, and use of particular technologies or utility energy conservation programs. Examples of information programs include educational brochures, hotlines, videos, home energy rating systems, design assistance programs, audits, energy use feedback programs, and labeling programs. As noted before, the information needs are strongly determined by the situation of the actor. Therefore, successful programs need to be tailored to meet these needs. Trade literature can be the most important source of information, followed by personal information from equipment manufacturer, as well as exchanges between colleagues is also an important information source.

<sup>8</sup> For details on the Thai energy sector privatization program: <http://www.eppo.go.th/doc/idp-07-Priv29Mar99.html>

### **United States: Energy Policy Act of 1992**

The Energy Policy Act in the United States specifically addressed information dissemination as part of the legislation:

Funding for State programs to support audits and promote energy efficiency.

#### **Section. 132. PROCESS-ORIENTED INDUSTRIAL ENERGY EFFICIENCY**

##### **(b) GRANT PROGRAMME.—**

- (1) **USE OF FUNDS.** — The Secretary shall, to the extent funds are made available for such purpose, make grants to States, which, consistent with State law, shall be used for the following purposes:
- (A) To promote, through appropriate institutions such as universities, nonprofit organizations, State and local government entities, technical centers, utilities, and trade organizations, the use of energy-efficient technologies in covered industries.
  - (B) To establish programs to train individuals (on an industry-by-industry basis) in conducting process-oriented industrial assessments and to encourage the use of such trained assessors.
  - (C) To assist utilities in developing, testing, and evaluating energy efficiency programs and technologies for industrial customers in covered industries.
- (2) **CONSULTATION.** — States receiving grants under this subsection shall consult with utilities and representatives of affected industries, as appropriate, in determining the most effective use of such funds consistent with the requirements of paragraph (1).
- (3) **ELIGIBILITY CRITERIA.** — Not later than one year after the date of the enactment of this Act, the Secretary shall establish eligibility criteria for grants made pursuant to this subsection.

Full text at: <http://thomas.loc.gov/cgi-bin/query/z?c102:H.R.776.ENR>

Labeling programs of motors and appliances are other examples of legislated information dissemination programs, although mostly applied to domestic appliances. Examples of labeling legislation can be found at:

#### **South Australia: Electrical Products Regulations 1990.**

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter3.html>

#### **European Union: Energy Labeling in the E.U.**

[http://europa.eu.int/smartapi/cgi/sga\\_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=31997L0017&model=guichett](http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=31997L0017&model=guichett)

## 2. Energy Efficiency Standards

Regulatory programs have proven effective in promoting energy efficiency gains by overcoming information barriers. Examples include appliance energy efficiency regulations, automobile fuel economy standards, commercial building standard, as well as energy efficiency standards. In such programs, the government passes a requirement that all products (or an average of all products sold) meet some minimum energy efficiency level. Energy efficiency standards are applied in many countries for various energy uses. Standards can be performance-based, i.e., they do not mandate how the manufacturer is to meet them (i.e., what technologies or design options to use) and are used for many mass-produced products.

Motor systems are used throughout any industrial operation. A motor system generally consists of an appliance, drive train and the motor. Motor systems consume over 60 percent of industrial electricity use in the United States, and nearly 70% in Europe. The share of motor electricity use will vary by sector. In the U.S. almost 25% of industrial motor electricity use is used by pumping systems, 14% by fans, 16% by compressed air systems and 23% for material processing. Other uses (e.g. material handling and refrigeration) represent over 23% of motor electricity use. Motors are efficient, and a well-designed and maintained motor has conversion efficiencies of over 90%. However, older and inefficient motors may have much lower efficiencies, while the efficiency losses are even higher in the total motor system.

System losses can be reduced through an analysis of the operating characteristics of a motor system. For example, adjustable speed drives better match speed to (varying) load requirements for motor operations. There are various technologies to control the motor. The systems are offered by many suppliers and are available worldwide. Adjustable speed drives may be used for any industrial motor system that has variable loads. ASDs are used in a wide array of applications. Savings are determined by the flow pattern and loads of the particular motor system. The savings may vary between 7 and 60%. Payback period may vary widely depending on the size of the motor system and use pattern.

Motor efficiency can be improved by requiring the use of more efficient motors. Efficiency standards are essential in achieving this. Motor standards have been introduced in Brazil, Canada, Malaysia, Mexico, Poland, Taiwan and the United States. The U.S. has pioneered the use of motor efficiency standards. In the U.S., the 1992 Energy Policy Act (EPAAct) contains standards that apply to all integral horsepower, general purpose, AC induction motors from 1 to 200 hp. These motors constitute 50 to 70% of all motors sold in the relevant horsepower classes. The standards vary from minimum efficiency levels of 80% for small motors to 95% for large motors. The standards apply to all motors sold in the U.S., and hence both to domestically and foreign manufactured motors.

### **United States: The current U.S. motor standards were introduced in 1999**

(Federal Register, Vol.64, No.192).

Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures, Labeling, and Certification Requirements for Electric Motors.

#### **Summary of Rule**

Today's final rule incorporates the energy efficiency test procedures and standards established by the EPCA for certain commercial and industrial electrical motors. EPCA sections 343(a)(5), 42 U.S.C. 6314(a)(5) and 342(b)(1) 42 U.S.C. 6313(b)1. It also establishes efficiency labeling requirements and compliance certification, as directed by EPCA. EPCA sections 344, 42 U.S.C. 6315, and 345(c), 42 U.S.C. 6316(c). Among its provisions, today's final rule (1) defines terms used in the rule, including definitions that clarify which motors, including metric, are covered under EPCA; (2) incorporates by reference the IEEE Standard 112 Test Method B (with minor modifications), CSA Standard c390 Test method (1), and portions of other industry standards; (3) sets forth methods for establishing compliance, such as sampling plan for selecting motors for testing, calculation in some instances of a motor's efficiency, use of accredited laboratory for testing, and use of a certification program; (4) establishes criteria for recognizing laboratory accreditation organizations and certification programs; (5) requires the energy efficiency value of an electric motor and a Department of Energy Compliance Certification number, to be both marked on the nameplate and disclosed in marketing materials, and allows use of an "ee" logo or other similar logo. The rule also addresses waiver of the test procedures, pre-emption of state regulations, and enforcement.

Text available at: <http://www.aceee.org/Motors/epactpdf.pdf>

In order to comply with EP Act, the efficiency of each model of electric motor must be determined by either testing or the application of an alternative efficiency determination method, following nationally accepted standardized testing procedures. Such an accepted testing method is a prerequisite for a successful standard and labeling program in any country. Furthermore, accredited and independent testing laboratories should be able to provide the testing services to certify the motors. A manufacturer or private testing laboratory must certify that the motors are in compliance with the EP Act standards, after which the U.S. Department of Energy (U.S. DOE) provides Compliance Certification number to that manufacturer. The Compliance Certification number must be displayed on the permanent nameplate of the motor, and has the option to add a trademarked logo. Also, such energy efficiency information must be displayed in motor catalogs and marketing materials.

Typically, the U.S. DOE relies upon the market participants (e.g. other manufacturers, motor purchasers) to identify potential violations. When U.S. DOE receives written information on a potential violation, it will investigate the potential violation, following a prescribed procedure for enforcement as spelled out in the EPAAct final rule, which can include testing and may result in penalties or an order to take the motors off the market.

For a general review of motor efficiency regulations, See:

<http://oee.nrcan.gc.ca/regulations/html/Factsheet6.cfm?text=N&printview=N>.

Other examples of energy industrial efficiency standards can be found at:

**China:** Energy Conservation Law of 1997.

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter4.html>.

### 3. Energy Taxation

There is compelling evidence that firms substantially under-invest in energy efficiency or, stated differently, exhibit high returns to make such investments. A large number of standard accounting procedures are available for firms to determine the economic feasibility and profitability of an investment. Many investors use instruments, such as simple payback period, rate of return, or net present value to evaluate energy efficiency projects. When energy prices do not reflect the real costs of energy, consumers under-invest in energy efficiency. Energy prices, and hence the profitability of an investment, are also subject to large fluctuations. The uncertainty about energy price, especially in the short term, seems to be an important barrier. The uncertainties often lead to higher perceived risks, and, therefore, to more stringent investment criteria and a higher hurdle rate.

Markets are a powerful and fundamental force in wide-scale implementation of energy efficiency. Subsidies that depress prices of energy provide a significant disincentive for energy efficiency. The removal of this barrier (low energy prices) is an important step toward creating an investment climate in which energy efficiency can prosper. Worldwide, consumer energy prices typically do not reflect the full costs of energy production, transmission, and distribution because these prices are often subsidized. Furthermore, the energy prices do not include environmental costs. Energy prices in some areas are beginning to more closely reflect costs in response to commercialization and deregulation of the electricity industry and investment by independent power producers.

Energy prices can also be corrected by introduction of taxation in the form of energy or carbon taxation. Most countries have some form of energy taxation. However, various countries have started to use energy or carbon taxes to make energy-efficiency improvement more attractive. These taxes are mainly aimed at small energy consumers and most-often exclude the energy-intensive industries for international competitive reasons. Carbon taxes, that include part of industry, have most recently been introduced in The Netherlands, and the United Kingdom.

## United Kingdom: Climate Change Levy in the Finance Act (2000)

### PART I: THE LEVY

#### Climate change levy

1. - (1) A tax to be known as climate change levy ("the levy") shall be charged in accordance with this Schedule.
- (2) The levy is under the care and management of the Commissioners of Customs and Excise.

#### Levy charged on taxable supplies

2. - (1) The levy is charged on taxable supplies.
- (2) Any supply of a taxable commodity is a taxable supply, subject to the provisions of Part II of this Schedule.

#### Meaning of "taxable commodity"

3. - (1) The following are taxable commodities for the purposes of this Schedule, subject to sub-paragraph (2) and to any regulations under sub-paragraph (3)-
  - (a) electricity;
  - (b) any gas in a gaseous state that is of a kind supplied by a gas utility;
  - (c) any petroleum gas, or other gaseous hydrocarbon, in a liquid state;
  - (d) coal and lignite;
  - (e) coke, and semi-coke, of coal or lignite;
  - (f) petroleum coke.
- (2) The following are not taxable commodities-
  - (a) hydrocarbon oil or road fuel gas within the meaning of the Hydrocarbon Oil Duties Act 1979;
  - (b) waste within the meaning of Part II of the Environmental Protection Act 1990 or the meaning given by Article 2(2) of the Waste and Contaminated Land (Northern Ireland) Order 1997.
- (3) The Treasury may by regulations provide that a commodity of a description specified in the regulations is, or is not, a taxable commodity for the purposes of this Schedule.

Text available at: <http://www.legislation.hms.gov.uk/acts/acts2000/00017-ad.html#sch6>



Canada has a comprehensive program for tax and other incentives to promote energy efficiency in industry, including an Industrial Building Incentive Program, providing funds for building new energy efficient infrastructure; Energy Retrofit Assistance Program, providing funds for energy efficient refitting of infrastructure; and Income Tax Rebates for purchase of energy efficient equipment. Income assessed under the Income Tax Act exempts goods included in Schedule 1 of the Regulations. Summary of the tax programs are available at: [http://oee.nrcan.gc.ca/publications/infosource/pub/cipec/Taxguide\\_E.cfm?text=N&printview=N](http://oee.nrcan.gc.ca/publications/infosource/pub/cipec/Taxguide_E.cfm?text=N&printview=N).

#### 4. Skilled Personnel

Especially for small and medium sized enterprises (SMEs), the difficulties installing new energy-efficient equipment, compared to the simplicity of buying energy, may be prohibitive. In many firms, there is often a shortage of trained technical personnel, because most personnel are busy maintaining production. A survey in The Netherlands suggests that the availability of personnel is seen as a barrier to investing in energy-efficient equipment by about one-third of the surveyed firms. In developing countries there is hardly any knowledge infrastructure available that is easily accessible for SMEs. Such knowledge is important, because SMEs are often a large part of the economy in developing countries, and are often inefficient. Information and monitoring programs are often established to help remove information barriers within industries to implement energy efficiency technologies or measures. A few countries had or have voluntary or compulsory requirements for companies to have a dedicated energy manager onsite when a plant's energy use would exceed a certain amount of energy use per year. Various countries have experience with energy manager programs, including Korea, Japan, Thailand, Finland and Portugal, as well as Denmark and Italy.

#### **Thailand: The Energy Conservation Promotion Act B.E. 2535**

##### **Division 1. Energy conservation in factories**

##### **Section 7. Energy conservation in factories means one of the following measures:**

- (1) Improvement in combustion efficiency of fuels;
- (2) Prevention of energy loss;
- (3) Recycling of energy wastes;
- (4) Substitution of one type of energy by another type;
- (5) More efficient use of electricity through improvements in power factors, reduction of maximum power demand during the period of the electricity system's peak demand, use of appropriate equipments, and through other approaches;
- (6) The use of energy-efficient machinery or equipment as well as the use of operation control systems and materials that contribute to energy conservation; and
- (7) Other means of energy conservation as stipulated in the Ministerial Regulations.

**Section 9** The owner of the designated factory must conserve energy, audit and analyze energy utilization in his factory, in accordance with the standard, criteria, and procedures as provided by the Ministerial Regulations issued by the Minister under the recommendation of the National Energy Policy Council.

**Section 11** In addition to provisions in Section 10, the owner of a designated factory shall have the following duties:

- (1) Assign at least one person to take a full-time position at the designated factory to take full responsibility with regard to energy programs. Such person shall have the qualifications as prescribed under Section 13;
- (2) Submit information on energy production, consumption, and conservation to the Energy Development and Promotion Department, according to forms and schedule prescribed in the Ministerial Regulations;
- (3) Keep records of information on energy consumption and installation or modification of machinery or equipment that affects energy consumption and conservation, in compliance with the criteria and procedures prescribed in the Ministerial Regulations;
- (4) Set targets and plans for energy conservation of the designated factory and submit to the Energy Development and Promotion Department, in compliance with the criteria, procedures, and schedule prescribed in the Ministerial Regulations; and
- (5) Audit and analyze operations to achieve such targets and plans for energy conservation, in compliance with the criteria, procedures and schedule prescribed in the Ministerial Regulations.

**Section 12** The owner of the designated factory shall arrange to have personnel responsible for energy and report to the Director General within one hundred and eighty days after the decrees prescribing designated factories under Section 8 come into effect in the case that such factory has been classified as a designated factory before the date the decrees under Section 8 come into effect, (180 days) after such factory becomes a designated factory in the case of being a designated factory on or after the date the decrees under Section 8 take effect.

Text available at:

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter10.html>

## B. What are the options for industry voluntary agreements?

One type of program that aims to address many of these barriers at once is referred to as voluntary or negotiated agreements. Voluntary agreements are “essentially a contract between the government and industry, or negotiated targets with commitments and time schedules on the part of all participating parties”. These agreements typically have a long-term outlook, covering a period of five to ten years, so that strategic energy-efficiency investments can be planned and implemented. A key element of voluntary agreements is that they focus the attention of all actors on energy efficiency or emission reduction goals.

Internationally, voluntary agreements have been shown to result in increased energy efficiency, with the more successful programs even doubling autonomous energy efficiency improvement rates. In addition, voluntary agreements have important longer-term impacts including changes of attitudes and awareness of managerial and technical staff regarding energy efficiency, addressing barriers to technology adoption and innovation, creating market transformation to establish greater potential for sustainable energy-efficiency investments, promoting positive dynamic interactions between different actors involved in technology research and development, deployment, and market development, and facilitating cooperative arrangements that provide learning mechanisms within an industry.

The essential steps for reaching a voluntary agreement are the assessment of the energy-efficiency potential of the participants as well as target setting through a negotiated process. Participation by industries is motivated through the use of “carrots” and “sticks”, which refers to incentives and disincentives. Supporting programs and policies (the “carrots”), such as facility audits, assessments, benchmarking, monitoring, information dissemination, and financial incentives all play an important role in assisting the participants in understanding and managing their energy use and greenhouse gas emissions in order to meet the target goals. Some of the more successful voluntary agreement programs are based on the use of a mechanism to reduce environmental regulations or taxes (the “sticks”) for participants. Many of the more stringent agreements build on the general conditions for contracts under civic law.

**Netherlands:** Long Term Agreement on Energy Efficiency 2001-2012 (publication: 3MJAF02.07)

For the period 2001-2012, participants have to develop an energy conservation plan (following Article 6):

1. The Enterprise shall submit a separate draft Energy Conservation Plan to the competent authority and to the Independent Expert in respect of each relevant facility, no later than six months after signing or joining this Long Term Agreement.
2. The Independent Expert shall advise the competent authority within three weeks (see annex 7) after the submission referred to in paragraph 1 as to whether the draft ECP meets the Protocol on the Appraisal of Energy Conservation Plans (annex 3). The Independent Expert shall simultaneously notify the Enterprise of this advice.

3. The Enterprise shall include in its Energy Conservation Plan definite, conditional and uncertain measures to improve energy efficiency. The Enterprise shall indicate the expected result of each of these measures, expressed as a percentage energy efficiency improvement per annum, plus the actual CO<sub>2</sub> emissions that will be avoided.
4. Within six weeks of the submission referred to in paragraph 1, the competent authority shall notify its judgment concerning the draft Energy Conservation Plan to the Enterprise and the Independent Expert. The Enterprise can then adjust the plan accordingly. The Enterprise and the competent authority shall try to reach a consensus. The competent authority shall co-ordinate its judgment with the views of the other public bodies involved.
5. The Enterprise shall submit the definitive Energy Conservation Plan to the competent authority no later than six weeks following receipt of the judgment of the competent authority on the draft plan. The definitive Energy Conservation Plan shall be sent to the Independent Expert at the same time.
6. The competent authority shall judge whether, if relevant, the definitive Energy Conservation Plan accords with the license-granting requirement based on the Environmental Management Act, namely that in order to qualify for the license, the enterprise must have made maximum provision to protect the environment, unless this cannot reasonably be expected. The competent authority shall notify the Enterprise and the Independent Expert in writing as soon as possible, yet no later than six weeks following receipt of the definitive Energy Conservation Plan, stating whether or not it approves the plan.
7. Together with its written approval of the definitive Energy Conservation Plan, the competent authority shall notify the Enterprise and the Independent Expert in writing as to whether in its opinion a notification pursuant to Article 8.1 paragraph 3, a report pursuant to Article 8.19 or a license of amendment pursuant to Article 8.1 of the Environmental Management Act is required in respect of the measures proposed by the plan. If a formalization of the proposals contained in the plan is required, this will in principle take place only when it is clear how long it will take to actually realize the proposals contained in the plan or in parts of it.
8. Once the competent authority has notified the Enterprise as to whether or not it approves the definitive Energy Conservation Plan, the plan will be open to public scrutiny, with the exception of any confidential information, subject to the agreement of the relevant competent authority. If the plan contains any confidential information, the Enterprise shall provide the competent authority with an open summary of the plan upon request.
9. The Enterprise shall update the Energy Conservation Plan by no later than 1 October 2004 for the period 2005-2008 and by 1 October 2008 for the period 2009-2012. Not only will this update specify the definite, conditional and uncertain process measures, but potential improvements in energy efficiency will also be based on an energy study in which energy consumption will, where possible, be analyzed with the help of the material and energy balance of the process system that is used for the product concerned. Paragraphs 2 to 8 shall similarly apply.

10. When drafting the Energy Conservation Plan, the Enterprise or group can, in order to assist the phasing of measures pertaining to the facility, also take account of energy efficiency improvement measures being implemented at other facilities belonging to the same Enterprise or group (group approach). Annex 6 explains the possibilities of a group approach in more detail.

Full text available at: [www.lta.novem.org](http://www.lta.novem.org)

Overall, international experience shows that voluntary agreements are an innovative and effective means to motivate industry to improve energy efficiency and reduce related emissions, if implemented within a comprehensive and transparent framework. Voluntary agreement programs can be roughly divided into three broad categories: 1) programs that are completely voluntary, 2) programs that use the threat of future regulations or energy/greenhouse gas emissions taxes as a motivation for participation, and 3) programs that are implemented in conjunction with an existing energy/greenhouse gas emissions tax policy or with strict regulations. A variety of government-provided incentives as well as penalties are associated with these programs. At least 25 voluntary agreement programs exist around the world in Europe, Canada, the U.S., Australia, New Zealand, South Korea, and Taiwan. Recently, China initiated pilot voluntary agreements with two steel mills in Shandong Province and Brazil is in the process of designing a voluntary agreement program with industry.

**Table 1. Examples of Voluntary Agreement Programs and Associated Legislation**

Country	VA Program	Associated Legislation	References
Denmark	Agreements on Industrial Energy Efficiency	Green Tax Program	Danish Energy Authority, 2002
Netherlands	Benchmarking Covenants	Environmental Management Act	Anon, 1999: Netherlands Ministry of Housing, Spatial Planning and the Environment, 2004.
South Korea	Voluntary Agreement System For Energy Conservation and Reduction of GHG Emissions	Article 12-2 of Rational Energy Utilization Act (Support for Company participating in Voluntary Agreement)  MOCIE Public Notice No. 2001-265 (December 28, 2001) (Regulation on the Management of Voluntary Agreement)	Korean Energy Management Corporation, n.d.

Country	VA Program	Associated Legislation	References
		MOE Public Notice No. 2001-98 (August 6, 2001) (Public Notice on the Use of Clean Fuel	
Switzerland	CO2 Law Voluntary Measures	Federal Law on the reduction of CO2 emissions (CO2 Law)	Swiss Federal Office of Energy, 2001; Federal Assembly of the Swiss Confederation, 1999
UK	Climate Change Agreements	Finance Act 2000	UK DEFRA, 2004; UK Parliament, 2000.

Other examples of voluntary agreement legislation can be found at:

**Denmark:**

Voluntary Agreements on Energy Efficiency- Danish Experiences.

[http://www.ens.dk/graphics/publikationer/energibesparelser\\_uk/EnergyEfficiency/voluntary\\_agreements.pdf](http://www.ens.dk/graphics/publikationer/energibesparelser_uk/EnergyEfficiency/voluntary_agreements.pdf)

**Netherlands:**

Energy Efficiency Benchmarking Covenant.

[http://www.benchmarking-energie.nl/pdf\\_files/covteng.pdf](http://www.benchmarking-energie.nl/pdf_files/covteng.pdf)

**Environmental Management Act:**

<http://www.eel.nl/Countries/EnvironmentalManagementActMay2004.pdf>

**Switzerland:**

Federal Assembly of the Swiss Confederation, 1999. Federal Law on the Reduction of CO2 Emissions (CO2 Law).

[http://www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg\\_klima/politik/CO2-Red/CO2-Ges/index.html](http://www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg_klima/politik/CO2-Red/CO2-Ges/index.html)

**United Kingdom:**

Climate Change Agreements and the Climate Levy.

<http://www.defra.gov.uk/environment/ccl/index.html>

**Finance Act 2000: Chapter 17:**

<http://www.legislation.hmso.gov.uk/acts/acts2000/20000017.html#aofs>

**Armenia:****Armenia:** Law on Energy Saving and Renewable Energy

## Article 8. Voluntary Certification of Energy Devices Compliance

1. Legal (physical) persons using, producing and importing energy devices can submit those in the manner established by the Republic of Armenia law "On Certification of Compliance of Goods and Services with Normative Requirements" for voluntary certification based on energy efficiency indicators.
2. Voluntary certification of compliance provided herein by the present article shall be implemented at the initiative and expense of the legal and physical persons using, producing and importing energy devices.
3. Based on results of voluntary certification of compliance, the labeling of energy devices shall be carried out in accordance with the energy efficiency indicators.

Full text available at:

[http://www.munee.org/media\\_center/files/Eng\\_ES&RE\\_Law\\_041204.doc](http://www.munee.org/media_center/files/Eng_ES&RE_Law_041204.doc)

**C. How can cogeneration technologies improve energy efficiency?**

Combined Heat and Power (CHP) (also known as cogeneration) is the simultaneous generation of two or more useful products from the same combustion process. CHP generates useful heat and uses residual heat to generate electricity. CHP applications offer efficiency benefits over even the best centralized machines. This results in improved overall fuel economy and reduced emissions. When the losses of the entire system are included in assessments, cogeneration can increase the overall efficiency of thermal generation of electricity from 30% (world average) and from 50-55% (world best practice) to 70-90%. These improvements can be translated directly into emission reductions of greenhouse gases (GHG) and other air pollutants. Fuel savings can also be translated into financial savings for those that operate the plant where CHP is used. Because of these characteristics, CHP deserves special attention in legislation development.

The policy and regulatory environment for CHP in particular and the energy market as a whole is the main factor determining the success of CHP markets, as evidenced by experiences in many countries. To date most examples of CHP policy initiatives that have proven successful are from the OECD countries. The following section highlights some examples of effective policies and measures from around the world that have delivered results.

Though there are no legislative measures at the national level in the United States to promote CHP several examples at the state level exist. Action at the national level has to date been limited to the development of an ambitious and constructive strategy document that may be useful background reading to those drafting legislation in other jurisdictions. The National CHP Roadmap: Doubling Combined Heat and Power Capacity in the United States by 2010 is a shared challenge for both the CHP industry and the government (<http://www.eere.energy.gov/de/pdfs/chproadmap.pdf>). This

initiative has been in train for no more than four years and it is probably a little early to fully assess its effectiveness. However, the evidence to date suggests that the strategy has led to a significant increase in promotion of CHP from the government, and consequent growth in awareness among the various CHP stakeholder groups, and has enabled all stakeholders to perceive a defined growth target and to quantify progress towards the achievement of that target. It has created some momentum at both the state level and among the various regulatory authorities for positive CHP initiatives.

In various states in the US legislation has been passed to promote the use of CHP, including California, New York, Pennsylvania, and Texas.

California Senate Bill 1298 (<http://www.arb.ca.gov/energy/dg/documents/gappa.pdf>) became effective in October 2002. The first phase helps CHP by setting NOX standards more lenient in situations where CHP is employed. Systems integrated with CHP are permitted 0.7 lb/MWh of nitrogen oxides versus the 0.5lb/MWh permitted for systems not integrated with CHP. The second phase is expected to take effect January 1, 2007 and is designed to take into consideration 100% of the thermal efficiency of a generation system. In cases where CHP is employed and the overall system has an efficiency of at least 60 percent system owners can increase the output calculation by 1 MWh for every 3.4 MMBtu of heat recovered, meaning that they are allowed to increase their emissions even though electrical output is not increased.

These allowed increases in emissions could create incentive for investment in CHP plants because their owners could save capital costs associated with mandatory scrubbers etc. To the extent that this extra leniency encourages additional development in CHP, overall air pollution is expected to decrease in the State. This is because the extra CHP will displace the need for much less efficient separate generation of heat and power. This law may create incentive to cut corners resulting in sub-optimal environmental performance at the plant level (comparing CHP plants with other CHP plants). However, overall efficiency at the local level will increase drastically because a much higher percentage of the useful energy in each unit of fuel will be used.

The legislation is well designed for two reasons:

1. Standards are based on permitted pollution per useful energy output rather than pollution in the exhaust per unit fuel input.
2. Standards are tied directly to thermal efficiency of the plants

In Texas, United States, the June 2001 permitting regulation, Air Quality Standard Permit for Electric Generating Units, passed by the Texas Commission on Environmental Quality, is designed to provide full credit for heat recovery in CHP projects. Similar to the planned second phase of the California law, in Texas CHP operators can add 1 MWh to the output calculation of permitted emissions for each 3.413 MMBtu of thermal output captured that would otherwise have been wasted. The other main strength of the legislation is that it provides definitions for CHP with specific requirements for overall plant efficiency. In order to take credit for CHP, the plant owner must, according to General requirements 4(B):

- (i) provide as part of the application documentation of the heat recovered, electric output, efficiency of the generator alone, efficiency of the generator including CHP, and the use for the non-electric output, and



(ii) the heat recovered must equal at least 20 percent of the total energy output of the CHP unit.

See text at: [www.tnrc.state.tx.us/permitting/airperm/nsr\\_permits/files/seg\\_permitonly.pdf](http://www.tnrc.state.tx.us/permitting/airperm/nsr_permits/files/seg_permitonly.pdf)

The 2003 European Union CHP Directive, Directive 2004/8/EC of the European Parliament and of the Council, deals with the promotion of cogeneration based on useful heat demand in the internal energy market. It provides a legal basis for CHP, obliges Member States to address key market barriers such as grid access and authorization procedures, provides a framework to support CHP, and gives a standard method for ensuring that energy and environmental benefits are achieved. The CHP directive (see Article 2) builds on the more general EU directive 2003/54/EC, Concerning Common Rules For The Internal Market In Electricity And Repealing Directive 96/92/EC. Within the scope of the federal structure of Europe, the CHP Directive is probably as strong a piece of legislation that can be achieved centrally for the promotion of CHP. The directive does not prevent member nations from also developing their own, more specific or ambitious, legislation. Indeed the directive compels member nations to undertake initiatives to promote CHP in their specific jurisdiction.

### **European Union: 2003 CHP Directive, Directive 2004/8/EC of the European Parliament**

#### **The basis for the directive is laid out in Paragraph 1:**

"The potential for use of cogeneration as a measure to save energy is underused in the Community at present. Promotion of high-efficiency cogeneration based on a useful heat demand is a Community priority given the potential benefits of cogeneration with regard to saving primary energy, avoiding network losses and reducing emissions, in particular of greenhouse gases. In addition, efficient use of energy by cogeneration can also contribute positively to the security of energy supply and to the competitive situation of the European Union and its Member States. It is therefore necessary to take measures to ensure that the potential is better exploited within the framework of the internal energy market."

The directive includes a number of important features that are likely to benefit the overall market climate for CHP within the European Union. These include:

The establishment of criteria for high-efficiency CHP. This will be defined in terms of the efficiency gain of CHP compared with separate production of heat and electricity. CHP should provide energy savings of at least 10% in order to qualify as high-efficiency CHP. The directive states (Article 4 Paragraph 1):

"For the purpose of determining the efficiency of cogeneration in accordance with Annex III, the Commission shall, in accordance with the procedure referred to in Article 14(2), not later than 21 February 2006, establish harmonized efficiency reference values for separate production of electricity and heat. These harmonized efficiency reference values shall consist of a matrix of values differentiated by relevant factors, including year of construction and types of fuel, and must be based on a well-documented analysis taking, inter alia, into account data from operational use under realistic conditions, cross-border exchange of

electricity, fuel mix and climate conditions as well as applied cogeneration technologies in accordance with the principles in Annex III.”

The need to show guarantee of origin for CHP electricity. The Directive will request Member States to establish certification systems that guarantee the origin of electricity from high-efficiency CHP. It would enable electricity producers to prove that their power comes from high-efficiency CHP. The directive states (Article 5, Paragraph 1):

“On the basis of the harmonized efficiency reference values referred to in Article 4(1), Member States shall, not later than six months after adoption of these values, ensure that the origin of electricity produced from high-efficiency cogeneration can be guaranteed according to objective, transparent and nondiscriminatory criteria laid down by each Member State. They shall ensure that this guarantee of origin of the electricity enable producers to demonstrate that the electricity they sell is produced from high efficiency cogeneration and is issued to this effect in response to a request from the producer.”

Text available at: [http://europa.eu.int/comm/energy/demand/legislation/heat\\_power\\_en.html](http://europa.eu.int/comm/energy/demand/legislation/heat_power_en.html).

The **Netherlands**, perhaps more so than any other nation, has a strong history of legislative and policy mechanisms for the promotion of CHP. In the last several decades, the Netherlands has achieved dramatic success through direct policy intervention on the basis of an informal CHP strategy. Critical to this success has been the fact that the department responsible for energy market regulation, the Ministry of Economic Affairs, has also been responsible for CHP development and has used regulatory intervention to drive the CHP market.

Since EU Directive 96/92/EC Concerning Common Rules For The Internal Market In Electricity Dutch legislators have focused on harmonizing their laws with the greater EU. These efforts are likely to continue with the amended Directive 2004/8/EC. As a result the effectiveness of legislation for promoting CHP in the Netherlands may have suffered. Nevertheless examples of contemporary laws that show promise for promoting CHP do exist. Law WJZ 4042151 (<http://wetten.overheid.nl/>) of June 2004, established a scheme in the Netherlands whereby CO<sub>2</sub> credits are earned for all CHP projects that qualify.

The Dutch Ministry of Economic Affairs introduced the scheme to calculate how much of a carbon reduction benefit can be attributed to CHP plants; and to establish a means of providing direct policy support for electricity derived from CHP plants. The system, known as the Blue Certificate System, applies to all power generated from CHP plants regardless of whether the power is fed into the grid or used onsite. The scheme establishes a methodology for attributing carbon benefits to CHP so that the benefits can be rewarded. Each kWh of ‘free CO<sub>2</sub>’ benefits earns a payment of €2.6. It is expected that the scheme will stabilize the commercial viability of existing plants but result in too much new plant investment.

In Brazil, on the 15th of March 2004 the government passed law 10848 with regards to electricity sector reform (<http://www.in.gov.br/>). The law in effect created two separate market structures for electricity exchange: the bilateral contract environment (ACL), where individual generators and

consumers can negotiate power purchase agreements (PPAs), and the regulated contract environment (ACR) where distribution companies must purchase the power they need to meet their contract from public auctions. The Decree 5163 dealt specifically with distributed generation<sup>10</sup>, and states that in the ACR scenario distribution companies must also buy power from “alternative sources” at prices set by the government and are permitted to buy up to 10% of their required supply. The clause was designed to create incentive for CHP and other designated alternative sources. The decree states specifically that cogeneration plants with an efficiency of over 75%, as well as hydro plants with a capacity below 30,000kW and other renewable sources all qualify as “alternative energy” for the purposes of the law.

The legislation is useful for promoting cogeneration as it specifically defines the efficiency required for a combined heat and power plant to be considered cogeneration for the purposes of fulfilling the law (75%), and it permits distribution companies to buy up to 10% of their power for meeting customer requirements directly from qualifying cogeneration operations.

In **India**, Maharashtra State introduced in 2002 new regulatory arrangements that provide incentives for owners of sugar mills, and other CHP plant operators using biomass fuel, to upgrade and improve the efficiency of their CHP plants. This has been accomplished by offering attractive buyback rates for any surplus electricity produced by the mill. This is making a significant difference to the prospects for CHP in the state and represents one of the most effective tools available to policymakers/legislators to spur investments in CHP.

Cleaner Production Promotion Law. See generally <http://www.chinacp.com/eng/cnenvleg.html>

The terms of the law are fairly broad, leaving the implementation of the policy to administrative bodies.

See also Energy Conservation Law 1997 at <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter4.html#Chapter%203>

### **India: The Maharashtra Electricity Regulatory Commission 2001 Order for Non-Fossil Fuel based Co-generation Projects, states:**

“The Tariff for the purchase of electricity by the Maharashtra State Electricity Board from the cogeneration project based on any non-fossil fuel (such as bagasse, biomass, biogas, agriculture waste such as rice husk, groundnut shells etc.) shall be Rs.3.05 (Rupees three and paise five only) per kWh for the first year of operation of the Co-generation project and the tariff shall be escalated at the rate of 2% per annum on compounded basis.”

Full text available at: <http://www.mercindia.com/pdf/16082002.zip>

<sup>10</sup> See <http://www.in.gov.br/> to view copy of the decree.

The tariff, which is firm and therefore unaffected by fuel price, interest rates etc. tax structure etc., is to be reviewed in March 2007 or when the total capacity of non-fossil fuel based CHP reaches 300MW whatever is sooner. One of the order's strengths is that it explicitly defines what is considered CHP plants according to the law in terms of technology, fuel and efficiency. It also lays down clear expectations as to cost sharing of transmission and distribution infrastructure and clarifies contractual obligations in terms of power supply, power quality and payments.

### III. CONCLUSION

Energy uses in industry and commerce vary widely, and so do the characteristics of the energy users and stakeholders. Hence, there is no single right way of promoting energy efficiency improvement via legislative measures. Rather, legislators considering the most effective ways of fostering energy efficiency improvement should look at a cross section of legal precedents, such as those presented in this chapter. Selecting elements from many existing or historical laws may be the best way of developing legal incentives for a particular jurisdiction. Effective approaches consider the characteristics of the stakeholders, and the barriers for energy efficiency improvement faced by the stakeholders, in the design of legal instruments.

In practice, this means that a combination of legislation that "pushes" the market towards more efficiency (e.g. minimum energy efficiency standards) and ones that "pulls" the top-end of the market towards increased efficiency (e.g. long-term goals in the form of voluntary agreements or policy goals) and supports innovation is an effective combination. Furthermore, policy and legislative approaches should innovate with the changing dynamics of industrial and commercial energy use to remain effective.

## CHAPTER C. APPLIANCE ENERGY EFFICIENCY LABELS AND STANDARDS

David R. Hodas\*

### I. INTRODUCTION

The need for electricity in developing countries is enormous, and so is the cost to build traditional electricity generation facilities. The International Energy Agency recently estimated that the capital needs from now to 2030 for constructing new electricity generation using business-as-usual technology would be US \$13 trillion, with most of the money invested in developed and rapidly developing nations such as China.<sup>11</sup> Given this capital squeeze, particularly in the least developed nations, rational, efficient use of electricity is essential to control electricity demand and make most efficient use of resources and capital.

One of the significant uses of electricity is the powering of appliances, equipment and lighting in residential and commercial buildings. Refrigerators, computers, clothes washers and dryers, air conditioners, office equipment, and heating consume huge amounts of electricity.<sup>12</sup> Although energy growth varies considerably among nations<sup>13</sup> and economic sectors, every nation should improve the energy efficiency of its new stock of electric appliances and commercial equipment, which generally can be done at a cost far lower than building new generation facilities, before incurring the large capital expense and adverse environmental consequences of increased generation capacity. Great savings and reduced environmental impact from generation can be achieved if all appliances are the most efficient available, and old appliances are replaced with new, more efficient ones.<sup>14</sup> These savings are not unique to highly developed countries, but are ubiquitous. Two examples will suffice to illustrate this crucial point:

In 1980, China decided to distribute refrigerators throughout the capital city of Beijing. It did so with resounding success, supplying refrigerators to over 60% of Beijing households by 1990, where only 6% had them in 1980. The reconditioned refrigerators from Japanese factories were thought to

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<sup>11</sup> Although this huge investment will expand developing country electrification, especially in Asia, "the ranks of the electricity-deprived will continue to swell in Africa," and 2.6 billion people worldwide will unsustainably rely on traditional biomass fuels for cooking and heating. INTERNATIONAL ENERGY AGENCY, WORLD ENERGY OUTLOOK 30, 36 (2004).

<sup>12</sup> Toru Kubo, Harvey Sachs, and Steven Nadel, Opportunities for New Appliance and Equipment Efficiency Standards: Energy and Economic Savings Beyond Current Programs iv, 5 (American Council for an Energy-Efficient Economy, Sept. 2001), at <http://aceee.org>. Kubo et al see potentially "enormous" savings and note that "as of 2000, appliance standards had already cut U.S. electricity use by 2.5% and U.S. carbon emissions from fossil fuel by nearly 2%. The total electricity savings are projected to reach 7.8% of U.S. electricity use in 2020. Proposed new mandatory appliance and equipment efficiency standards could save another 3.8% in total U.S. electricity. See *Id.*, Tables ES.1 and ES1.3.1. The paper analyzes the potential savings from new standards for 21 different types of equipment. The paper also provides a comprehensive review of the history of energy efficiency standards in the U.S.

<sup>13</sup> Wherever "nation" is used in this chapter, it applies as well to states and municipalities within nations since in many countries states, cities and other municipalities have adopted their own energy efficiency labeling and standards programs.

<sup>14</sup> Kubo et al, *id.* estimate that existing U.S. standards will save consumers and businesses, cumulatively, by 2030 about \$186 billion; savings from updating current standards to reflect efficiency improvement will save another \$19 billion (net present value). *Id.* at 5-6. Potential new standards on new products could save consumers and business owners another \$75 billion for equipment purchased through 2020. *Id.* at iv.

be cheap. They were not cheap, however, when the costs of the electric power supply necessary to run these very inefficient machines became apparent. In fact, the purchase and supply of inefficient equipment cost more than three times what would have been the cost of supplying the most efficient refrigerators on the world market [in 1991].

Another example is “the \$150 million refurbishment of thirteen incandescent bulb factories in Hungary in 1990. The \$150 million [investment] could have been used to finance more than twenty new compact fluorescent lamp factories.” The construction of fluorescent lamp factories could have avoided the construction of 12,000 megawatt (MW) power plants resulting in savings of \$20 billion and minimizing air pollution in a country already suffocating in smog.<sup>15</sup>

Appliance efficiency labels that accurately inform consumers of the electricity the appliance will require, and appliance efficiency standards that set minimum efficiency requirements for appliances in the marketplace are among the most inexpensive and effective means of improving the efficiency of residential and commercial electricity use.<sup>16</sup> Under either approach, government policymakers, at relatively low cost, can establish appliance efficiency performance standards and consumer information requirements (labels), and can monitor compliance and enforce violations. Private manufacturers will innovate and compete within the government set ground rules.

The government also provides incentives to industry to improve appliance efficiency beyond minimum standards. As greater product efficiency is realized, the government could ratchet the standards to the higher level achieved by the innovation. This iterative process can transform the market to one that drives substantial efficiency improvements.<sup>17</sup>

Globally, both labels and standards have been adopted as valuable tools for setting and implementing national energy efficiency policy. A European-wide requirement has been adopted by the European Union, and some 35 nations around the world have adopted some form of energy efficiency label or standard.<sup>18</sup> These programs work. For instance, after its first year, the Philippines’ mandatory standards and labeling program resulted in a 25% increase in average efficiency of all air conditioners, which translates into an energy savings of 6 MW in demand and 17GWh in consumption. Korea, three years into its mandatory standards and labels programs enjoyed an 11% decrease in refrigerator energy consumption and a 24% decrease in air-conditioner

<sup>15</sup> Richard L. Ottinger, *Energy and Environmental Challenges for Developed and Developing Countries*, 9 PACE ENVTL. L. REV. 55, 59-60 (1991).

<sup>16</sup> Benefits from existing U.S. standards are more than 2,500 times greater than the program costs and represent an overall societal cost-benefit ratio (after the appliances are purchased) of 3 to 1. Standards that were about to take effect in 2001 were estimated to generate benefits worth about 2000 times the program costs. Savings from updating current U.S. standards to reflect efficiency improvement will have an overall cost-benefit ratio nearly as good as the original standards: 2.8 to 1. Energy savings from potential standards in new product categories would enjoy an overall benefit-to-cost ratio of 5 to 1 – far better than the 3 to 1 ratio for existing standards and 2.8 to 1 for updated existing standards. From a government resources perspective, the new standards’ benefits would probably be 1,000 times greater than the government’s costs. Kobu et al, *supra* note 2 at iv, 5-6.

<sup>17</sup> Steven Nadel, Jennifer Thorne, Harvey Sachs, Bill Prindle, and R. Neal Elliot, *Market Transformation: Substantial Progress from a Decade of Work* (American Council for an Energy-Efficient Economy April 2003), at <http://aceee.org>.

<sup>18</sup> Lloyd Harrington and Melissa Damnic, *ENERGY LABELING AND STANDARDS PROGRAMS THROUGHOUT THE WORLD*, The National Appliance and Equipment Energy Efficiency Committee, Australia, Report 2004/04 (2d ed. 2004), at [www.energyefficient.com.au](http://www.energyefficient.com.au). This report details the labeling and standards programs, with references and pictures of each the labels used by each program in Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Costa Rica, Croatia, European Union (25 nations), Ghana, Hong Kong (China), India, Indonesia, Iran, Israel, Jamaica, Japan, Korea, Malaysia, Mexico, New Zealand, Norway, Peru, Philippines, Russia, Saudi Arabia, Singapore, South Africa, Sri Lanka, Switzerland, Chinese Taipei, Thailand, Tunisia, and the United States. It also provides a summary of the International Energy Star® program.

energy consumption. Thailand, which instituted a voluntary program, recorded a 14% decrease in refrigerator energy consumption (after 3 years) and a 65 MW decrease in energy demand and a 643 Gwh drop in consumption.<sup>19</sup>

Romania addresses energy efficiency standards for devices, equipment, machine tools and technologies through government regulations and controls over sales and leasing:

## Romania: Law Concerning the Efficient Use of Energy

### Chapter IV - Standards of energy efficiency

**Article 8:** (1) Technical regulations and national standards of energy efficiency for devices, equipment, machine-tools and technologies with a high energy consumption, buildings as well as in other fields are approved through Government Decision after the proposal of the Romanian Agency for Energy Conservation, the competent ministries and the Standard Association in Romania.

(3) The national energy efficiency standards set the minimum or maximum limits for the energy performances of devices, equipment, machine tools and technologies.

**Article 9:** The producers and importers of devices, machine-tools, equipment and technologies, for which national standards of energy efficiency have been developed, cannot sell, lease or put in any way the respective products on the Romanian market, unless they observe the national standards of energy efficiency and the attestation certificate, issued according to the provisions of Art. 10.

**Article 10:** (1) The producers and the importers of devices, machine-tools, equipment and technologies, for which national standards of energy efficiency have been developed, are obliged to ask for tests and measurements to be carried out according to the regulations in force, in order to get the conformity certification.

(2) The institutions accredited to that effect by the Romanian Agency for Energy Conservation will carry out the tests and measurements. After carrying out the tests and measurements, the accredited institution issues the producers and importers certificates for the products that comply with the compulsory national energy efficiency standards.

(3) The certification and attestation procedure is approved through the same regulation as the standard.

**Article 11:** The national energy efficiency standards for devices, machine tools, equipment and technologies, the standards for buildings, as well as those for the other fields of activity come in force and are compulsory one year after their publication in the Official Monitor of Romania.

Full text available at: <http://www.munee.org/go.idecs?c=12>

<sup>19</sup> CLASP Success Stories, [www.clasponline.org/resource.php3?nnx=6&no=13](http://www.clasponline.org/resource.php3?nnx=6&no=13)

This chapter will offer an overview of the process and issues involved in drafting appliance efficiency and labeling laws, examples of typical legislative language, and references to powerful resources with detailed information, analytical templates and supporting databases for drafting a nation's legislation and regulations.

## II. HELPFUL DRAFTING RESOURCES CLASP

Substantial expertise and resources are available to developing countries seeking to engage in this process. Funding is available from national foreign assistance programs, multilateral development banks, regional U.N. Economic Commissions, the Global Environmental Facility, and various private foundations. Most of the expertise and funding is coordinated through the Collaborative Labeling and Appliance Standards Program (CLASP).<sup>20</sup> It is the single best resource for any nation considering adopting or revising appliance efficiency standards of labeling laws.

CLASP, a joint project of Lawrence Berkeley National Laboratory (LBNL), the Alliance to Save Energy, and the International Institute for Energy Conservation, supports the design, drafting and implementation of efficiency standards and labels in developing and transitional countries through partnerships with agencies, stakeholders and relevant institutions in those countries. CLASP's mission is to be "an independent, global, technical resource for governments and other organizations wanting assistance in developing energy efficiency standards and labels." CLASP, "with support from USAID, the UN Foundation, the Energy Foundation, the US Department of Energy, the U.S. Environmental Protection Agency, the US Department of State, the Global Environmental Facility, World Bank, the Australian Greenhouse Office and others, is developing globally applicable technical and policy support tools, conducting regional outreach, and providing technical support to partner countries. In each participating country, the project results in enhanced institutional capacity for implementing standards and labeling programs, increased production of energy-efficient products by manufacturers, improved average energy efficiency of appliances and equipment, significant reductions in electricity consumption, and lower energy-related emissions of greenhouse gases and other pollutants."

CLASP also maintains a web-based international clearinghouse of efficiency standards and labels programs,<sup>21</sup> has published a comprehensive manual for drafting efficiency standards and labels,<sup>22</sup> has developed and makes available important analytical tools, and concretely assists interested nations in developing their programs. For instance, CLASP has developed a Residential Energy Consumption Survey (RECS) and Small Business Energy Consumption Survey (SBECS) to help policy makers assemble the data critical to designing an effective standards or label program:<sup>23</sup>

<sup>20</sup> [www.CLASPOnline.org](http://www.CLASPOnline.org). For additional background on the need for and creation of CLASP, see Mirka F. Della Cava, Stephen Weil, Peter DuPont, Sood R. Na Phuket, Sachu Constantine, and James E. McMahon, *Supporting a Network for Energy Efficiency Labels and Standards Programs in Developing Countries (CLASP 2000)*, at [www.CLASPOnline.org/download/Standards\\_Labeling/2000/104/](http://www.CLASPOnline.org/download/Standards_Labeling/2000/104/).

<sup>21</sup> CLASP's worldwide standards and label programs database, at [www.CLASPOnline.org](http://www.CLASPOnline.org), contains materials on 87 different products, across 60 nations and the European Community; the database is searchable by product, nation, region, standard, or label program type

<sup>22</sup> Stephen Weil & James. E. McMahon, Eds., *ENERGY-EFFICIENCY LABELS AND STANDARDS: A GUIDEBOOK FOR APPLIANCES, EQUIPMENT AND LIGHTING* (February 2001), at [www.CLASPOnline.org](http://www.CLASPOnline.org). The book is also in Chinese, Korean, and Spanish.

<sup>23</sup> The survey and instructions are at [www.clasponline.org/survey.php3](http://www.clasponline.org/survey.php3).



Quality data regarding equipment ownership and use patterns are the technical foundation of the assessment and development of any energy efficiency policy. In particular, standards and labeling programs for residential and commercial products depend on accurate and locally relevant information at the level of an individual household or commercial enterprise. Residential and commercial survey datasets provide give an indication of ownership rates, common product classes, and use patterns for a variety of products. In addition, they yield market information such as brand, model type and price paid of common equipment. The United Nations Foundation recognizes the value of facilitating collection of quality survey data for use in developing Standards and Labeling programs. It has therefore developed, in collaboration with CLASP, a publicly available set of tools as a resource to program managers and analysts.

There are two survey types provided - residential (RECS) and small business (SBECS). In many countries around the world, small shops, restaurants, offices and other businesses use equipment that is similar to that used in residences for lighting, refrigeration, heating and cooling, and heating water. Therefore, the two surveys have many common elements. Large and specialized commercial equipment are not covered.

The tools provided are (1) a standard printable survey form (2) data entry and collection software and (3) an instruction guide for survey management and implementation. Elements (1) and (2) are combined into a single Microsoft Excel spreadsheet for each survey type. The files are designed such that a printout can be made, constituting an exact hardcopy survey form for use in the field by interviewers. Once data is collected, the same files are used to transfer the collected data efficiently and accurately into a datasheet, which can then be used for analysis. User Instructions are given in Microsoft Word files and provide details of how to use the spreadsheet tools and describe each type of information to be collected. In addition, the User Instructions provide guidance towards the effective implementation of a survey program, including training requirements.

The CLASP website and CLASP support enable any nation to engage in energy efficiency law reform. The CLASP website describes a law development process that is comprehensive, expert, and straight forward:

CLASP works at the national level to build the skills and institutional capacity necessary to develop, enforce, and maintain standards and labels. National successes help build a critical mass of knowledge, skills, and infrastructure in each region. Participation by multiple countries in the same region begins to have an effect at the regional and international levels through effects on cross border trade flows. To achieve this outcome, CLASP devotes about 70% of its resources to national assistance, about 20% to regional alignment/harmonization projects, and about 10% to building partnerships and creating tools such as this web site to facilitate the national and regional projects.

CLASP projects build upon existing initiatives in any country to promote the cost-effective adoption and implementation of energy efficiency standards and labels. CLASP's objective is to transform the manufacture and sale of energy consuming products to higher levels of energy efficiency, thereby presenting an opportunity for all countries in the region to grow in a more environmentally sustainable and economically efficient manner. CLASP projects often focus on regional markets.

CLASP provides assistance in any or all of the following seven process-oriented steps in standard-

setting or labeling program implementation, including: 1) deciding whether and how to implement energy efficiency standards and labels (appropriate products, priorities, timing); 2) developing a testing capability; 3) designing and implementing a labeling program, encompassing consumer, manufacturer, and retailer outreach; 4) analyzing and setting standards; 5) involving all stakeholders at a country and regional level, including industry, NGOs and consumers; 6) maintaining and enforcing compliance, and 7) evaluating the labeling and standards-setting program to demonstrate overall effectiveness and to determine opportunities for upgrade and improvement.

CLASP designs its projects to facilitate exchanges among governments, industry, inter-governmental organizations, and technical support groups based on the concept of linking assistance providers and assistance recipients in partnerships with shared responsibilities. It facilitates the participation of stakeholders with global and national expertise in energy efficiency standard-setting and labeling and builds upon previous successful experiences worldwide to implement any S&L program. CLASP's basic approach is to assist project stakeholders in defining and performing their appropriate roles, rather than performing any basic functions on their behalf. Fundamentally, all the activities can be classified as capacity building.

Experience suggests that inefficient appliance and equipment technology often becomes available to developing countries (low entry costs, little copyright protection) from new-entrant local suppliers no longer able to sell inefficient products in developed countries.

CLASP projects seek to strike the most appropriate balance among the sometimes competing objectives of:

1. providing and stimulating the use of highly efficient products;
2. supporting local manufacturers; and
3. ensuring that consumers have the capacity within the context of the local industrial, economic and energy infrastructure to afford efficient technology.

### III. STANDARDS AND LABELING DRAFTING CONSIDERATIONS

#### A. How does one decide whether to adopt standards and/or label programs?

Appliance Energy Efficiency and Label Programs generally use two different techniques, energy efficiency labels and energy efficiency standards, either separately or combined.<sup>24</sup> Label designs can take varying approaches, such as endorsements, certifications, product comparisons, and product energy usage. No matter the form, all labels are designed to inform consumer choice at the time of purchase. The labels do not mandate how efficient a product must be. Instead, label programs seek to provide consumers with energy efficiency and lifecycle cost information to

<sup>24</sup> The overview that follows in this and later sections of the chapter are, unless otherwise specifically noted, taken from STEPHEN WEIL & JAMES E. MCMAHON, EDS., ENERGY EFFICIENCY LABELS AND STANDARDS: A GUIDEBOOK FOR APPLIANCES, EQUIPMENT AND LIGHTING (CLASP February 2001), the CLASP web site, [www.CLASPOnline.org](http://www.CLASPOnline.org), ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC, ENERGY EFFICIENCY: COMPENDIUM OF ENERGY CONSERVATION LEGISLATION IN COUNTRIES OF THE ASIA AND PACIFIC REGION (UNITED NATIONS 1999), AND INTERNATIONAL ENERGY AGENCY, ENERGY STANDARDS AND LABELS (OECD/IEA 2000), at [www.iea.org](http://www.iea.org).

encourage market choices to purchase energy efficient appliances. To the extent accurate energy efficiency and lifecycle cost information is conveyed by labels to the purchaser, consumer choice will be tilted towards more efficient products and manufacturers will be induced to make and market more efficient appliances.

In contrast to labels, energy efficiency standards set specific, minimum energy performance requirements for products and classes of products. Whichever approach, or combination of approaches used, the government must decide whether to make them mandatory or voluntary.

The first step in the decision process is for the government to decide whether it should use labels or standards, or both, and if so, which approaches would be best for the country; the policymaker must also decide whether the program will be mandatory or voluntary. This first step is critical to the success of any program. It is analytically challenging and requires the availability of a broad range of valid, reliable data. The policymaker must assess the nation's institutional, economic, legal, and cultural capacity to develop and implement a program, must determine if there is adequate political support for the effort, must quantify the economic and environmental costs and benefits of an appliance efficiency program, and must estimate the effect of a program on consumer preference.

**Example of a statutory energy efficiency policy statement:**

### **JAPAN: The Rational Use of Energy Law**

#### **Chapter 1, Objectives, Article 1.**

This law's purpose is to contribute to the sound development of the national economy through implementing necessary measures for the rational use of energy in factories, buildings, and machinery and equipment, and other necessary measures to promote comprehensively the rational use of energy in order to ensure the effective use of fuel resources that would meet the economic and social environment of energy at home and abroad.

#### **Chapter 1-2. Fundamental Policies, etc., Article 3.**

1. The Minister of Economy, Trade and Industry shall determine and make public Fundamental Policies for the purpose of promoting comprehensively the rational use of energy at a factory, business premise,
2. The Fundamental Policies shall, in order to rationalize the use of energy, define measures to be implemented by energy users, policies to promote the rational use of energy in consideration of a long-term outlook of energy supply and demand, technical level for the rational use of energy or other circumstances.

Full text at [http://www.eccj.jp/index\\_e.html](http://www.eccj.jp/index_e.html).

Additional useful information and data on energy efficiency in Japan is available from Japan's Agency for Natural Resources and Energy, [www.enecho.meti.go.jp](http://www.enecho.meti.go.jp).

To begin, the policymaker must assemble the data on and evaluate a) the current and potential efficiency of different appliances that are or will be available in the market, b) whether the products are or could be domestically produced or must be imported, c) and the kinds of standards other countries have or are about to adopt. CLASP is an important resource for this step. This information must be combined with the evaluation of the nation's needs and institutional capacity to determine what range of products should be covered by the efficiency program (e.g., refrigerators, lighting, air conditioning, freezers, computers, etc.), what kind of regulation (label or standard) would work best for each covered product category, and the anticipated costs and benefits of each approach to determine the kind, scope and stringency of policy that should be adopted. The end product of this analytical process will be the decision whether to adopt a program, and if so, the kind, scope and stringency of the policy that should be adopted.

## **B. What testing capability is needed for a standards and/or label program?**

The next critical requirement is that the nation be able to determine whether a product complies with the proposed standard and whether the label's claims are accurate. Thus, it is essential that the country establishes or obtains access to a qualified testing center for evaluating the energy efficiency of products and label claims. Both standards and label requirements must be supported by protocols for product energy efficiency testing in order to standardize measurement of a product's energy use and efficiency and to standardize the efficiency information on labels. The nation could set up its own center, join with other nations to run a regional center, or contract with an existing facility for the services. This testing capability is essential for program legitimacy and effectiveness, both when establishing the regulatory requirements and in insuring compliance. Also, the testing protocols and protocols for product certification by industry must be publicly promulgated, so both industry and the testing center can reliably and comparably evaluate product performance and market compliance.

### **EXAMPLE OF LEGAL AUTHORITY FOR PRODUCT TESTING AND DATA REPORTING**

#### **Canada: Energy Efficiency Act - 1992, c. 36**

##### **Product testing 6**

- (1) The Minister may require any dealer who ships or imports energy-using products as described in subsection 4(1) to make available, at such place as the Minister may specify, such number of those products as the Minister considers to be reasonably necessary for examination and testing under this section, and the dealer shall forthwith comply with the request.
- (2) The Minister may dismantle and examine any energy-using product made available pursuant to subsection (1) and may conduct such tests on it as the Minister considers to be reasonably necessary to determine the product's energy efficiency.

(ó) The Minister may enter into an agreement or other arrangement with any person for the examination and testing of energy-using products under this section.

### **Regulations – Statistics**

22. The Governor in Council may make regulations requiring prescribed persons to file with the Minister, in the prescribed form and manner, at the prescribed time and for each prescribed reporting period, a report setting out prescribed statistics and information respecting

- (a) the value, quantity, type and use of energy, including alternative energy, purchased, consumed or sold by that person;
- (b) the expenditures of that person on the research, development, acquisition and operation of energy-using equipment and related technology; and
- (c) the sales of prescribed energy-using products or classes of energy-using products by that person, including the revenue from, and geographic distribution of, the sales.

Source: <http://laws.justice.gc.ca/en/E-6.4/text.html>

Availability of technical expertise and testing capability is also essential in designing standards and labels. In choosing a testing standard, the nation must decide what kind of data is most valuable to assess energy efficiency. This could include a range of measures, such as how much energy does the product use overall, and in performing different aspects of its tasks. The analysis must also consider how much variability in energy consumption and efficiency will be acceptable for a product to meet applicable standards or labeling requirements, how much variability in the test method itself is acceptable, and how much all this testing will cost.

### **Example of Technical Testing Facility in Developing Countries**

**Egypt.** The Ministry of Electricity and Energy is setting up an energy efficient equipment laboratory as part of its Energy Efficiency Improvement project; the laboratory is funded jointly by the Egyptian Government, UNDP and Global Environment Facility. The laboratory will be an important tool in Egypt's efforts to reduce energy consumption, and will provide "teeth" to Egypt's recently adopted energy efficiency standards for refrigerators, washing machines and air conditioners. The laboratory will enable Egypt to verify energy consumption levels of imported and locally made electrical appliances, and to monitor compliance with energy efficiency standards.

Source: <http://www.CLASPOnline.org>.

## C. What factors must be considered in designing standards and labeling efficiency programs?

Once a nation has decided to adopt a standard or label program it must establish adequate legal authority for and then set about to design a specific label and set particular product efficiency standards.<sup>25</sup>

### EXAMPLE OF LEGAL AUTHORITY FOR A STANDARDS AND DESIGN PROGRAM

#### Canada, Energy Efficiency Act - 1992, c. 36

##### Trade in Energy-Using Products

4. (1) No dealer shall, for the purpose of sale or lease, ship an energy-using product from , or import an energy-using product into Canada, unless
- (a) the product complies with the energy efficiency standard; and
  - (b) the product or its package is labeled in the prescribed form
- (2) No person shall, before an energy-using product is sold to the first retail purchaser or leased to the first lessee, remove, deface, obscure or alter any label put on the product or its package in accordance with the regulations.

##### Regulations

20. (1) The Governor in Council may make regulations
- (a) prescribing as an energy-using product any manufactured product designed to operate using electricity, oil, natural gas or any other form or source of energy or to be used as a door system or window system;
  - (b) prescribing energy efficiency standards for energy-using products or prescribed classes of energy-using products;
  - (c) prescribing the form and manner of labeling energy-using products or their packages or prescribed classes of energy-using products or their packages with respect to the products' energy efficiency;
  - (d) providing for the testing of energy-using products to determine their energy efficiency;

Source: <http://laws.justice.gc.ca/en/E-6.4/text.html>

<sup>25</sup> CLASP maintains an extensive, searchable label design library with 326 different labels. The site displays each label, which can be sorted by country, label type, or product; it also maintains links to each program. It is located at [www.clasponline.org/label.php3?m=0&n=5](http://www.clasponline.org/label.php3?m=0&n=5). Another extensive database and important resource is maintained by the Asia-Pacific Economic Cooperation (APEC) Energy Standards and Labeling Program. The APEC Energy Standards Information System (ESIS) is a new APEC-funded initiative to develop a comprehensive web site on testing standards, MEPS, and labeling requirements for countries in the Asia-Pacific region. Information is at [www.apec-esis.org/home.asp](http://www.apec-esis.org/home.asp)

## D. What are the Label Design Considerations?

A label can simply provide an endorsement or seal of approval from a certified program, either public or private. The U.S. EPA and Department of Energy ENERGY STAR® label is an excellent example of an endorsement label.<sup>26</sup> Other nations that use endorsement labels include Australia, Brazil, China, European Union (some EU countries, such as Germany, Great Britain, The Netherlands, Austria, Spain and Poland, also have their own endorsement label), India, Japan, Korea, Mexico, New Zealand, Singapore, Switzerland, and Thailand.<sup>27</sup> Endorsement labels generally display a seal of approval that provides no specific energy use data to the consumer, but instead represents the endorser's assurance that the product meets some level (hopefully high) of performance, either in absolute terms or in relative terms, such as identifying products that perform at the top 10% of all products of that type on the market.

The value of the endorsement label is directly related to the credibility of the endorser to the purchaser. Hence, the U.S. and International Energy Star label, all of which are government issued, has been very effective. However, as the variety of endorsements and endorsers expands, and endorsements compete with each other, seals of approval labels become confusing to consumers and lose their power to influence consumer choice. On the other hand, one of the major strengths of endorsement labels is that they are easy for the consumer to read because they contain little or no statistical information.

### EXAMPLE OF LAW ESTABLISHING A LABELING PROGRAM

#### European Union: Energy labeling of household appliances, (EC) reg. No. 2422/2001

The Directive applies to refrigerators, freezers and their combinations; washing machines, dryers and their combinations; dishwashers; ovens; water heaters and hot-water storage appliances; lighting sources; and air-conditioning appliances.

Household appliances offered for sale, hire or hire-purchase must be accompanied by a fiche and a label providing information relating to their consumption of energy (electrical or other) or of other essential resources. Where appliances are offered for sale, hire or hire-purchase by catalogue or by other means whereby the potential customer is unable to see the appliance displayed, the essential information contained in the label or fiche must be provided to the potential customer before purchase.

The supplier must establish, and make available, technical documentation sufficient to enable the accuracy of the information contained in the label and the fiche to be assessed. This documentation must include: a general description of the product; the results of design calculations, where necessary; test reports; and where values are derived from those obtained for similar models, the same information for these models.

<sup>26</sup> For detailed information see [www.energystar.gov](http://www.energystar.gov) (United States), <http://energyefficiency.jrc.cec.eu.int/energystar/> (European Union Energy Star), or [www.energystar.gov.au](http://www.energystar.gov.au) (Australia and New Zealand Energy Star).

<sup>27</sup> Compiled from data reported by Harrington and Damnic, ENERGY LABELING AND STANDARDS PROGRAMS THROUGHOUT THE WORLD, *supra* note 8, and by the CLASP label design library, *supra* note 15.

**Suppliers must provide:**

- a free label, to be attached to the appliance by the dealer in the appropriate position and in the appropriate language version;
- a product fiche, contained in all the brochures relating to the product or, where these are not provided, in all other literature provided with the appliance.

**Member States must take the necessary measures to:**

- ensure that all suppliers and dealers established in their territory fulfill their obligations under this Directive;
- prohibit the display of labels, marks, symbols or inscriptions relating to energy consumption which do not comply with the requirements of this Directive and which are likely to cause confusion, with the exception of Community or national environmental labels;

**The Directives adopted in implementation of the present Directive must specify:**

- the exact definition of the type of appliances to be included;
- the measurement standards and methods to be used in obtaining the information relating to energy consumption;
- details of the technical documentation required;
- the design and content of the label;
- the location where the label shall be fixed to the appliance;
- the content and where appropriate the format of the fiche, on which must be included the information appearing on the label;
- the information details to be provided in the case of mail-order offers for sale.

The label also or alternatively can provide a qualitative rating, specific performance data, or comparative information for consumers. Comparison labels contain various types of energy information, qualitative or quantitative, that can be used to compare products in a category. Examples of comprehensive product comparison label are those mandated in the European Community, Argentina, Australia, Brazil, China, Colombia, Hong Kong (China), Hungary, India, Indonesia, Iran, Israel, Malaysia, Mexico, Sri Lanka, Switzerland, Thailand, and United States.<sup>28</sup>

Comparison labels provide more consumer information than endorsements, but are less easily readable. Canada and the U.S. use a label that rates appliances on a continuous scale, as does Israel, Jamaica, Japan, Malaysia, Mexico, Indonesia, Russia, Singapore and Sri Lanka.<sup>29</sup>

<sup>28</sup> Id.

<sup>29</sup> Id.



Information only labels provide a high level of information but sacrifice readability and ease of product comparison. Information only labels are used in the Costa Rica, Mexico, Indonesia and Philippines.<sup>30</sup> These provide energy consumption, efficiency ratings and operating costs for the product only, leaving it up to the consumer to gather and compare data on other products on the market.

Label design can vary within a country from product category to category; countries may make labels mandatory for one product category but leave them voluntary in another category. The particular approach and actual design of labels should be the one that best suits the nation's economic, social, and cultural factors, and should also consider the need to harmonize the label with that required by other nations in the region and with the requirements of the countries where the products are manufactured.

### **E. What Are Consideration For Drafting Design Standards?**

Standards set product-by-product performance criteria that manufacturers must achieve. Standards can be designed to eliminate the least efficient products from the market, eliminate all but the most efficient products from the market, to harmonize with other nations' standards, or to encourage local manufacturers to make or local importers to import and sell products more efficient than meet the minimum standards. In making these decisions, policy makers need to make an engineering analysis, a national impact analysis, a consumer analysis, and a manufacturing analysis.<sup>31</sup>

- The engineering analysis evaluates the energy efficiency of products sold in the country and determines both the technical feasibility and cost of improving the products' efficiency, and also considers how the efficiency improvements will affect the products' overall performance.
- The national impact analysis examines the specific proposed standard's potential social costs and benefits, the impact reduced energy consumption would have on local utilities, and the environmental benefits and possible adverse effects the standard's reduced energy consumption might cause.
- The consumer analysis evaluates the standards' economic impact on a consumer's purchase decision.
- Finally, the manufacturing analysis evaluates the effect of the standard on domestic and international manufacturers, suppliers, importers, employment, and retailers.

In considering this information, whether for label design or standard setting, it is important that all stakeholders be involved, both to establish political credibility, legitimacy, and support for the proposed standard, and to insure that the data and analysis do not ignore key factors, or reflect analytical mistakes. Stakeholders should include community leaders, government officials, legislators, manufacturers, importers, retailers, consumers, energy suppliers, and environmental interests.

The result of this public deliberative process should be substantial consensus on measures that best meet the social, economic, political, and environmental needs of the communities and nation, and fit their scientific and technical capability. Policy makers must also consider what the communities and

<sup>30</sup> Id.

<sup>31</sup> Weil and McMahon, CLASP GUIDEBOOK, 23, *supra* note 12

nation must do to develop adequate institutional capability for the program, what legal authority will be necessary, how and what kind of monitoring capacity they have and will need, how they will inform those regulated of the new mandates, and their capacity to assist those regulated to achieve compliance. Lessons from other nations can be extremely valuable in this endeavor. Finally, the policy makers must evaluate how to develop the capacity to assess the program's actual impacts, its successes and failures, to learn from these lessons, and to use this learning to fix and improve the program.

### Examples of Standards Programs in Developing Countries

**Ghana.** Ghana's Electrical Appliance Labeling and Standards Programme (GEALSP) has set a mandatory minimum standard for air conditioners; it is test standard GS362 (2001) which uses as a reference standard ISO 5151. The implementing entity for this standard is the Ghana Energy Foundation ([www.ghanaef.org](http://www.ghanaef.org)). The Ghana Energy Foundation is a non-profit, public-private partnership institution devoted to the promotion of energy efficiency and renewable energy as a key strategy to Ghana's growing energy needs in a sustainable manner. It was established in November 1997, by the Private Enterprise Foundation in collaboration with the Government of Ghana, energy sector stakeholders and private sector energy consumer.

**Egypt.** In 2003, the Egyptian Organization for Standardization approved Energy Efficiency Standards Specifications for refrigerators, washing machines and air conditioners. A Ministerial decree requires that manufacturers and importers comply with this standard and label electrical appliances with energy consumption data about the appliance.

Source: <http://www.CLASPOne.org>.

## IV. WHAT ASSISTANCE CAN THE CLASP GUIDEBOOK AND OTHER RESOURCES PROVIDE?

The process described above reflects an overview of the general procedures for establishing energy efficiency labeling and standards requirements. It has been taken largely from the invaluable CLASP Guidebook that elaborates on each step, with special consideration given to the special challenges facing developing countries. Written by experts from around the world who have extensive experience in helping developing nations develop energy efficiency and label programs, it is an invaluable resource for the process. In 219 pages it details, chapter by chapter, every aspect of the steps described above. It is, in the authors' words, "a manual for government officials and others around the world for designing, implementing, enforcing, monitoring and maintaining labeling and standard-setting programs. It discusses the pros and cons of adapting energy-efficiency labels and standards and describes the data, facilities, and institutional and human resources needed for these programs. It provides guidance on the design, development, implementation, maintenance, and evaluation of the programs and on the design of the labels and standards themselves." It is available free from CLASP at [www.CLASPOne.org](http://www.CLASPOne.org).

Another valuable resource for those interested in developing a label or standards program is Economic and Social Commission for Asia and the Pacific, Energy Efficiency: Compendium of Energy Conservation Legislation in Countries of the Asia and Pacific Region (United Nations 1999), ([www.unescap.org/publications/detail.asp?id=758](http://www.unescap.org/publications/detail.asp?id=758)). It contains articles that discuss general considerations for a label or standards program, and that describe the regulatory programs in Australia, Japan, Korea, the Philippines and Thailand. Additionally, it contains examples of energy labels and extensive portions of the relevant laws in Australia, China, Japan, Republic of Korea, the Russian Federation, Thailand, the U.S., and Uzbekistan.

**Extensive resources are available on the internet. Among the most useful web sites are:**

- Collaborative Labeling and Appliance Standards Program (CLASP) – [www.CLASPOnline.org](http://www.CLASPOnline.org)
- APEC Energy Standards Information Systems [www.apec-esis.org](http://www.apec-esis.org)
- African Energy Policy research Network - [www.afrepren.org/](http://www.afrepren.org/)
- Alliance to Save Energy - [www.ase.org/](http://www.ase.org/)
- American Council for an Energy-Efficient Economy (ACEEE) – [www.aceee.org](http://www.aceee.org)
- Appliance Standards Awareness Project - [www.standardsasap.org](http://www.standardsasap.org)
- Energy Efficient Strategies, Australia – [www.energyefficient.com.au](http://www.energyefficient.com.au) and [www.energyrating.gov.au](http://www.energyrating.gov.au)
- Energy Star, U.S. - [www.energystar.gov](http://www.energystar.gov)
- Ghana Energy Foundation - [www.ghanaef.org/](http://www.ghanaef.org/)
- International Energy Agency – [www.iea.org](http://www.iea.org), [www.caddet.org/](http://www.caddet.org/)
- International Institute for Energy Conservation – [www.iiec.org/](http://www.iiec.org/)
- U.S. Department of Energy - Energy Efficiency Network - [www.eere.energy.gov](http://www.eere.energy.gov)
- Lawrence Berkeley National Laboratory Energy Efficiency Program – [www.eetd.lbl.gov](http://www.eetd.lbl.gov)
- Capacity Building Project in Energy Efficiency and Renewable Energy (CaBEERE) (a joint project of South Africa and Denmark) - [www.dme.gov.za/publications/cabeere\\_project.html](http://www.dme.gov.za/publications/cabeere_project.html)
- India Bureau of Energy Efficiency - [www.bee-india.com/index.php](http://www.bee-india.com/index.php)
- Canada Natural resources Office of Energy Efficiency – [www.oee.nrcan.gc.ca/english/](http://www.oee.nrcan.gc.ca/english/)
- Renewable Energy and Energy Efficiency Partnership - [www.reeep.org/](http://www.reeep.org/)
- Brazil Secretaria de Estado do Meio Ambiente, [www.ambiente.sp.gov.br/](http://www.ambiente.sp.gov.br/)

## V. CONCLUSION

Appliance energy efficiency standards and label programs are among the most cost effective, durable, and rapidly accessible means to achieve efficient use of electricity. Every Kwh of electricity saved by a more efficient appliance is a Kwh that is available for other uses, or is a Kwh that need not be generated. These savings reduce the need to invest in additional generating capacity, and allow available electricity to be used more effectively. In a developing nation, with enormous capital needs in all sectors, such savings are invaluable. Moreover, in the developing world, where some two billion people still lack access to electricity, it is imperative that every Kwh of electricity be used as efficiently as possible, so it can benefit as many people as possible. Particularly as applied to new investment in electric using products, efficiency standards and labels can realize substantial energy savings at remarkably low cost. The savings from standards and label programs can also reduce the burning of polluting fuels, saving both fuel costs and the health and environmental costs of the otherwise unnecessary electricity generation.

At initial glance, the notion of developing and implementing a standards or labeling program might seem daunting. However, that is not the case. Rather, because these programs are so cost effective, an impressive array of organizations have combined efforts to make the process of program development and implementation relatively easy and inexpensive.

This chapter has outlined the range of issues that must be addressed in establishing an energy efficiency standards or label program, has pointed to some of the many examples of successful effort, and has provided reference to the extensive resources that are available to support any program. In particular, CLASP and APEC-ISIS provide access to expertise and support to any developing nation that wishes to adopt a program. Quite simply, with the expertise, resources, and support currently available, there is no reason that any country should be unable to enact standards and/or label program that will enable that nation to use its electricity more efficiently

## CHAPTER D. Energy Efficiency In The Building Sector

David B. Goldstein

### I. INTRODUCTION

#### A. Energy Consumption in Buildings and its Impact

Although the industrial sector typically dominates the energy consumption patterns in developing countries, in the most prosperous countries, buildings account for about 40% of energy use; considering the energy needed to construct the buildings, this total is even larger. Moreover, the pattern of energy consumption in buildings, focusing on the use of electricity and predominantly at the time of the electric peak load, means that buildings are even more important in terms of energy costs to consumers and to the utility system than the 40% energy consumption number would indicate.

As countries develop, the general pattern tends to be an increasing percentage of energy and peak power are being used in the building sector. This growth can result in serious strains on the energy infrastructure of a country. For example, in 2004, a large number of regions in China began to experience serious problems of imbalance between electricity supply and demand driven by explosive growth in new construction and a low level of energy efficiency in these new buildings.

Energy efficiency can contribute immensely to the solution of these problems, even in the relatively short term. But they cannot be expected to occur “automatically” as a result of market forces, or even in response to market reforms that price energy at its true market value. Instead, experience throughout the world shows that there are numerous, powerful market barriers to rational investment in energy efficiency. These barriers can be overcome by government policies, which are discussed in this chapter.

#### B. Energy Efficiency in Buildings

Energy efficiency is defined as the ability to provide the same (or higher) level of energy services, such as thermal comfort, high-quality lighting, etc. at lower energy consumption and cost. Energy efficiency is increased by investing in improvements in the design and the technology used in the building. Typically (but not always) an energy efficient building costs more to construct but it always costs less to operate. The ratio of the value of energy savings to the additional first cost can be considered a return on investment (ROI) on energy efficiency. Typically, the returns on investment greatly exceed what can be obtained in financial marketplaces; in the United States, for example, returns on investment for efficiency in commercial buildings typically range from 25% to 50% annually and higher. In examples for other countries, the ROI is even higher.<sup>32</sup>

<sup>32</sup> When the city of Moscow in the Russian Federation adopted and enforced its most recent energy standard, the incremental cost of energy efficiency turned out to be negative after manufacturers found after making adjustments to meet the new standard that the more highly insulated standard-compliant wall panels could be manufactured more cheaply than the old panels, because they use less (relatively expensive) concrete and more (relatively cheap) polystyrene insulation. With a negative first cost of efficiency, returns on investment are no longer even a valid metric: the ROI for a negative cost measure is better than infinite.

From a societal perspective, investments in energy efficiency in a building can be compared with the cost of capital investments necessary on the supply side of the energy system to produce a similar amount of peak capacity or annual energy production. Usually, the capital costs of efficiency are lower, and often far lower, than comparable investments in increased supply. The additional operating costs of efficiency are usually zero or negative,<sup>33</sup> compared to substantial operating costs for supply-side options. In addition, energy efficiency investments generally have much shorter lead times than energy supply investments, a particularly important consideration in countries where the demand for energy services is growing rapidly.

For new construction, energy efficiency in buildings is particularly important because the costs of retrofits are almost always much higher than the costs of energy efficient new construction. New construction is a “lost opportunity” resource for energy efficiency, because any efficiency investments not made during construction will be much more expensive to achieve as retrofits.

Energy efficient buildings generally provide not merely the same level of energy service, but a higher level of energy services than conventional buildings. Energy efficient buildings have higher levels of thermal comfort, greater ability to operate usably in the face of energy supply disruptions, and encourage greater productivity of their occupants. These benefits may be substantially larger than (and in addition to) the benefits of direct energy savings.

The most effective programs are designed not only to ensure that a particular target level of energy efficiency improvement is realized but also to assure that the market is prepared continually to introduce better and better technologies for energy efficiency. This process of continuous improvement in energy efficiency should be anticipated in the developmental process for energy efficiency codes by requiring that the codes be reviewed periodically – such as every three or four years – and updated to include requirements for the use of newer technologies that are cost-effective and feasible.

## II. LEGISLATIVE TOOLS TO PROMOTE BUILDING EFFICIENCY

### A. What are the legislative tools to encourage and require energy efficiency in new and existing buildings?

A number of jurisdictions throughout the world have had great success at overcoming market barriers and producing dramatically higher levels of energy efficiency than would otherwise have occurred. For example, California has held electricity consumption per capita steady for the past 30 years, while the rest of the United States experienced a 50% growth in electricity consumption (and slower economic growth than in California). This remarkable success was achieved primarily through only two legal mechanisms: codes and standards for new construction and performance-based economic incentives to go beyond the standards.

Other legislative and policy options that make sense and have had some record of success include:

- Normative labels to distinguish the most energy efficient buildings and equipment:

<sup>33</sup> Negative operating costs occur when the energy efficiency measure results in non-energy related operating cost savings for the building. For example, replacing incandescent lights with fluorescent lights reduced the maintenance cost of lamp replacement, which can be expressed as negative building maintenance cost for the efficiency measure.

- Informative labels that provide the information necessary to measure energy efficiency and annual energy costs for operation.
- Education and outreach to promote market acceptance of energy efficiency technologies and energy efficient designs, most notably efficiency demonstration centers;
- Long-term incentives with ambitious energy efficiency targets; and
- Government-funded research and development on energy efficiency in buildings.

This paper reviews legislation and its resulting regulations that have been effective.

## B. What are the Requisites for Codes and Standards?

We use the term codes to refer to mandatory energy efficiency requirements for new construction in buildings.<sup>34</sup> New construction may refer to an entirely new building being erected, or may refer to the construction of a new energy-using system (such as a lighting system or an air conditioning system) in an existing building. Standards refer to minimum mandatory requirements for equipment used in buildings, such as air conditioning units, furnaces or boilers, refrigerators, water heaters, clothes washing machines, dishwashing machines, etc.

The potential impact of energy codes and standards is dramatic. California is already saving over 6,000 megawatts of peak power from energy codes and equipment standards; this figure will grow to 12,000 megawatts in the year 2010. These savings figures can be compared to a peak load in California of 45,000 megawatts.

A jurisdiction planning on adopting codes and standards must undertake a two-step procedure. First, the jurisdiction must develop test protocols to determine how much energy use whole buildings or energy-using components of buildings are responsible for. These test protocols must cover insulation materials, fenestration materials (windows and doors), heating and cooling distribution systems, efficiencies of motors and fans, efficiencies of energy-using equipment, etc. Ideally, compliance with these protocols will yield databases listing the performance of each product or building offered for sale, and labels publicizing the tested performance.

The second step is to set mandatory minimum levels of performance for the criteria measured by each of these test protocols. As the reader can see from reading these documents, they are long and complex. Technical interchange between representatives of countries or provinces considering standards and representatives or technical experts from jurisdictions that have experience will be helpful; indeed, all of these documents rely heavily on inter-regional or international technical/legal contacts.

<sup>34</sup> EU: Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings (OJ L 1, 4.1.2003, p. 65).

See full text of law: [http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/L\\_001/L\\_00120030104en00650071.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/L_001/L_00120030104en00650071.pdf)

Summary/note: This Directive lays down requirements as regards:

- (a) the general framework for a methodology of calculation of the integrated energy performance of buildings;
- (b) the application of minimum requirements on the energy performance of new buildings;
- (c) the application of minimum requirements on the energy performance of large existing buildings that are subject to major renovation;
- (d) energy certification of buildings; and
- (e) regular inspection of boilers and of air-conditioning systems in buildings and in addition an assessment of the heating installation in which the boilers are more than 15 years old.

See: **United States** California's Title 24 energy codes regulations establishing minimum levels of performance. [http://www.energy.ca.gov/2005\\_standards/rulemaking/documents/15-day\\_language/2003-10-21\\_400-03-001-ET15F.PDF](http://www.energy.ca.gov/2005_standards/rulemaking/documents/15-day_language/2003-10-21_400-03-001-ET15F.PDF).

See: **California** appliance efficiency standards regulations. [http://www.energy.ca.gov/reports/2003-09-10\\_400-03-016.PDF](http://www.energy.ca.gov/reports/2003-09-10_400-03-016.PDF)

See: **U.S.** Federal U.S. appliance standards codified in 10 C.F.R. § 430.

See: **CANADA** Energy Efficiency Act (1992)

Link to full text of law: <http://laws.justice.gc.ca/en/E-6.4/text.html>

Summary/note: provides for the making and enforcement of regulations concerning MEPS for energy-using products, as well as the labeling of energy-using products and the collection of data. Regulations for the Energy Efficiency Act can be found at: <http://laws.justice.gc.ca/en/E-6.4/SOR-94-651/100709.html>

See: **MEXICO** Ley Federal Sobre Metrología y Normalización (1992)

Link to full text of law: <http://www.cddhcu.gob.mx/leyinfo/pdf/130.pdf> (Spanish version only)

Summary/note: creates voluntary and mandatory and efficiency standards

See: **RUSSIA** new energy code is SNiP 23-02 ("Thermal Performance of Buildings"). It is based on earlier regional standards, a list of which can be found at [http://www.cenef.ru/home-pg/List\\_e\\_1.html](http://www.cenef.ru/home-pg/List_e_1.html). The legal basis for both federal and regional codes is described at <http://www.cenef.ru/home-pg/hp-48e.html>.

See: **KAZAKHSTAN** regulations adopted by the scientific/technical board of the Construction Committee in Order number 250, dated 27 May 2004; the code document is entitled "The Republic of Kazakhstan Code, 2.04-21-2004, Energy Consumption and Thermal Performance of Civic Buildings." <http://www.cenef.ru/home-pg/Paper112e.pdf>.

See: **UZBEKISTAN** Law on the Rational Use of Energy (1997)

Link to full text of law: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter12.html>

Summary/note: includes building efficiency language

See: **CHINA** lighting energy efficiency standard for new buildings GB50034-2004, published in the Ministry of Construction Gazette (No. 247). This standard provides mandatory limits on lighting power density (watts of lighting that can be installed per square meter of lighted space). It also provides recommendations for the use of natural day lighting and the provision of controls for electric lighting, as well as recommended design methods, equipment efficiencies, and equipment selections for different applications. It covers both commercial ("public") and residential buildings.

For residential energy efficiency standards in China, "Warm in Summer, Cold in Winter" (Heating zone) standards that has "cold" and "very cold" subsections that was adopted in 1985 and "improved" in 1995, "Hot in Summer, Cold in Winter" (transition zone) standard promulgated in 2000, and "Hot in Summer, Warm in Winter" (cooling zone) standard promulgated in 2003. The draft commercial standard in China is GB 500XX – 2005 "Design Standard for Energy Efficiency of



Public Buildings" (office building sector), expected to be finished by the end of 2004. For reference, see [http://www.chinaeeb.com.cn/canada/tt\\_policy.html](http://www.chinaeeb.com.cn/canada/tt_policy.html).

See: **INDIA** The Energy Conservation Act (2001)

Link to full text of law: [http://www.keralaenergy.org/ecact/ecact\\_main.html](http://www.keralaenergy.org/ecact/ecact_main.html)

Summary/note: includes building efficiency language

Technical specifications at: [http://www.info.gov.hk/bd/english/documents/code/e\\_otiv.html](http://www.info.gov.hk/bd/english/documents/code/e_otiv.html)

See: **JAPAN** Law Concerning the Rational Use of Energy (1979)

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter5.html>

Summary/note: creates measures for the rational use of energy by factories, buildings, machinery and equipment, see especially Chapter 3: Measures for Buildings. [http://www.eccj.or.jp/index\\_e.html](http://www.eccj.or.jp/index_e.html) is a good reference as well.

Enforcement Ordinance for the Law Concerning the Rational Use of Energy can be found at:

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter6.html> and

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter7.html>.

See: **KOREA** Rational Energy Utilization Act (1995)

<http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter8.html>

Summary/note: includes building efficiency language

See: **PHILIPPINES** Guidelines for Energy Conserving Design of Buildings and Utility Systems

[http://www.doe.gov.ph/pls/portal30/docs/FOLDER/DOECONTENT\\_AREA/ENERCON/GUIDELINES+FOR+ECDBUS.PDF](http://www.doe.gov.ph/pls/portal30/docs/FOLDER/DOECONTENT_AREA/ENERCON/GUIDELINES+FOR+ECDBUS.PDF)

Summary/note: creates voluntary and mandatory and building and appliance efficiency standards.

See: **THAILAND** Energy Conservation Promotion Act (1992)

Link to full text of law: <http://www.eppo.go.th/admin/law/doc-NEPO-ACT2.html>; <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter10.html> ; <http://ostc.thaiembdc.org/energy/engact.html>

Guidelines, Criteria, Conditions and Expenditure Priorities of the Energy Conservation Promotion Fund during the Fiscal Period 2000-2004 can be found at: <http://www.eppo.go.th/encon/encon-fund00.html>

## Thailand

The Royal Decree Prescribing the Regulated Buildings, B.E. 2538 (1995) prescribes the regulated buildings by quantity of energy use. Section 3 provides that the following buildings are regulated buildings:

- (1) a building or group of buildings of which electricity installation is from 1,000 KW or 1,175 KVA and above; and
- (2) a building or group of buildings of which electricity, steam heat, or any other non-renewable energy consumption between 1 January and 31 December of each year is from 20 million MJ of electricity equivalent or above.

### C. What role do economic incentives play in the regulatory shift toward energy efficient buildings?

Economic incentives complement codes and standards. They depend on the prior existence of these standards both to establish the criteria by which superior performance can be measured and to establish levels of efficiency at which economic incentives are justified. In turn, incentives can complement standards by providing for differentiation in the marketplace between minimum efficiency or commodity buildings or products and enhanced-value, high efficiency buildings or products. Incentives can also encourage the widespread use of new technologies that may later be appropriate for standards, but which it is impossible to require at a given time due to questions about availability or universality of application.

Many economists prefer incentives to mandates, as a matter of philosophy, but this preference must be balanced against the need to provide a financial revenue source for the incentives. Standards require a dramatically smaller investment by the government in producing a given level of energy efficiency. They also guarantee that at least a basic level of efficiency will be met in all cases covered by them.

Legislation establishing programs for energy efficiency incentives must provide a funding mechanism for the incentive as well as an administrative mechanism for spending the money in the most effective way. These issues are discussed in Section IV.

## III. CODES AND STANDARDS

### A. What is the Importance of Test Protocols?

#### Residential and Commercial (Public) Buildings

All of the major energy-related choices – the thermal conductivity of insulation, the thermal transmission qualities of windows, the heat capacity of building materials, the solar heat transmission qualities of windows, the visible light transmission of windows, the air and water movement output of fans and pumps, the efficiency of motors, heat transfer efficiencies of heaters for air and water, etc., must be

determined by standardized measurements. Before advanced energy efficient equipment can be required for either a mandatory or a voluntary program, test protocols and labeling rules must be established and enforced. For building energy efficiency, the most effective codes offer two options of compliance, called “prescriptive” and “performance-based.”

Prescriptive standards set requirements for the components of a building, for example, the thermal conductivity of insulation or the efficiency of a heating device. They do not offer the designer the flexibility to vary from many of these minimum specifications.

Performance-based standards instead set maximums on the energy consumption or annual predicted energy cost of a building taken as a whole. They allow the designer to specify less energy efficiency in some components in return for more efficiency in others. They are more economically efficient because they allow the designer or builder to optimize the selection of efficiency measures to minimize first costs. They also tend to lead to innovations in which the efficiency measures actually used are better than the ones that were required in the prescriptive standards.

Prescriptive and performance-based standards generally are tightly connected to each other in that a building that has a typical design and meets all of the prescriptive requirements defines the level of energy performance required by this approach. The buildings performance method can be considered a test protocol for an entire building. In jurisdictions where such protocols have been easy to implement by the designer, they are the preferred method of compliance. However, in most parts of the world, builders comply using prescriptive-based approaches.

Standards also need to be updated to accommodate new materials and new questions over interpretation. Thus, it is probably more effective to authorize an administrative agency to adopt energy standards according to specific criteria. Then, the authorizing legislation can specify that the standards be revised every so many years in order to provide continual advancement in the level of energy savings

Many countries have test protocols for virtually all of the important energy-related systems and components in buildings. It will undoubtedly be easier for a jurisdiction to adopt or modify an existing test protocol already in use in another country or jurisdiction than to develop its own from scratch. This is particularly true with respect to components that are traded internationally.

At the present, there is little harmonization in methods for calculating whole building energy performance.

See, California Building Energy Efficiency Standards [http://www.energy.ca.gov/2005\\_standards/rulemaking/documents/15-day\\_language/2003-10-21\\_400-03-003-ET15.PDF](http://www.energy.ca.gov/2005_standards/rulemaking/documents/15-day_language/2003-10-21_400-03-003-ET15.PDF);

[http://www.energy.ca.gov/2005\\_standards/rulemaking/documents/15-day\\_language/2003-10-21\\_RES\\_ACM\\_APP.PDF](http://www.energy.ca.gov/2005_standards/rulemaking/documents/15-day_language/2003-10-21_RES_ACM_APP.PDF);

[http://www.energy.ca.gov/2005\\_standards/rulemaking/documents/15-day\\_language/2003-10-21\\_400-03-004-ET15.PDF](http://www.energy.ca.gov/2005_standards/rulemaking/documents/15-day_language/2003-10-21_400-03-004-ET15.PDF);

[http://www.energy.ca.gov/2005\\_standards/rulemaking/documents/15-day\\_language/2003-10-21\\_NON\\_ACM\\_APP.PDF](http://www.energy.ca.gov/2005_standards/rulemaking/documents/15-day_language/2003-10-21_NON_ACM_APP.PDF);

[http://www.energy.ca.gov/2005\\_standards/rulemaking/documents/15-day\\_language/2003-10-21\\_400-03-001JAET15.PDF](http://www.energy.ca.gov/2005_standards/rulemaking/documents/15-day_language/2003-10-21_400-03-001JAET15.PDF);

Perhaps the most comprehensive guide on how to measure whole-building performance is the California “Alternative Calculations Methods Manuals” for residential and commercial buildings, which describe the characteristics for software needed to do these calculations and the level of physical inspections needed to provide proper input to the software.

In addition to establishing protocols for testing buildings and components and regulating minimum acceptable levels of performance, the jurisdiction must develop plans for implementation and enforcement of the standards. These can be more difficult to establish at first, since the goal is to establish a positive feedback cycle in which companies and individuals that comply receive positive reinforcement in the marketplace, where those that are out of compliance face the potential of delays, requests for repair or restitution, or penalties. Once an expectation that a code will be enforced is established, it is not difficult to maintain these positive expectations, but a jurisdiction must plan on spending significant effort at first on establishing credibility on enforcement.

## **B. What are the requisites for new construction standards?**

Standards for new construction can be adopted legislatively or administratively. Where legislative adoption has been used, the legislative body has often adopted the local requirements of a national or international model, rather than having the details worked through the legislative process.

The issues concerning the adoption and implementation of energy efficiency codes are surprisingly similar around the world. The same types of stakeholders are involved in the discussions concerning both adoption and implementation, and their positions are quite similar from country to country. There is surprisingly little difference in the political dynamic between centrally planned economies and market economies and between developed countries or less-developed countries or regions.

Most jurisdictions delegate authority to an administrative agency and provide it with general instructions or criteria that code revisions must meet. In the United States, these typically require that the code incorporate all energy efficiency measures that are technologically feasible and cost effective to the consumer over the lifetime of the building. It is important that strong language (such as requiring that the codes include all cost-effective energy efficiency features) be used in the legislation, because powerful economic forces defending the status quo are likely to come to bear at the administrative agency.

A second general process is for the agency to allow public comment on draft standards and require the agency to respond to this commentary. Public comment identifies in advance areas with problems for implementation and can create a more positive attitude among the design and construction community towards eventual compliance.

The authorizing legislation usually specifies what agency or agencies is/are responsible for implementing the energy standard. This may or may not be the same agency that adopts it.

See: HONG KONG: Building (Energy Efficiency) Regulation at: <http://www.arch.hku.hk/research/BEER/bee-reg.html>

(Delegates authority and broad discretion for building energy efficiency to regulatory Building Authority.)

A key part of adopting standards is developing forms and instruction on how to use them and making these widely.<sup>35</sup>

Implementation will require a program of outreach and education to enforcement officials, building designers, and the construction industry. At a minimum, this includes a means for disseminating current and updated versions of these standards and a process for compiling and publicizing interpretations of the standards as they are made.

Implementation should also include the development and dissemination of design manuals that show how to construct buildings or details such that they comply. The design manuals should almost motivate the designer to meet or do better than the energy code. Examples of residential and non-residential design manuals are found at: [http://www.energy.ca.gov/title24/residential\\_manual/res\\_manual\\_2001.PDF](http://www.energy.ca.gov/title24/residential_manual/res_manual_2001.PDF) and [http://www.energy.ca.gov/title24/nonresidential\\_manual/2001\\_NONRES\\_MASTER\\_REVISED.PDF](http://www.energy.ca.gov/title24/nonresidential_manual/2001_NONRES_MASTER_REVISED.PDF).

There also needs to be an agency to provide fast-response telephone and e-mail answers to questions concerning the meaning of the code. Frequent training of code enforcement officials as well as building industry officials has proven necessary. Funding for training can be provided by government as part of the legislation authorizing the standards. But usually other funding sources have been used.

Some form of third-party inspection by government officials or independent private-sector inspectors is necessary to assure quality control.

See: CANADA: Energy Efficiency Act (1992) §§ 9-12, at, <http://laws.justice.gc.ca/en/E-6.4/text.html>.

In many countries, building inspectors at the local level already certify building compliance with construction codes with respect to fire safety, electrical safety, etc. These officials also can enforce energy codes. But they will require frequent training as well as motivation to get them to do so. The damage that can be caused if a building fails to meet an electrical code and the failure leads to a fire is apparent. It is less intuitive to a code official who has not been trained regarding energy that if a building fails to meet an energy efficiency standard, it will generate additional air pollution that will kill people from cardiopulmonary disease 20 years later. But the connection is just as real statistically. Some jurisdictions, instead of relying on building code inspectors, allow or require the use of independent third-party private sector inspectors. In this case, the government or some other supervisory agency must establish standards for technical expertise, professional conduct, and financial independence of the inspector from the builder in order to assure that the private sector inspectors are doing their job.<sup>36</sup>

Once documentation that a building complies with the code is obtained, it is helpful if the information concerning energy performance can be made a permanent part of the record of the building. This

<sup>35</sup> See, e.g. note 41

<sup>36</sup> An example of NGO-based supervision for energy code raters can be found at <http://www.natresnet.org/accred/amended.html>.

provides automatic market recognition of higher levels of efficiency than minimum code compliance; it also provides a legal record of what the building was supposed to have done to comply so that the owner can act as an additional quality assurance channel for code compliance. This establishment of public records is currently required in the Russian Federation and the Republic of Kazakhstan.

See: The Federal Law on Energy Saving (RUSSIA, 1996) <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter9.html>.

Article 6 (Certification): "Energy consuming products of any destination, as well as the energy resources, are liable to compulsory certification with regard to relevant energy efficiency indices. The compulsory certification shall be carried out in the order established by the Law of the Russian Federation. The fact that the manufactured electric appliances meet the adopted state standards with regard to energy consumption indices must be confirmed by appropriate labeling of the said equipment."

### C. What are the Requisites for Retrofit Standards?

There are two ways to affect energy efficiency in existing buildings. The first is to require that energy efficiency measures be installed when a major renovation or reconstruction is taking place. This could include something as minor as a new tenant moving into an existing commercial building and installing a replacement lighting system; in this case, the codes require that the new lighting system comply with the same energy efficiency standards as if it were an entirely new building. Similarly, when a component in a building is replaced in a fashion that requires a building permit, the component can be required to have the same energy efficiency as it would for a new building (or even a somewhat different level of efficiency). This is the case for window replacements in residential buildings in California, for example.

A second way of addressing the problem of existing buildings is to require retrofits at a particular time, typically, point of sale. In this case, the code requires the owner to undertake construction projects that would not have been undertaken at all but for the energy code, in contrast to requiring that upgrades already being undertaken be done in an energy efficient manner. The next two sections discuss this second sort of energy efficiency standard.

California's Public Resources Code Section 25401.5 authorizes the California Energy Commission to set retrofit standards, but except as discussed in this paper, the Commission has not done so yet.

#### **See, Cal Pub Resources Code § 25401.5. Development of measures to enhance energy efficiency in certain dwellings**

*"For the purpose of reducing electrical and natural gas energy consumption, the commission may develop and disseminate measures that would enhance energy efficiency for single-family residential dwellings that were built prior to the development of the current energy efficiency standards. The measures, if developed and disseminated, shall provide a homeowner with information to improve the energy efficiency of a single-family residential dwelling. The commission may comply with this section by posting the measures on the commission's Internet Web site or by making the measures to the public, upon request."*

Mandatory energy efficiency standards for retrofit buildings are relatively rare, although they have been discussed as a policy measure for more than two decades. There are some examples of successful mandatory retrofit ordinances at the local level in the United States, however. In 1981, the California city of San Francisco adopted the Residential Energy Conservation Program (RECO),<sup>37</sup> a prescriptive code designed to improve the energy efficiency of existing housing. RECO has reduced the amount of energy the average home uses in San Francisco by more than 15%, without any cost to the city treasury.<sup>38</sup>

RECO has proven to be simple to understand and easy and inexpensive to enforce. RECO requires such energy-saving measures as adding insulation; caulking and weather-stripping doors, windows, and other openings in the building shell; insulating hot water heaters and pipes; installing low-flow faucets and shower heads; installing low-flush toilets or flush reducers on existing toilets; and insulating heating ducts. Once RECO is triggered, homeowners or landlords must hire a private contractor to install the prescribed energy efficiency measures or do it themselves. A compliance inspection is then required to assure the work was completed.

Several events can trigger the need for compliance with RECO, including the sale of a building; metering conversions (changing from a master to individual meters, for example); improvements greater than \$20,000 for single and two-family homes, \$6,000 per unit for buildings with three or more units, or \$1,000 per unit for residential hotels; condominium conversion; or a complete building inspection (for adding or combining units, for instance). To give the ordinance teeth, an Order of Abatement can prevent the transfer of property unless the owner complies with RECO.

In spite of initial sharp opposition from the real estate community, the ordinance is now a routine part of doing business in San Francisco. Acceptance was helped along by extensive publicity, an informed public, and involvement of the private sector from the beginning and training workshops for both city and private inspectors. The simplicity and cost-effectiveness of the measures required for compliance also play a part in RECO's success.<sup>39</sup>

RECO has a commercial building counterpart aptly named CECO. RECO established the political and administrative basis for CECO, which took effect in July 1989. The story of San Francisco's Commercial Conservation Ordinance (CECO) illustrates the complexities of designing energy standards for use in a competitive commercial real estate market.

California mandates energy efficiency standards for all new buildings, but does little to improve the performance of buildings already built.<sup>40</sup> Support was strong in San Francisco to find ways to conserve energy, but translating energy efficiency policy into a workable ordinance presented some challenges. Commercial codes are more complicated than residential ones and the city is examining the commercial ordinance to simplify its requirements and streamline its enforcement.

Presently, the events that can trigger CECO review and enforcement include the transfer of a building's title, an addition to a building that increases the heated space by more than 10%, and

<sup>37</sup> City and County of San Francisco Housing Code, Chapter 12, §§ 1201-1212.

<sup>38</sup> U.S. Department of Energy, *Tomorrow's Energy Today for Cities and Counties: Commercial Energy Codes Lay Foundation for Saving Money 3* (February 1995).

<sup>39</sup> *Id.*

<sup>40</sup> See, note Error! Bookmark not defined.

renovation and improvements valued at more than \$50,000. After a trigger event, CECO review is required. A private inspector conducts an inspection for a fee and identifies the areas of the building that do not comply with the ordinance. The building owner must then implement prescribed energy efficiency measures up to a simple payback of 4 years.

## IV. INCENTIVES

### How Does Net Metering Work As An Incentive?

Conventional economic thinking that has guided the modernization of energy systems in buildings in many countries has been that if energy is metered and charged directly to the end user, this will encourage the optimal levels of energy efficiency. But such a concept is oversimplified, because it explicitly assumes that energy decisions primarily are lifestyle or energy management decisions: to what degree is an apartment or commercial space heated or cooled?

For example, in former Soviet countries, where heat is not metered, many residents control the temperature in their apartments by opening windows to prevent overheating in the middle of winter. If energy were metered, even at the whole building level, there would be an incentive for the residents to supply less heat to the building overall and avoid the need to open windows. And, if the metering extended to the individual flat, consumers would be motivated to shut off radiators (assuming this is possible – in much of Russia and the former Soviet Union it is not) rather than opening windows.

But the more important energy decisions relate to the efficiency of energy-using systems and equipment. If this is the case, then providing individual metering and bill paying for the tenant can create a problem of split incentives where none had existed previously. For example, consider a multi-family apartment building owned by the State or by a private sector landlord. If the building itself is master-metered and the owner pays the bill it will be in the economic interest of the owner to invest in energy efficient systems such as replacement fenestration systems, wall and ceiling insulation, more efficient heat production or distribution systems, better controls, etc. Wherever the rate of return on the efficiency investment is higher than the rate of return on alternative investments on property. In theory at least, this will lead to the optimal response.<sup>41</sup>

But if the building is individually metered, the owner will have to pay the costs of the improvements, but the tenant will reap the energy bill savings benefits. Thus, the efficiency measures are much less likely to be installed.

Even for a condominium or a cooperative ownership arrangement, it will be more difficult to induce energy efficiency investments if each unit is metered individually than if the whole building is master metered. If each unit is metered individually, individuals whose usage is below average may be encouraged to vote against the investment of energy efficiency measures that they perceive will benefit primarily the heavier users. It may be difficult to get a significant majority to sponsor such retrofit programs. In contrast, if the condominium association pays directly for the entire heating and/or cooling bill, it will be a straightforward business decision whether or not to invest in energy

<sup>41</sup> In practice, this optimality seldom occurs, but it is at least possible to provide incentives or legal requirements for the owner to invest in energy efficiency based on the concept that it will be cost-effective for the owner.



efficiency measures. This theoretical analysis is validated by studies of American programs that try to produce energy savings in multi-family housing.

The conclusion is that individual metering below the building level probably should not be a high priority energy efficiency policy. If the savings realized through behavioral changes outweigh the savings forgone through efficiency investments and the difference is large compared to the cost of the meters, then metering might be the right approach. However, if the reverse conditions are obtained, such a policy could amount to a large misplaced investment that shows no real return.

### **A. Utility Incentives - What is the role of Utility-sponsored incentives?**

Utilities can be a powerful force in promoting energy efficiency, particularly in the short run. For example, when California was facing an acute peak power shortage in 2001 – a predicted shortfall of 5,000 megawatts or nearly 10% of peak capacity – the state expanded its energy efficiency incentive programs dramatically and cut back peak power by 7%-11% in each of the summer months compared to the previous year.

Performance-based incentives for energy efficiency need not be sponsored by utilities, and successful examples of state-run or NGO-run incentive programs can be found. But utilities are, in many ways, a natural choice as the operators of energy efficiency incentive programs for several reasons:

- Utilities already have existing business relationships with their customers, so they generally are a trusted source of information and advice on energy efficiency. Lack of trust of other efficiency providers has been identified as a significant market barrier.
- If properly regulated, utilities have ability internally to balance the cost and benefits of energy efficiency investment with the costs and benefits of supply-side investments and choose the least-cost answer. This is true whether the utility is a distribution company procuring energy in a competitive system or whether it is an integrated monopoly.
- Utilities already collect revenue from all energy users, so they are a natural choice of vehicle for collecting the funds needed to support an incentives program.

The successful development of utility-based incentive programs for energy efficiency involves two similar but quite independent issues:

- The incentives offered to the building owner or designer by the utility, and
- The incentives placed on the utility by the state to conserve energy or peak power.

#### **1. What reforms in utility regulations are essential to the success of incentives?**

Utilities will not be motivated to implement incentive programs effectively if doing so makes them less profitable. And unfortunately, this is the case in most jurisdictions throughout the world. In most jurisdictions, the more energy a utility sells, the more profit it makes. Thus, the more successfully a utility promotes energy efficiency, the less successful its own business operation will be.

This problem is a consequence of the cost structure of utilities in which most of the costs are capital costs whereas revenues are generally provided on a per-unit sales basis. These problems can be

corrected easily, as has been done in several states of the U.S. The key principles are:

- Decoupling of sales and profits, also known as regulation based on revenue caps rather than rate caps. This process is described next;
- Provision of a public benefits trust elected by utilities from all customers that can be used to pay for energy efficiency services; and
- Performance-based incentives for rewarding the utility with increased profit to the extent that programs succeed at saving overall costs for their customers.

Decoupling or revenue cap regulation can be implemented by changing the way distribution companies, or vertically integrated utilities are regulated such that revenues are based on projected sales rather than realized sales. For example, if a utility is expected to sell  $X$  kWh/yr, tariffs are set at a level of  $Y$ /kWh, the total revenue is expected to be  $X$  times  $Y$ . Revenue is then fixed at this level regardless of sales. If the utility sells more than  $X$  kWh and collects more than  $X$  times  $Y$  in revenue this year, the excess (minus the variable cost) is placed in a special account and the tariff is reduced in the following year by enough to limit net revenues to  $X$  times  $Y$ . Similarly, if sales fall short of  $X$ , tariffs are increased to make up the difference to the utility.

This adjustment occurs every year. To the extent that new capital facilities are added by the utility, and to the extent that growth occurs on the system,  $X$  times  $Y$  is adjusted every few years. This is already normal practice in many jurisdictions. What is new is that the tariff  $Y$  is not kept fixed between those every-few-years adjustments, allowing revenues to grow with sales, but is changed annually to keep the product  $X$  times  $Y$  constant. So for any year, the utility's net profits are independent of sales.

The third requirement, performance-based incentives, can be implemented by measuring the costs, both to the utility and to the customer, of the efficiency measures and the program administration, and comparing them to the present value of benefits from fuel savings and capacity avoidance or deferral. (This evaluation is a good idea in any event to assure that programs are working.) The utility can receive a share of the savings, such as 10%.

The second two requirements – provision of a fund to support incentive programs and economic incentives to the utility for its success – are implemented by increasing the tariff  $Y$  to provide the desired revenues to the utility.

Since efficiency programs can be required to be cost effective (or else the utility is not encouraged to implement them), although the tariff  $Y$  increases slightly, overall bills are less and the customer comes out ahead.

Legislation to implement these suggestions might require regulation of utilities based on the three bulleted requirements above. Actual administrative/regulatory language is complex and usually situation-specific, and is probably best crafted through international or interregional technical/legal cooperation.

## 2. How can utility incentive programs be designed?

If building codes are already in place, utility incentive programs can be designed based on exceeding the minimum requirements of the code. This can be done based on the extent to which individual components exceed the prescriptive requirements in the code, or the extent to which whole building performance exceed the performance-based thresholds in the code. Typically, programs seek savings in the range of 10%-40% compared to the code-required levels.

Utility-based incentive programs are the most effective means of inducing retrofits to existing buildings as well as promoting more efficient new construction. Indeed, the majority of utility expenditures on energy efficiency are for retrofits in existing buildings rather than new construction, and the majority of energy savings and peak power savings are also in the retrofit area.

Several key criteria can be used to develop and implement utility-based incentive programs:

- **Cost effectiveness.** Programs can be rank-ordered in terms of two important ratios: the ratio of the present value of societal benefits of the energy efficiency investment to the amount of money invested in energy efficiency (by both the utility and the customer); and the ratio of net present value of savings to the amount of money the utility spends on its program. The best programs or program elements will score well on both criteria.
- **Performance-based.** The incentive should be based on performance, not cost. The purpose of an incentive is to encourage the market to sell more of products or designs that are more highly energy efficient. By creating more supply and more demand for energy efficiency, normal market forces will cause the price of efficiency to go down and the availability to increase. This would not necessarily be the case for a standard that pays a percent of the cost of an efficiency measure (even ignoring the fact that incremental costs of efficiency are hard to document). The natural tendency for a supplier confronted with a cost-based incentive would be to mark up the cost and increase profitability while not selling more of the product.

Performance-based standards are easy to design within the context of an existing system of test protocols for energy use. The utility can offer a fixed incentive for the achievement of any given level of energy efficiency rating or a tiered set of incentives offering progressively more for higher levels of efficiency. Typically, if a tiered approach is used, the incremental incentive (incentive value per unit energy savings) should increase with the ambitiousness of the target. This will encourage the market to focus on the largest possible gains in energy efficiency in the long term.

- **Active management of the programs.** It is difficult or impossible to predict what the market uptake of an incentive for energy efficiency will be. Utilities must budget fixed amounts of money for a program, but actual implementation may not go according to plan. The utilities should develop the management information systems concerning markets response and the ability to adjust programs as necessary to react to markets. For example, if a program is not achieving much success in the marketplace, the utility could either promote it more heavily through information and outreach or could increase the incentive levels. If a program is a "runaway success" – for example, generating 10 times the market activity that was expected – perhaps the incentives can be scaled back or eliminated.

It is a difficult challenge to balance the need for good customer relations and trust that are

inherent in keeping a program fixed for a significant length of time with the need to manage a program to contain costs and maximize effectiveness. This is discussed further in Section B on tax incentives.

- **The development of education and outreach efforts and efficiency demonstration centers.** Typically, utilities spend a substantial portion of their efficiency investments on programs that provide information and outreach to the public rather than focusing solely on incentives, although incentives generally constitute the majority of program budgets. Information programs are harder to measure in terms of their effectiveness at saving energy. But significant evaluation studies have been performed on energy efficiency demonstration centers. These studies have shown measurable and large changes in the attitudes of decision makers on energy efficiency investments. Interviews with program managers show clearly that the demonstration centers funnel customers into incentive-based programs. These customers may not have been aware of or have participated in the programs otherwise.

Perhaps surprisingly, these principles seem not to have been written up anywhere, nor are there instructional materials or advice on program design generically. Technical/managerial interactions between nations, regions, or utilities seeking to design programs and those that are implementing them (and also consultants or NGOs advising the utilities) would seem to be the most effective means of information transfer. But see also section C. below.

## **B. Tax Incentives - Where are Tax Incentives most effective for promoting energy efficiency?**

Tax incentives can be used to supplement utility-based programs. The difference in the two relates to the extent to which programs can be managed in response to changes in the market. A utility-based incentive program can be scaled up or down either in terms of financial incentives or in terms of its energy targets depending on how the market responds.

On the other hand, some changes are so dramatic that they require producers or designers to make substantial investments in new production facilities or in retraining. For example, when a jurisdiction adopts a new test protocol for a building component (e.g., windows) an infrastructure of testing labs and testers and certifiers must be set up, and manufacturers must design new assembly lines for new efficient products, which must then all be tested. If major changes in design are needed, such as 50% lower lighting power densities or providing for natural day lighting and controls that dim the electric lights in response, lighting designers must learn new skills to create good designs. These investments will not be made unless there is a multi-year commitment that incentives will remain fixed in stone. In many countries, the tax code is the most effective way to assure that incentives will be for the long-term.

Thus, tax incentives are a more effective way to encourage truly advanced levels of technology in new buildings.<sup>42</sup>

<sup>42</sup> An example of tax incentive legislation currently pending in the U.S. Congress is in Title I of S. 2311 (Efficient Energy Through Certified Technologies and Electricity Reliability (EFFECTER) Act of 2004), found at <http://thomas.loc.gov/cgi-bin/query/D?c108:6:./temp/~c108M042BC>: (As leg is pending, this citation will not be posted permanently).

### C. Market Transformation - What is Market Transformation and what is its role?

Market transformation involves adoption of measures that alter the long-term market for implementation of efficiency measures. Market transformation can be seen as an intermediate step between the long-term incentives that can be offered through the tax system and the short-term focused, managed programs that are most commonly run by utilities. Since, with only a few exceptions, tax incentives designed with a long-term perspective have not yet been used in the real world, market transformation programs are the only broadly adopted measures to promote the building efficiency in the long term.

Market transformation programs have worked by setting ambitious targets for energy efficiency and providing national consistency of programs and multi-year lead times for achieving the desired goal. Programs in Sweden and in the United States have relied both on winner-take-all requests for proposals (RFPs) or on establishing uniform high targets for efficiency and the expectation of financial incentives (which do not necessarily have to be the same throughout the country) for their achievement.

A description of market transformation programs currently operating in the United States can be found at <http://cee1.org>. Additional information on programs aimed at nonresidential buildings can be found at <http://www.newbuildings.org>. These programs were organized by informal agreements among NGOs and private companies, or by government agencies at the provincial or national level on their own initiative, and not always in response to legislation, although it appears easy to create legislation to require utilities or government agencies to undertake such actions.

Information on the U.S. government's efforts at market transformation can be found at <http://www.energystar.gov>.

Market transformation programs work most effectively when they are developed around actual experiences in the marketplace. Two interesting examples are presented by the history of the American program for encouraging compact fluorescent lamps (CFLs), which use a third to a quarter as much energy as the incandescents they replace.

When efficiency advocates first promoted compact fluorescent lamps as an opportunity for utility-sponsored programs in the early 1990's, the utilities were skeptical about the maturity of the technology. One utility representative remarked that she did not believe that CFL products were. When an efficiency advocate showed her a selection of a dozen or so lamps that had been purchased in a neighboring hardware store, the utility representative responded that, yes, she understood that it was possible to buy individual samples of CFLs, but that she had had an order for 100,000 of them that no one could fill.

When it comes to the introduction of new technologies for energy efficiency, the "invisible hand" of the marketplace does not always work. To make it work, a market transformation non-profit convened a meeting of lamp manufacturers and utilities where the manufacturers were presented with the desires of a number of different utilities that wanted to run programs. The expected volume was about 1 million lamps per year, drastically beyond industry's expectations and beyond their production capacity. But when industry became convinced of the market opportunity that was with the utility incentive support, new factories were constructed promptly and the supply became available.<sup>43</sup>

<sup>43</sup> A similar experience occurred with CEE's clothes washer market transformation program. A representative of one of the manufacturers who attended the meeting was overheard on the telephone telling his production department that the CEE program was bigger than they had expected and that they should ramp up production.

The second problem emerged in the mid-1990's, when quality control problems became identified as a key impediment to the success of CFL market transformation programs. Consumers were dissatisfied with compact fluorescent lamps because they were too noisy, offered poor color rendition, or seemed too dim. In response, the Consortium for Energy Efficiency (CEE) developed quality control specifications for CFLs that eventually were also adopted by the U.S. EnergyStar® program. These criteria focused on requirements that the lamps provide as much light output as was claimed on the box, that their lifespan meet the rated number of hours, that their color rendition exceed a minimum threshold, that the lamps turn on immediately without blinking, and that they operate noiselessly. These criteria addressed consumers' main complaints.

See: [http://www.energystar.gov/ia/partners/product\\_specs/program\\_reqs/cfls\\_prog\\_req.pdf](http://www.energystar.gov/ia/partners/product_specs/program_reqs/cfls_prog_req.pdf) for the specification.

Quality control on fluorescent lamp products is a problem worldwide, so it is evident that similar programs would be needed to make this product acceptable to consumers not only for the initial purchase but more importantly for subsequent replacements. In China, for example, numerous anecdotes describe CFLs that burn out at less than one-tenth of their rated lifetime. In India, as a different example, a major barrier to CFLs is that they will not turn on when system voltage is depressed due to overloads (which occur frequently); thus, a shop owner who needs reliable light at the peak hour will either burn his CFLs for hours before they are need or will use much more inefficient incandescents.

Thus, in both developed country and developing country contexts, the provision of quality specifications backed up by a testing program to assure that quality-rated products actually live up to their claims is a necessary piece of the market transformation program.

## V. OTHER POLICIES

### A. Normative Labels – What are normative labels and their role?

Normative labels mark products or buildings that achieve an “exemplary” or recommended level of energy efficiency higher than the base level of efficiency. Normative labels can be established or as a freestanding government program, such as the U.S.-based EnergyStar® program (<http://www.energystar.gov/>), or as private sector programs (although the author is not aware of any successful examples at present with respect to energy efficiency).

Government policy can make use of normative labels by requiring that products purchased by the government directly or on government contracts qualify for the appropriate label.

The building energy codes in Russia and Kazakhstan also provide a weak form of normative label in that they both require that informative labels be established and maintained as part of the documents for all buildings, and these labels include the designation of two “beyond code” exemplary levels of energy efficiency.

## **B. Informative Labels – What are informative labels and what is their role?**

While only Russia and Kazakhstan require informative labels on buildings at present, and even these are limited to new construction, information labeling as a policy tool can be a meaningful part of energy efficiency policy. The European Union, for example, has recently required that all buildings be rated for energy efficiency over the next several years. (Unfortunately, the EU has not yet developed a test protocol with which to do such ratings.) These ratings would apply to all buildings, both existing and new.

Easy-to-understand and well-designed labels for energy-using equipment, such as those employed in the European Union and Australia, also appear to have a significant beneficial effect.

Informative labels have also been required on appliances and equipment in the United States for over two decades. However, these labels do not appear to be particularly effective. This may be due to flaws in the design of the labels.

Some of the references in Annex 1 (See next page) report on labeling programs in different countries.

## **VI. CONCLUSION**

As demonstrated above, efficiency in both new and retrofitted buildings can be achieved economically if adequate test protocols, building codes, equipment standards and labeling are adopted through legislation and regulations and are firmly enforced.

**ANNEX I**

The following is a list of references for laws relating to energy efficiency standards and buildings.

**CANADA: Energy Efficiency Act (1992)**

Link to full text of law: <http://laws.justice.gc.ca/en/E-6.4/text.html>

Summary/note: provides for the making and enforcement of regulations concerning MEPS for energy-using products, as well as the labeling of energy-using products and the collection of data.

- Regulations for the Energy Efficiency Act can be found at: <http://laws.justice.gc.ca/en/E-6.4/SOR-94-651/100709.html>

**CHINA: Cleaner Production Promotion Law (2003)**

Link to full text of law: [http://www.chinacp.com/eng/cppolicystrategy/cp\\_law2002.html](http://www.chinacp.com/eng/cppolicystrategy/cp_law2002.html); [http://www.setc.gov.cn/english/setc\\_engl/zyjy\\_eng/zyjy\\_0001.html](http://www.setc.gov.cn/english/setc_engl/zyjy_eng/zyjy_0001.html)

Summary/note: Requires construction projects to adopt the design options, construction and decoration materials, construction structures, fixtures and equipment resulting in energy and water conservation and other environmentally friendly and resource-conserving construction planning options by complying with national standards.

**CHINA: Energy Conservation Law (1998)**

Link to full text of law: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter4.html>

**Summary/note:** law to enhance energy use management and to reduce loss and waste in the chain of energy production and consumption in ten major Chinese cities

- Implementing Regulations of the Law on Energy Conservation of PRC in Shanghai Municipality can be found at: <http://www.pnl.gov/china/shangecl.pdf> ([http://www.google.com/search?q=cache:UElRmje\\_w7YJ:www.pnl.gov/china/shangecl.pdf+&hl=en](http://www.google.com/search?q=cache:UElRmje_w7YJ:www.pnl.gov/china/shangecl.pdf+&hl=en))
- Implementing Regulations of the Law of Energy Conservation of the PRC in Shandong Province can be found at: <http://www.pnl.gov/china/shandecl.pdf> (<http://www.google.com/search?q=cache:E9uMLfUqbqj:www.pnl.gov/china/shandecl.pdf+&hl=en>)
- Implementing Regulations of the Law on Energy Conservation of PRC in Zhejiang Province can be found at: <http://www.pnl.gov/china/zhejecl.pdf>

EU: Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings (OJ L 1, 4.1.2003, p. 65).



Link to full text of law: [http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l\\_001/l\\_00120030104en00650071.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_001/l_00120030104en00650071.pdf)

**Summary/note:** This Directive lays down requirements as regards:

- (a) the general framework for a methodology of calculation of the integrated energy performance of buildings;
- (b) the application of minimum requirements on the energy performance of new buildings;
- (c) the application of minimum requirements on the energy performance of large existing buildings that are subject to major renovation;
- (d) energy certification of buildings; and
- (e) regular inspection of boilers and of air-conditioning systems in buildings and in addition an assessment of the heating installation in which the boilers are more than 15 years old.

### **HONG KONG: Building (Energy Efficiency) Regulation**

Link to full text of law: <http://www.arch.hku.hk/research/BEER/bee-reg.html>

**Summary/note:** Delegates authority and broad discretion for building energy efficiency to regulatory Building Authority

### **INDIA: The Energy Conservation Act (2001)**

Link to full text of law: [http://www.keralaenergy.org/ecact/ecact\\_main.html](http://www.keralaenergy.org/ecact/ecact_main.html)

**Summary/note:** includes building efficiency language

- Technical specifications at: [http://www.info.gov.hk/bd/english/documents/code/e\\_otv.html](http://www.info.gov.hk/bd/english/documents/code/e_otv.html)

### **JAPAN: Law Concerning the Rational Use of Energy (1979)**

Link to full text of law: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter5.html>

**Summary/note:** creates measures for the rational use of energy by factories, buildings, machinery and equipment, see especially Chapter 3: Measures for Buildings. [http://www.eccj.or.jp/index\\_e.html](http://www.eccj.or.jp/index_e.html) is a good reference as well.

- Enforcement Ordinance for the Law Concerning the Rational Use of Energy can be found at: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter6.html>
- Enforcement Regulations for the Law Concerning the Rational Use of Energy can be found at: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter7.html>

**KOREA: Rational Energy Utilization Act (1995)**

Link to full text of law: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter8.html>

Summary/note: includes building efficiency language

**MEXICO: Ley Federal Sobre Metrología y Normalización (1992)**

Link to full text of law: <http://www.cddhcu.gob.mx/leyinfo/pdf/130.pdf> (Spanish version) I can't find an English translation.

Summary/note: creates voluntary and mandatory and efficiency standards

**PHILIPPINES: Guidelines for Energy Conserving Design of Buildings and Utility Systems**

Link to full text of law: [http://www.doe.gov.ph/pls/portal30/docs/FOLDER/DOECONTENT\\_AREA/ENERCON/GUIDELINES+FOR+ECDBUS.PDF](http://www.doe.gov.ph/pls/portal30/docs/FOLDER/DOECONTENT_AREA/ENERCON/GUIDELINES+FOR+ECDBUS.PDF)

Summary/note: creates voluntary and mandatory and building and appliance efficiency standards.

**RUSSIA: The Federal Law on Energy Saving (1996)**

Link to full text of law: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter9.html>

Summary/note: includes building efficiency language

**THAILAND: Energy Conservation Promotion Act (1992)**

Link to full text of law: <http://www.eppo.go.th/admin/law/doc-NEPO-ACT2.html>; <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter10.html>; <http://ostc.thaiembdc.org/energy/engact.html>.

Summary/note: includes building efficiency language

- Guidelines, Criteria, Conditions and Expenditure Priorities of the Energy Conservation Promotion Fund during the Fiscal Period 2000-2004 can be found at: <http://www.eppo.go.th/encon/encon-fund00.html>

**Energy conservation in regulated buildings**

Part 2 provides energy conservation measures for regulated buildings prescribed by royal decree enacted under section 18. Section 18 provides that such royal decree shall prescribe regulated buildings by types or sizes of buildings or quantities or methods of energy use.

The Royal Decree Prescribing the Regulated Buildings, B.E. 2538 (1995) prescribes the regulated buildings by quantity of energy use. Section 3 provides that the following buildings are regulated buildings:<sup>44</sup>

- (1) a building or group of buildings of which electricity installation is from 1,000 KW or 1,175 KVA and above; and
- (2) a building or group of buildings of which electricity, steam heat, or any other non-renewable energy consumption between 1 January and 31 December of each year is from 20 million MJ of electricity equivalent or above.

Section 17 provides a number of energy conservation measures for regulated buildings.

### **UZBEKISTAN: Law on the Rational Use of Energy (1997)**

Link to full text of law: <http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter12.html>

**Summary/note:** includes building efficiency language

Additional background information on standards and labeling, especially for appliances and equipment, can be found at:

<http://www.iea.org/dbtw-wpd/textbase/nppdf/free/2000/label2000.pdf>

<http://www.iea.org/Textbase/publications/pappubres.asp?select=4122&Submit=Submit>

<http://www.iea.org/dbtw-wpd/textbase/papers/2003/effeit.pdf>

<sup>44</sup> This discussion is quoted from "Laws in Thailand Promoting Renewable Energy" by Chacrit Sitdhiwej

## CHAPTER E. ENERGY EFFICIENCY IN ROAD TRANSPORT

**Adrian J Bradbrook\***

Road transport causes vast environmental, planning and sociological problems in modern society. The increasing dominance of motor vehicles throughout the twentieth century as a means of transport has caused poor air quality in urban areas, deteriorating quality of life in inner city areas as a result of traffic congestion and the decline of public transport, reliance on insecure oil supplies, enormous expenditures to protect oil production and transport and contributed to the hazards of climate change. In the developed countries, perhaps the greatest effect of motor vehicle usage has been on the design of major towns and cities. The general availability of cars has resulted in the creation of sprawling outer suburbs, poorly serviced by other forms of transport and services, where life is effectively impossible without motor vehicles. Many large cities in developing countries suffer the same fate and the problems will proliferate unless remedial action is taken.

As developing country economies grow, they are rapidly building and acquiring motor vehicles, thus incrementally increasing the world demand for petrol to the point where energy security for all is jeopardized. This security problem is exacerbated by the need for increased reliance for petrol supplies on politically unstable Middle East countries that have most of the world's proven petrol reserves.

Road transport represents one of the greatest areas of challenge for energy efficiency. Approximately 50 per cent of the world's oil production is consumed by road vehicles. In other sectors of the economy, oil has been partially or totally substituted by other fuels in recent years. Thus, for example, oil is declining today as a source of home or office heating, and has been largely phased out in most of its commercial and industrial uses, including power generation. Transport is the one sector where oil has not been effectively substituted. Various forms of fuel substitutes have been developed, such as ethanol, liquefied petroleum gas (LPG) or compressed natural gas (CNG), but each of these options appears to suffer from various disadvantages or inconveniences. In the long term, hydrogen may prove to be the ideal substitute fuel, but even ardent proponents of a hydrogen economy concede that this will not occur in the near future. Currently the manufacture of hydrogen from fossil fuel, the usual source today, removes most of the environmental advantages of hydrogen.

In the context of enhancing energy efficiency in the transport sector, national laws exist in some countries regulating the motor vehicle industry and providing fiscal incentives. The various possibilities will be examined under each of these headings.

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## I. WHAT ARE THE OPTIONS FOR REGULATING THE MOTOR VEHICLE INDUSTRY?

### A. Fuel Economy Standards for Vehicle Manufacturers

This proposal relates to the introduction of fuel economy standards for all domestically sold passenger cars, four-wheel drive vehicles and light commercial vehicles. This could be achieved by voluntary agreement between the government and vehicle manufacturers, but if such negotiations fail to achieve acceptable targets a regulatory mechanism can be developed and introduced by national legislation.

Laws requiring vehicle manufacturers to ensure that their vehicle fleet conforms in any given year with government-prescribed maximum fuel consumption figures are in operation in the United States and Japan. Canada has similar legislation to that in the United States but has never promulgated it into effect in light of a voluntary code of practice between government and industry (Motor Vehicle Fuel Consumption Standards Act, R.S. 1985, c M-9; available at <http://www.laws.justice.gc.ca/en/M-9/index.html>).

#### The United States' System

The United States' standards are contained in the Corporate Average Fuel Economy (CAFÉ) standards, enacted in 1975 pursuant to the Energy Policy and Energy Conservation Act. The legislation has since been consolidated with other legislation affecting motor vehicles and forms Title V of the Motor Vehicle Information and Cost Savings Act. It is located in Title 49 of the US Code (available at <http://www4.law.cornell.edu/uscode/49/32901>).

In outline, the CAFÉ system involves the establishment by the government of a precise average fuel economy standard or standards that each vehicle manufacturer must attain each year in respect of all vehicles produced during that year. The CAFÉ figure for each manufacturer takes into account the fuel economy of each class of vehicle produced and is weighted to take account of the number of vehicles produced in each class in each year. Two separate standards have been introduced, one for passenger vehicles and one for light trucks. In respect of passenger vehicles and light trucks, the standard is currently 27.5 miles and 20.7 miles per gallon, respectively. Manufacturers may earn a credit by exceeding the standard set in any year. This credit can then be applied against the standard for any of the following three years.

A major loophole in the CAFÉ standards was created when the US government decided to classify large sport utility vehicles (SUVs) and light trucks as passenger vehicles. This action largely nullified the very strong petrol savings from the CAFÉ standards

The significant feature, of the statute, United States CAFÉ system, Title V of the MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT, 49 U.S.C. § 32904, full text at <http://www4.law.cornell.edu/uscode/49/32901>, are:

1. The determination of each manufacturer's CAFÉ figure is stipulated in 49 USC 32904(a)(1) as follows:

(1) The Administrator of the Environmental Protection Agency shall calculate the average fuel economy of a manufacturer subject to –:

(A) section 32902 (a) of this title in a way prescribed by the Administrator; and

(B) section 32902 (b)&(d) of this title by dividing –

(i) the number of passenger automobiles manufactured by the manufacturer in a model year; by

(ii) the sum of the fractions obtained by dividing the number of passenger automobiles of each model manufactured by the manufacturer in that model year by the fuel economy measured for that model

Full text at <http://www4.law.cornell.edu/uscpde/49/32904>

The CAFÉ system is commonly referred to as one of “harmonic averaging”. The averaging is the reciprocal of the average of the gallons per mile used by each vehicle in the fleet. The effect of this is that the system is more onerous on manufacturers than might appear at first glance. To put it simply, the café figure for two vehicles, one rated at 20 miles per gallon and the other at 40 miles per gallon will not be 30 miles per gallon, as might be expected, but 26.7 miles per gallon. The use of this system provides the most accurate measure of the fuel consumption of the fleet. This, in the above illustration, if the two cars were each driven 10,000 miles, they would jointly consume 750 gallons of petrol, thereby achieving an aggregate fuel consumption figure of 26.7 miles per gallon.<sup>45</sup>

2. Pursuant to 49 USC 32904(b), there is a two-fleet rule. This means that there are in effect two CAFÉ figures in operation, one for cars manufactured locally in the US and one for cars produced overseas. A vehicle is classed as an overseas produced vehicle if it fails to meet the 75% of local content requirement. The two-fleet rule was added at the insistence of trade unions that feared that CAFÉ standards would lead to US car manufacturers producing all their cars overseas. An exemption from the normal CAFÉ requirements is provided for overseas manufacturers who produce fewer than 10,000 vehicles per year in worldwide sales.
3. A system of carry-forward credits enables manufacturers to comply with CAFÉ regulations at a level less than their prescribed fuel efficiency standard for any given year. By 49 USC 32903(a), manufacturers may earn a credit by exceeding the standard set in any year. This credit can then be applied against the standard for any of the following three years.

<sup>45</sup> See Adrian J Bradbrook, “Regulating for Fuel Energy Efficiency in the Road Transport Sector” (1994) 1 *Australasian Journal of Natural Resources Law and Policy* 1 at 8.

## The Japanese System

The Japanese system of fuel efficiency is based on a 1992 report of the Study Group on Automobile Fuel Efficiency Improvement, established by the Ministry of Transport and the Ministry of Trade and Industry.<sup>46</sup> This led to the 1993 Law Concerning the Rational Use of Energy (available at <http://spider.iea.org/pubs/newslett/eneff/jp.pdf>).

This Japanese legislation divides vehicles into three categories based on vehicle weight. Separate targets are set for future years for each category, which have taken into consideration various factors affecting fuel efficiency, including the feasibility of technological development, safety measures, driving comfort and easiness. The effect of improvements in vehicle weight reduction and constant technological development is also taken into consideration. The fuel efficiency targets set for FY2000 were as follows:

Cars weighing less than 827.5kg	19.0 km/litre
Cars weighing 827.5kg up to 1,515.5kg	13.0 km/litre
Cars weighing 1,515.5kg and over	9.1 km/litre

For trucks, the fuel economy standards were set for FY2003 at an average improvement of between 4.8 and 5.8 per cent over the 1993 results depending on the type of vehicle.

The targets are to be progressively tightened. The revised 1998 Law Concerning the Rational Use of Energy (available at <http://spider.iea.org/pubs/newslett/eneff/jp.pdf>) requires new standards designed to improve energy efficiency in vehicles by 25 per cent from 1995 to 2010. In order to discourage manufacturers from increasing vehicle size, under the Japanese system the heavier the vehicle category the higher is the required rate of increase in targeted fuel efficiency.

## South Africa

South Africa has proposed amendments to the National Air Quality Management Bill to consider control of emissions from “appliances,” which include motor vehicles. Such an amendment could strengthen national motor vehicle emissions and fuel-specification legislation that becomes effective over the next several years. In 2002, separate draft regulations were first published requiring oil refineries to phase out leaded fuels and reduce sulfur content of diesel fuels by 2006. Longer-term plans, which include the introduction of public transport systems and production of high quality unleaded gasoline, are yet to come to fruition.<sup>47</sup>

## China

China has set standards on limits of fuel consumption for passenger cars.<sup>48</sup> The standard sets the limits of fuel consumption for passenger cars. The standard is for M1 vehicles with positive ignition engines or compression ignition engines, maximum designed speed of which are larger or equal

<sup>46</sup> See Ministry of Transport (Japan), M.O.T. News, No 54 (March 23, 1993).

<sup>47</sup> EIA South Africa Country Analysis Brief

<sup>48</sup> Regulation of the China State Planning Board no. GB19578-2004

to 31.1 mile per hour, and maximum designed total weight of which don't exceed 7716lb. The standard is not for vehicles powered only by gaseous fuels or alcohol fuels. Test weight is curb weight plus a driver's weight. Testing cycle is ECE-15 cycle. For new model application, Phase I starts on July 1st, 2005, and Phase II starts on Jan. 1st, 2008. For old models currently being produced, Phase I starts on July 1st, 2006, and Phase II starts on Jan. 1st, 2009.<sup>49</sup>

**Limits of fuel consumption for passenger cars, MPG**  
**Manual transmission, excluding SUVs & MPVs**

Test weight, lb		Phase I	Phase II
	CM≤1653	32.7	37.9
1653	CM≤1907	32.7	36.2
1907	CM≤2161	30.6	33.6
2161	CM≤2403	28.3	31.4
2403	CM≤2657	26.4	29.0
2657	CM≤2910	24.8	27.4
2910	CM≤3153	23.3	25.6
3153	CM≤3395	22.0	24.3
3395	CM≤3660	20.8	23.1
3660	CM≤3902	19.8	22.0
3902	CM≤4145	19.0	21.2
4145	CM≤4409	18.4	20.5
4409	CM≤4652	17.8	19.8
4652	CM≤5026	17.2	19.1
5026	CM≤5534	16.1	18.0
5534	CM	15.2	16.9

<sup>49</sup> Regulation of the China State Planning Board no. GB19578-2004



### Limits of fuel consumption for passenger cars, MPG

#### Automatic Transmission, including SUVs & MPVs

(For passenger cars with automatic transmission, or have 3 or more rows of seats, or M1G type cars, which refer to SUVs, MPVs)

Test weight, lb		Phase I	Phase II
	CM <sub>≤</sub> 1653	31.0	35.6
1653	CM <sub>≤</sub> 1907	31.0	34.1
1907	CM <sub>≤</sub> 2161	28.7	31.8
2161	CM <sub>≤</sub> 2403	26.7	29.4
2403	CM <sub>≤</sub> 2657	25.0	27.4
2657	CM <sub>≤</sub> 2910	23.3	25.9
2910	CM <sub>≤</sub> 3153	22.0	24.0
3153	CM <sub>≤</sub> 3395	20.8	22.8
3395	CM <sub>≤</sub> 3660	19.6	21.8
3660	CM <sub>≤</sub> 3902	18.7	20.8
3902	CM <sub>≤</sub> 4145	18.0	19.9
4145	CM <sub>≤</sub> 4409	17.3	19.3
4409	CM <sub>≤</sub> 4652	16.8	18.7
4652	CM <sub>≤</sub> 5026	16.2	18.1
5026	CM <sub>≤</sub> 5534	15.2	16.9
5534	CM	14.3	16.0

Source: Regulation of the China State Planning Board no. GB19578-2004

## B. Fuel Consumption Labeling <sup>50</sup>

The majority of countries with legislation on consumer protection appear to have legislated in recent years to provide a compulsory system of labeling for commonly-used domestic electric appliances, such as refrigerators, heaters, air conditioners, washing machines, dishwashing machines and clothes dryers. The use of labeling for fuel consumption statistics of new motor vehicles is found less commonly. The major illustrations of such legislation are in the United States, Europe and Australia. The US legislation is contained in Title 49 section 32908 of the US Code ([www4.law.cornell.edu/uscode/49/32908.html](http://www4.law.cornell.edu/uscode/49/32908.html)). The European Parliament has adopted a mandatory Directive (1999/94/EC) relating to the availability of consumer information on fuel economy and CO<sub>2</sub> emissions in respect to the marketing of new passenger cars ([www.europa.eu.int/eur-lex](http://www.europa.eu.int/eur-lex)). The Australian fuel labeling law is contained in Australian Design Rule (ADR) 81/01 ([www.greenhouse.gov.au/fuellabel/label.html](http://www.greenhouse.gov.au/fuellabel/label.html)). A voluntary system of energy labeling for motor vehicles also exists

<sup>50</sup> For a general discussion of this issue, see Adrian J Bradbrook, note 1 above, at 19-23.

in Canada, where legislation designed to make the system compulsory has been enacted and will be promulgated if vehicle manufacturers cease to comply with the present “voluntary” scheme (Motor Vehicle Fuel Consumption Standards Act, c M-9, §§ 17-21; [www.laws.justice.gc.ca/en/M-9/83591.html#rid-83653](http://www.laws.justice.gc.ca/en/M-9/83591.html#rid-83653))<sup>51</sup>.

Labeling for fuel consumption assists in promoting consumer confidence in motor vehicles. It enables customers to make an informed choice between various competing products, provides an incentive to manufacturers to design more energy efficient vehicles, and promotes energy conservation generally. Labeling for fuel consumption is commonplace in relation to consumer appliances and equipment.

The proposal to introduce a mandatory system of fuel consumption labeling has been criticized on the basis that the fuel consumption figures achieved under test conditions could never be achieved under road conditions, and that this would lead to a rash of complaints against the manufacturers. While it is certainly true that road conditions significantly increase fuel consumption over test conditions, the figure or figures displayed on the label could be modified to take account of this fact. This occurs in the United States where, under the current legislation (cited above), two fuel consumption figures are displayed, one for fuel consumption in city conditions, and one for fuel consumption in highway conditions. These figures are calculated by discounting the figure for city driving by 10 per cent from the figure obtained during test conditions, and by discounting the figure for highway driving by 22 per cent. Any overall fuel consumption figure displayed must be calculated using the discounted figures above and on the assumption that the vehicle will be driven 55 per cent under city conditions and 45 per cent under highway conditions.

It will be necessary to prescribe in the legislation the exact form of the label, preferably in the regulations attached to the enabling statute. As the labeling system is designed as a consumer protection and information measure, it is essential that the label be carefully designed so as to disclose the relevant amount of information in a manner that is easy to understand. Thus a six-star system, currently used in many countries in labeling for appliance energy efficiency, including Australia, appears to be too vague and more exact information is required. Conversely, the label currently used in the United States may be considered to be too difficult to comprehend in that the same label also gives information on the price of the standard vehicle and all optional equipment, together with a mass of miscellaneous information including the vehicle identification number, the dealer number, the final assembly point, the method of transportation, and the vehicle description. It is quite likely that the fuel consumption figures would be overlooked by consumers in the overall mass of information.

An effective form of label would consist simply of fuel consumption information and, like the US label, would give separate figures for city and highway fuel consumption, appropriately discounted from the figures obtained from standard test conditions. For comparative purposes the label could indicate the range of fuel consumption figures obtained by passenger vehicles and light trucks generally. It is further suggested that a global figure for the estimated annual fuel cost for the vehicle, which forms part of the US label, not be included in any new label. The estimated fuel

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<sup>51</sup> The Canadian system is discussed in Transport Canada, *Voluntary Motor Vehicle Fuel Consumption Program*, Report TP6890/E (Transport Canada, Ottawa, 1993).

cost is considered by the writer to be too vague and misleading, from a consumer perspective, as the figure will depend very largely on the number of kilometers driven in a given year. This will be unknown in each case and will vary greatly between consumers.

As an alternative to introducing a system of compulsory fuel consumption labeling for motor vehicles, it would be possible to legislate for other point-of-sale material such as a system of display charts and placards indicating fuel consumption statistics of various types of vehicles on the walls of dealers' showrooms. This has been proposed in Australia by vehicle manufacturers. While such a proposal would represent an improvement on the present position, from the perspective of consumer information and protection it would seem to be a less satisfactory alternative.

### C. Fuel Consumption in Model-Specific Vehicle Advertising

In Australia, the Ecologically Sustainable Development Transport Working Group proposed that all advertising in relation to the sale of new vehicles make specific reference to each vehicle's fuel consumption statistics.<sup>52</sup> This proposal was justified in four ways: first, it would raise the public awareness of fuel consumption as a factor in the purchase decision; secondly, it would put fuel consumption information before the prospective buyer at an early stage in the purchasing process; third, sufficient fuel consumption data exists, so that the need for additional testing costs is avoided; and fourthly, it ranks fuel efficiency alongside other attributes in the overall image of desirability of ownership delivered by the advertisement.<sup>53</sup> The current use by vehicle manufacturers of fuel consumption statistics in advertising is rare: in Australia, the Department of Primary Industries and Energy has reported that only about 10 per cent of model-specific motor vehicle advertisements contain statements about fuel consumption, and that many of these statements are misleading.<sup>54</sup>

#### Republic of Korea Rational Energy Utilization Act (1995), article 18(4)

South Korea has legislation of this similar nature. This sub-section reads:

"If a manufacturer, importer or distributor of the efficiency indicated machinery and materials, makes any advertisement of the efficiency indicated machinery and materials using such advertisement media as prescribed by the Ordinance of the Ministry of Trade, Industry and Energy, he shall include the energy consumption efficiency or quantity consumed, and the method of use in the contents of the advertisement".

Full text available at: [www.unescap.org/esd/energy/publications/compend/ceccpart4chapter8.html](http://www.unescap.org/esd/energy/publications/compend/ceccpart4chapter8.html)

<sup>52</sup> Ecologically Sustainable Development Working Groups, Final Report – Transport, Australian Government Publishing Service, Canberra, 1991.

<sup>53</sup> In relation to the last-mentioned point, see Nelson English, Loxton and Andrews Pty Ltd, Study on Potential to Improve Fuel Economy of Passenger Motor Vehicles, Part 1 – Study, 1991, at 115.

<sup>54</sup> Discussion Paper, "Vehicle Fuel Consumption Advertising" (Energy Programs Branch, Department of Primary Industries and Energy (Australia), Canberra, November 1992 (unpublished) (on file).

Analogies can be drawn with legislation controlling advertising in other industries in support of the type of law reform under consideration. Perhaps the closest analogy is with tobacco advertising, which is subject to many and varied controls. The controls in some cases expressly prohibit corporations from publishing in a print medium an advertisement for smoking or for the use of tobacco products. Interestingly, in some jurisdictions, tobacco advertisements are allowed, but are subject to the inclusion of a health warning in prescribed terms (see, for example, Canada: Tobacco Act 1997, c T-11.5 (<http://laws.justice.gc.ca/en/T-11.5/index.html>); New Zealand: Smoke-Free Environments Act 1990; [www.legislation.govt.nz](http://www.legislation.govt.nz)). Food advertising legislation is also relevant by analogy. Under legislation in many jurisdictions, it is an offence to publish, or to be a party to the publication of, an advertisement that falsely describes any food that is likely to mislead as to the nature, substance or quality of the food (see, for example, Victoria, Australia: Food Act 1984, §§ 11-12; ([www.austlii.edu.au/au/legis/vic/consol\\_act/fa198457/](http://www.austlii.edu.au/au/legis/vic/consol_act/fa198457/))).

## II. HOW ARE FINANCIAL MECHANISMS USED TO IMPROVE THE MOTOR VEHICLE FUEL EFFICIENCY?

Various economic measures might be introduced to encourage vehicle manufacturers to manufacture more fuel-efficient vehicles and to encourage the public to purchase such vehicles. Such stimulatory measures might be introduced as an alternative, or in addition to various forms of regulation. A combination of regulatory and stimulatory measures (together with voluntary agreements negotiated between government and the motor vehicle industry to promote fuel efficiency) may well be the most effective approach to take. The regulatory measures would require manufacturers to adopt a minimum standard of compliance, while the stimulatory measures would encourage and reward them to go as far as possible beyond the specified minimum.

The financial strategies that governments may pursue to improve motor vehicle fuel efficiency include the following:

### A. Differential sales or goods and services tax

The present sales tax or goods and services tax legislation in existence in nearly all countries could be amended to introduce either a skewed sales tax where higher charges are imposed on the purchase of motor vehicles with a high rate of fuel consumption; or a sales tax increase/rebate program where higher rates of tax for inefficient vehicles are combined with tax rebates for relatively efficient vehicles.

#### 1. Skewed sales or goods and services tax

In the United States, a specified supplementary lump sum tax is imposed on manufacturers on the sale of new passenger motor vehicles that do not meet prescribed standards of energy efficiency. This system has been in operation since 1978. It is commonly referred to as the “gas guzzler tax”. The supplementary federal tax is imposed according to the following schedule, set out in US Code, s 4064(a) (<http://assembler.law.cornell.edu/uscode/>):

If the fuel economy of the model type in which the automobile falls is:	The tax is:
At least 22.5 miles per gallon (mpg)	\$0
At least 21.5 but less than 22.5 mpg	1,000
At least 20.5 but less than 21.5 mpg	1,300
At least 19.5 but less than 20.5 mpg	1,700
At least 18.5 but less than 19.5 mpg	2,100
At least 17.5 but less than 18.5 mpg	2,600
At least 16.5 but less than 17.5 mpg	3,000
At least 15.5 but less than 16.5 mpg	3,700
At least 14.5 but less than 15.5 mpg	4,500
At least 13.5 but less than 14.5 mpg	5,400
At least 12.5 but less than 13.5 mpg	6,400
Less than 12.5 mpg	7,700

Emergency vehicles such as ambulances and police cars are exempt from the tax. The legislation defines the terms “automobile”, “fuel economy”, “model type”, “model year” and “manufacturer, and also explains how fuel economy is to be measured (ibid)

The imposition of such a system would raise additional tax revenue. The reform could be made revenue-neutral and give additional incentive for the purchase of fuel-efficient vehicles if the schedule were modified and expanded so as to give a lump-sum reduction for the sale of each vehicle that met or exceeded the specified fuel-consumption statistics. The introduction of a sliding scale would result in a significant price reduction for the most fuel-efficient vehicles.<sup>55</sup>

Rather than imposing lump-sum payments, the legislation could impose differential sales or goods and services tax rates based on motor vehicle fuel efficiency. Under this proposal the existing sales or goods and services tax rates could be modified so as to increase the rate of tax payable in respect of fuel-inefficient vehicles and (possibly) to reduce the rate of tax payable by fuel-efficient vehicles. The differing sales or goods and services tax rates approach is more consistent with most current tax regimes, which specify rates rather than lump sums. This approach was favored in Australia by the report of the ESD Working Group on Transport.<sup>56</sup>

<sup>55</sup> See Adrian Bradbrook and Alexandra Wawryk, “Legislative Implementation of Financial Mechanisms to Improve Motor Vehicle Fuel Efficiency” (1998) 22 Melbourne University Law Review 537 at 543.

<sup>56</sup> ESD Working Groups, note 1 above, 138 (Recommendation 4).

## 2. A Feebate System

A second option is to levy a lump-sum charge or rebate on customers on the purchase of new vehicles. The actual charge or rebate would vary according to the level of fuel-efficiency of the vehicle. Such a system would specify a sliding scale of charges for vehicles of lower efficiency ("gas guzzlers"), but also incorporate a sliding scale of rebates for vehicles of higher efficiency ("gas sippers"). This option is commonly referred to in North America as "feebates". A system of this nature, entitled the Tax for Fuel Conservation, was introduced by the Ontario government in 1990 (Retail Sales Tax Act, RSO 1990, c R.31; [www.e-laws.gov.on.ca](http://www.e-laws.gov.on.ca)). The additional tax ranges between \$75 to \$7,000 for vehicles with fuel consumption ratings in excess of nine liters per 100 kms. A \$100 tax rebate is given to purchasers of vehicles with fuel consumption ratings below six liters per 100 kms. On 23 June 2004, the French press reported that the Government intends to impose a tax on large sports utility vehicles (SUVs) while subsidizing the most efficient cars. The measure would rate new cars according to their efficiency. The least efficient, the larger SUVs, would be taxed €3,200 at point of sale. The revenue would be channeled to subsidizing the most efficient, smaller cars by €800.

Work has been undertaken in the United States by the American Council for an Energy-Efficient Economy on the development of a model formula for the calculation of feebate charges and rebates designed to best encourage energy efficiency.<sup>57</sup> This study defines a feebate as the product of a feebate rate and the difference between a vehicle's energy factor and some reference level relative to which all vehicles are judged. Thus:

Feebate = (feebate rate) x [(energy factor) - (reference level)].

The energy factor is a measure of the vehicle's energy efficiency. For a fuel-economy based feebate, the energy factor is the vehicle's fuel economy rating in kilometers per litre.<sup>58</sup> The reference level is an average value of the energy factor. For example, for a fuel economy feebate, the reference level could be a fleet-based fuel economy. The feebate rate is the monetary value assigned to each unit difference in the energy factor above or below the reference level.<sup>59</sup>

Another very high leverage option would be directed to inefficient cars presently on the road, often older vehicles that are the most polluting. For example, 65 per cent of the cars in Egypt are over 10 years old, 25 per cent are over 20 years old, and 25 per cent of the buses are over 15 years old. These figures are typical for most developing countries. Feebates have been suggested – charging a fee on inefficient vehicles, which would pay for granting a rebate for the purchase of more efficient models. The older model would be scrapped, and the newer model purchased with the rebate. Amory Lovins of the Rocky Mountain Institute made the following calculation (using US prices):

"Giving the owner of the average 1990 car (23 mpg) a \$4,900 rebate – four times trade-in value – for scrapping it and replacing it with a new \$21,000, 48-mpg, 5-seat compact hybrid car would save enough gasoline to repay the rebate of its life at \$1.25 a gallon".<sup>60</sup>

<sup>57</sup> John DeCicco et al, *Feebates for Fuel Economy: Market Incentives for Encouraging Production and Sales of Efficient Vehicles* (1992).

<sup>58</sup> The energy factor may account for other vehicle attributes such as vehicle size, carbon dioxide emissions, vehicle class, "crashworthiness", alternative fuel use, payload weight, power to weight ratio, or the level of domestic (as opposed to imported) content: *ibid*, at 19.

<sup>59</sup> Note 6 above, at 544.

<sup>60</sup> Amory B Lovins, *Energy Security Facts*, Rocky Mountain Institute, 2 June 2003.

## B. Skewing Motor Vehicle Registration Charges Towards Higher Charges on Inefficient Vehicles

Another tax policy option is to amend existing national or State motor vehicle registration charges so as to require the owners of cars with a high rate of fuel consumption to pay increased charges. While the laws imposing such charges differ from jurisdiction to jurisdiction, it is common to find that different registration fees are imposed for different vehicles. Commonly, the registration charges are based on a number of factors, such as the type of vehicle to be registered, the weight of the vehicle to be registered, the number of cylinders of the motor vehicle and whether the vehicle is to be used for private or commercial purposes (see for example, New South Wales, Australia: Motor Vehicles Taxation Act 1988; ([www.austlii.edu.au/au/legis/nsw/consol\\_act/mvta1988268/](http://www.austlii.edu.au/au/legis/nsw/consol_act/mvta1988268/)); South Australia, Australia: Motor Vehicle Regulations 1996; ([www.austlii.edu.au/au/legis/sa/consol\\_reg/mvr199628/](http://www.austlii.edu.au/au/legis/sa/consol_reg/mvr199628/)). It would be possible to amend or replace this legislation with a law varying the amount of motor vehicle registration charges according to the fuel consumption statistics of the vehicle.

## C. Increasing Petroleum Excise Taxes

Petroleum excise taxes are levied directly on the consumers of petrol at the point of sale on a cents per litre basis. Such a tax already provides an incentive to consumers to reduce the use of petrol and to purchase fuel-efficient cars. In Australia, a paper commissioned by the Commonwealth Department of Transport and Communications suggested that motor vehicle fuel efficiency could be significantly improved by eliminating or reducing sales or goods and services taxes on cars and raising petroleum excise taxes to compensate for the lost revenue.<sup>61</sup> This reform could be achieved by a simple amendment to the relevant petroleum excise and sales or goods and services tax legislation. Kenya has an Environmental Energy Policy that includes higher taxes on gasoline to discourage wasteful and conspicuous consumption. Among the main programs or projects undertaken to reduce emissions from the usage of petroleum-based fuels for transport are legislation and fiscal policies that help to reduce consumption of fuel and limit the age of imported second-hand vehicles.<sup>62</sup>

## D. Income Tax Incentives

Income tax is currently imposed in almost countries by national legislation. It is usually calculated by applying the appropriate tax rate to the taxable income, then subtracting any rebates or credits. Taxable income is determined by subtracting allowable deductions from a taxpayer's assessable income.

Governments could offer income tax rebates or credits on the purchase of motor vehicles that meet specified fuel economy standards. This concept is similar to the various incentive programs in the United States, which are designed to stimulate the purchase of alternative-fuel vehicles and the conversion of petrol-based vehicles to alternative fuels. For example, in 1990 California enacted

<sup>61</sup> Nelson English, Loxton & Andrews Pty Ltd, Study on Potential to Improve Fuel Economy of Passenger Motor Vehicles (Working Paper, Commonwealth Department of Transport and Communications, Canberra, 1991).

<sup>62</sup> UNEP communication

legislation providing an income tax credit to individuals and businesses that either purchased new alternative fuel vehicles or retrofitted their standard vehicles using an alternative-fuel conversion kit certified by the State's Clean Air Regulatory Board.<sup>63</sup> Under this low emission vehicle (LEV) credit, a taxpayer could receive as a tax credit 55 percent of the incremental cost (that is, the cost above the purchase price of an equivalent standard-fuel vehicle) associated with purchasing a new vehicle that meets specified emission standards or converting an existing vehicle so as to meet the same standards. The maximum credit was \$1,000 for vehicles under 5,750 pounds and \$3,500 for vehicles over 5,750 pounds.<sup>64</sup>

A new scheme of income tax rebates or credits linked to the purchase or lease of fuel-efficient vehicles would require administrative supervision. In California, the California Energy Commission (CEC) was declared responsible for administering the State's program. Parties interested in purchasing an alternative-fuel vehicle contact the CEC for information on the availability of and rules relating to the tax credits. The taxpayer fills out the appropriate form, giving information as to the type of car purchased or converted. If the purchase or conversion is approved by the Clean Air Regulatory Board, the CEC approves the application and sends a certification letter to the taxpayer. This certification letter was kept for income tax audit purposes.<sup>65</sup>

## E. Employer-supplied Vehicle Fringe Benefits

Fringe benefits tax (FBT) is currently imposed in some countries, including Australia, where it is located in the Fringe Benefits Tax Assessment Act 1986 ([www.austlii.edu.au/au/legis/cth/consol\\_act/ftbaa1986312/](http://www.austlii.edu.au/au/legis/cth/consol_act/ftbaa1986312/)). FBT is a separate tax paid by employers regardless of the employees' liability for income tax. Liability is assessed on an annual basis, but paid in quarterly installments. The return is separate from the normal income tax return. Tax is payable on the "tax inclusive" value of benefits, that is, the "grossed up" taxable value of the benefits. The grossed up taxable value of fringe benefits can be calculated by using the formula:

## F. Aggregate FBT amount x 1/(1 - FBT rate)

Where the aggregate FBT amount means the aggregate FBT amount in relation to the employer in relation to the year of tax, and the FBT rate is the rate applicable for the year of tax.

The Australian Fringe Benefits Tax Assessment Act 1986 sets out particular rules for assessing the value of car fringe benefits. As a general rule, liability for FBT will arise where an employee has the private use of an employer's car. The car may be leased or owned by the employer. "Car" is defined in s 136 of the Fringe Benefits Tax Assessment Act 1986 (Cth). Exemptions from FBT apply to certain types of commercial vehicle where the only private use of the vehicle is for "work-related" travel (s 8).

<sup>63</sup> Act of 1 January 1991 ch 1611, 6 Cal Stat (1990). California Legislative Analyst's Office, "An Analysis of the Low-Emission Vehicle Tax Credit Program" (1996) [www.lao.ca.gov/rp62196.html](http://www.lao.ca.gov/rp62196.html).

<sup>64</sup> California Legislative Analyst's Office, note 13 above. The scheme expired in 1996. Federal tax incentives for the purchase of, or conversion to, alternative fuel vehicles are established in National Energy Policy Act 1992, 42 USC 13201-556 <http://assembler.law.cornell.edu/uscode>.

<sup>65</sup> California Legislative Analyst's Office, note 13 above.



Governments could seek to encourage the purchase or lease by businesses of more fuel-efficient motor vehicles by providing FBT incentives, in the form of tax deductions or rebates. Such deductions or rebates would reduce the cost to businesses of providing vehicles to employees. Similarly to sales tax, a skewed system could be employed whereby FBT surcharges on the provision of energy-inefficient cars to employees would co-exist with FBT rebates for fuel-efficient vehicles.<sup>66</sup>

### **G. Grants, low-interest loans or loan guarantees to businesses for the lease or purchase of fuel-efficient vehicles**

Another option to encourage the use of more fuel-efficient vehicles by businesses is by government subsidy of the purchase or lease of new fuel-efficient vehicles by grants, low-interest loans or loan guarantees.<sup>67</sup>

In addition, national governments could provide assistance to local or State government agencies to lease or purchase fuel-efficient vehicles. In many countries, local and/or state governments operate a fleet of motor vehicles, comprised of various types of vehicles. Many of these vehicles are large and energy-efficient. Although fuel efficiency is a factor that local and/or State governments take into account when determining the composition of their vehicle fleet, it is often only one out of many. National governments could influence the vehicle mix of local and/or State governments by making the selection of fuel-efficient vehicles more economically attractive. This could be achieved by the providing funding for the purchase and/or the operating costs of fuel-efficient vehicles.

## **III. WHAT ARE THE OPTIONS FOR PLANNING AND DEVELOPMENT LAWS?**

The UN Commission on Sustainable Development, at its Ninth Session, reported that in 1995 46 per cent of the world's population resided in urban areas, and that this figure was expected to increase to 50 per cent in 2006 and to more than 60 per cent by 2030. The Commission noted that the rapid pace of urbanization means that not only are more people living and working in cities, but also more people and more goods are making more trips in urban areas, often over longer and longer distances (Report E/CN.17/2001/19-E/2001/29; [www.un.org/esa/sustdev/csd/CSD9.html](http://www.un.org/esa/sustdev/csd/CSD9.html)).

This development has profound effects on the transport sector. The design of cities can directly influence the amount of consumption of transport fuels. If cities are allowed to spread without adequate controls, the danger exists that public transport to the extended areas will become inadequate, necessitating almost exclusive reliance on motor vehicles. This has already occurred in a number of major cities throughout the world. In addition, of course, the spread of cities without adequate planning controls inevitably means more travel and therefore more fuel consumption. Rapid urbanization is probably inevitable, but with political will the shape and design of such urban areas can be controlled so as to render such cities efficient in terms of transport usage and fuel consumption. Such planning controls can ensure that development occurs in such a way that public transport can provide an adequate service and that the need for vehicle travel within urban areas is minimized.

<sup>66</sup> See Note 6 above, at 547-548.

<sup>67</sup> See note 6 above, at 548.

In many developing countries planning and development laws are very rudimentary. Even in developed countries the comprehensive planning and development laws seldom take into consideration issues of improving energy efficiency in the transport sector by providing measures for reducing fuel consumption. This is despite the clear recommendations contained in Agenda 21, paragraphs 7.52 and 9.15 ([www.un.org/esa/sustdev/documents/agenda21/English/agenda21toc.html](http://www.un.org/esa/sustdev/documents/agenda21/English/agenda21toc.html)) requiring national action to be taken to encourage development patterns which reduce transport demand, promoting public transport, supporting non-motorized modes of transport and controlling traffic management. This is echoed in clause 20 of the Johannesburg Plan of Implementation, signed in September 2002 ([www.un.org/esa/sustdev/documents/WSSD\\_POI\\_PD/English/POIChapter3.html](http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIChapter3.html)).

Many of these policies will require implementation by legislation. The following legislative options can be identified:

### **A. The Introduction of or Changes to Existing Town Planning Laws to Encourage Urban Consolidation**

Urban consolidation is designed to use urban land more efficiently in order to improve accessibility to city centers and other important hubs. It can be promoted in a variety of ways, including the following:

- (1) By ensuring that inappropriate regulations and processes preventing urban consolidation be removed from local and national building and town planning laws.
- (2) By government authorities conducting assessments of the capability for redevelopment in each local government area through a study of the infrastructure capacity
- (3) By creating within town planning laws guidelines or development rules providing clear zoning and priorities as to where and how much development should occur in each city area.
- (4) By ensuring that attention is paid to redevelopment of land around key public transport nodes to include dense housing and some commercial activity so that travel is minimized and public transport facilities are made more attractive.
- (5) By investigating whether taxation laws can be changed so as to encourage high density housing in areas identified for development by government authorities.
- (6) By encouraging dual or multiple occupancy. This is the right to register and rent a self-contained apartment or unit forming part of an existing or new residence, the right to subdivide existing blocks so as to create additional housing units, and the right to sell large backyards of existing blocks for further development.

All these options are designed to reduce travel demand by allowing more people to live close to established areas where employment and other urban facilities, such as shops and entertainment complexes, exist. They will all require law reform to either introduce new planning and/or building legislation or to amend such existing legislation.

Cities that have taken legislative action in this area include Curitiba (Brazil), Singapore and Canberra (Australia). For the Curitiba local legislation, see [www.curitiba.pr.gov.br](http://www.curitiba.pr.gov.br) (in Portuguese), and for a

general discussion of the provisions in English, see ([www3.iclei.org/localstrategies/summary/curitiba2.html](http://www3.iclei.org/localstrategies/summary/curitiba2.html)). The Singapore provisions are contained in Planning Act, Part II, §§ 5-11 (<http://statutes.agc.gov.sg>). The Canberra provisions are made under the Planning and Land Act 2002 (ACT) ([www.legislation.act.gov.au/a/2002-55/current/pdf/2002-55.pdf](http://www.legislation.act.gov.au/a/2002-55/current/pdf/2002-55.pdf)) 11(1)(d) and the Planning and Land Regulation 2003 (ACT) ([www.legislation.act.gov.au/sl/2003-16/current/pdf/2003-16.pdf](http://www.legislation.act.gov.au/sl/2003-16/current/pdf/2003-16.pdf)).

## B. The greater use of environmental impact assessment

National legislation requiring environmental impact assessment for all major development projects has been a cornerstone of environmental law in general, and sustainable development in particular, in recent years and is regarded internationally as essential. It has been supported in many international legal instruments, most recently in clause 97 of the Johannesburg Plan of Implementation ([www.un.org/esa/sustdev/documents/WSSD\\_POI\\_PD/English/POIChapter3.html](http://www.un.org/esa/sustdev/documents/WSSD_POI_PD/English/POIChapter3.html)).

Environment impact statements are considered to be one of the most effective means of ensuring that environmental concerns are taken into account in any development and of raising awareness of the importance and impact of the environment both in the public and in government agencies. This option would ensure that past practices of simply ignoring the environmental impact of proposed developments is not allowed to continue. While the use of such statements is mandated in some countries in certain circumstances, its use is currently limited in developing countries. All town planning changes, which would actually or potentially impact on public or private transport usage or availability could be made subject to a compulsory environmental impact statement as a precursor to approval.

## C. Demand Management Programs

A variety of demand management programs have been implemented and proposed for adoption in various countries in order to reduce the need for travel, the amount of travel and the impact on this travel, without restricting access to urban facilities. Such programs are wide-ranging in their scope and nature. They include the following:

- (1) The use of staggered or flexible working hours and the deregulation of weekend working.
- (2) The encouragement of ride sharing (and consequently the reduction in vehicle and fuel use) by measures such as: high occupancy vehicle lanes; laws requiring employers with more than a specified number of employees to develop increased vehicle occupancy schemes for their employees; the removal of legal prohibitions on payment for ridesharing; "every car a taxi" laws permitting drivers to pick up pedestrians at designated areas.
- (3) Improvement of traffic flow by the use of traffic management measures, such as computer-coordinated traffic signals.
- (4) Regulatory control of access to city centers for private vehicles, by such means as: vehicle permits required to enter city centers; granting access to odd or even number plated-vehicles on alternate days; car free days; bans on certain classes of vehicles; vehicle taxation according to city access privileges; or lotteries to allocate city access rights.
- (5) Increased parking controls, including increased fees and restrictions on the number of parking places available.

- (6) Restricting the number of cars that may be registered.
- (7) Road pricing controls, by imposing fees for vehicle use of certain key roads. This can be achieved electronically by the use of overhead cameras and special computer cards attached to vehicle windscreens, which record when vehicles pass a certain point.
- (8) Encouraging residents to use modes of transport other than private vehicles, by: establishing bicycle lanes; the provision of special parking areas outside inner city areas and encouraging people to walk to work or take buses from these parks; fee reductions and/or timetable improvement for public transport services.
- (9) Modification of taxation laws to discourage companies from providing company cars to their senior employees, and to impose on employees liability for income tax on the value of company cars.
- (10) The inclusion of driver education on the need for fuel efficiency driving practices as part of the requirements for passing the driving test necessary to secure a driver's license.

While some of these measures may be introduced administratively by government agencies, the majority of these reforms will require amendments to, or new national or state legislation affecting, road traffic, labor and taxation legislation.

#### **Singapore Road Traffic Act, Part I, § 10A**

Singapore has restrictions on the number of cars that may be registered. Under this system, in order to register a car, the owner must obtain from the Land Transport Authority a Certificate of Entitlement, for which the price is set through a market system. The law in §10A reads in part:

- “(1) No vehicle shall be registered or, except as otherwise provided by this Act, continue to be registered under this Act unless there is in force a permit issued by the Registrar authorizing the registration of the vehicle.
- (2) Except as otherwise provided by this Act, a permit shall be issued upon the payment of a levy.
  - (3) The Minister may from time to time, by notification in the Gazette, prescribe a limit on the number of permits to be issued by the Registrar under subsection (1) and the Minister may prescribe different limits for vehicles belonging to any category, class or description.
  - (4) The Minister may make rules for carrying out or giving effect to this section and, in particular, the rules may —
    - (a) provide for the issue of permits under this section to successful applicants who submitted bids for the permits;
    - (b) require fees and deposits to be paid for the submission of applications for the issue of permits under this section, and provide for the forfeiture of deposits for non-compliance with any conditions governing the submission of such applications;

- (c) prescribe the levy, or the method or manner for determining the amount of the levy, payable for a permit issued under this section;
- (d) prescribe the period for which a permit issued under this section is in force and different periods may be prescribed for vehicles belonging to different categories, classes or descriptions;
- (e) prescribe the conditions upon which permits are issued under this section;
- (f) provide for a rebate on all or any part of the levy payable for the issue of a permit under this section, in such circumstances as may be permitted by the rules;
- (g) provide for the cancellation of a permit issued under this section and the refund of all or part of the levy paid for the issue of the permit in such circumstances as may be permitted by the rules;
- (h) impose a levy on the transfer of a permit at any time prior to the registration of a vehicle authorized by the permit;
- (i) provide for the issue of permits, whether with or without the payment of a levy, for vehicles which were registered under this Act prior to 2nd April 1990;
- (j) provide for the renewal of a permit before or after its expiration and the levy and any other fee to be paid therefore;
- (k) exempt any particular vehicle or class of vehicles from the payment of the levy for a permit issued under this section; and
- (l) provide for all matters which are required or permitted to be prescribed or which are necessary or convenient to be prescribed for carrying out or giving effect to this section."

Road pricing controls are illustrated by Singapore. This has an electronic road pricing scheme that operates during peak hours. This is administered by the Land Transport Authority, under rules provided in the Road Traffic Act, Part IA, §§ 34A, 34B, 34C and 34D. This reads in part:

"34B(1) The Minister may prescribe road-user charges to be paid in connection with the use of any specified road.

(2) All road-user charges collected under this Part shall be paid into the Consolidated Fund.

34C The Authority may install or cause to be installed on any road in respect of which a road-user charge is levied under this Part such electronic or computerized or other facilities as it thinks fit for the purpose of collecting the road-user charge and may also install or cause to be installed such ancillary facilities as the Authority thinks necessary.

34D (1) The Minister may make rules for the purposes of carrying this Part into effect and, in particular, may make rules —

- (a) specifying the roads in respect of which, and the days and hours during which, a road-user charge shall be levied;
- (b) prescribing the amount of road-user charge to be levied in respect of any specified road and for this purpose, road-user charges of different amounts may be prescribed in respect of —
  - (i) different specified roads or parts thereof;
  - (ii) different hours of the day or different days of the week; and
  - (iii) different classes, categories or descriptions of vehicles;
- (c) prescribing the manner in which road-user charges shall be levied and collected, including the use of electronic or computerized or other facilities therefore, and for this purpose, the rules may —
  - (i) require all vehicles (whether registered in Singapore or elsewhere) to be installed with such devices and appurtenances and in such manner as may be prescribed before they may be ridden, driven or moved on a specified road during the prescribed hours;
  - (ii) provide for the issue by the Authority or its agents of stored value cards to be used with any device prescribed under sub-paragraph (i), regulate the use of such stored value cards and prohibit the issue of such stored value cards by any person not authorized by the Authority to do so;
  - (iii) prohibit the sale, supply, installation, repair or maintenance of any device or appurtenance prescribed under sub-paragraph (i) by any person not authorized by the Registrar to do so;
  - (iv) specify the conditions under which any device or appurtenance prescribed under sub-paragraph (i) may be removed from one vehicle and installed in another or transferred from one person to another; and
- (d) prescribing the records to be kept by the Registrar in connection with this Part and regulating the disclosure by the Registrar of any information in such records.

Statutes and regulations available at: <http://statutes.agc.gov.sg>.

Regulation of vehicle access to city centers occurs in Gothenburg (Sweden) and Copenhagen (Denmark). These reforms have been implemented as part of the European Union's Progress Project. The Project is discussed at [www.progress-project.org](http://www.progress-project.org), and the legal aspects of the Project, including the relevant legislation, at [www.progress-project.org/Progress/pdf/D4\\_2.pdf](http://www.progress-project.org/Progress/pdf/D4_2.pdf).

The best illustration of encouraging other methods of transport is Copenhagen (Denmark). This city particularly encourages bicycle use. This is undertaken under the planning legislation by administrative action. See the City of Copenhagen Policy Document: ([www.vejpark.kk.dk/byenstrafik/cyklernesby/uk/cykelpolitik\\_uk.pdf](http://www.vejpark.kk.dk/byenstrafik/cyklernesby/uk/cykelpolitik_uk.pdf)). For basic details, see ([www.eaue.de/winuwd/175.html](http://www.eaue.de/winuwd/175.html)) and ([www.ils.nrw.de/netz/leda/database/measures/meas0356.html](http://www.ils.nrw.de/netz/leda/database/measures/meas0356.html).)

Increased parking controls have been implemented in Singapore. These are regulated by the Land Transport Authority under the Planning Act (available at ([http://www.lta.gov.sg/dbc/index\\_dbc\\_vehicle.html](http://www.lta.gov.sg/dbc/index_dbc_vehicle.html))).

# SECTION FOUR

## RENEWABLE ENERGY

### CHAPTER A. THE IMPORTANCE OF RENEWABLE ENERGY

Katherine Kennedy\*

#### I. INTRODUCTION

There are many compelling reasons for countries to seek to increase their use of renewable energy to produce electricity. Most sources of renewable energy produce zero or extremely low air and water pollution impacts, although, as is discussed in subsequent chapters, some forms of renewable energy, such as large hydro and some forms of biomass, can have negative environmental consequences. As the world struggles to address global warming, renewable energy presents a crucial zero carbon alternative to carbon-intensive fossil fuel generation. Renewable energy sources are by definition sustainable and unlimited, not subject to depletion. Most renewable energy sources, such as hydro, solar, geothermal, wind, tidal and wave power, have zero fuel costs, helping to reduce and hedge against energy price volatility.

Despite the many advantages of renewable energy, use of renewable energy (except large hydropower) to produce electricity is extremely low, especially use of renewable resources other than non-large hydro. So-called “new renewables” (all renewable energy resources except large-scale hydropower and traditional biomass), currently meet only 2% of global energy demands.<sup>68</sup> There are a number of formidable economic, regulatory and political barriers to further deployment of renewable energy;

- The cost of most forms of renewable energy has steadily decreased over the past few decades, and wind is competitive or close to competitive in many parts of the world. Other forms of renewables, such as solar, are competitively priced in niche applications, including off the grid applications. Still, traditionally heavily subsidized fossil fuel electricity has a price advantage over most forms of renewable energy. While renewable energy has zero or low fuel costs, the initial cost of construction per megawatt is often higher for most forms of renewable energy than for fossil fuel plants. As the commercialization and demand for renewable energy grows and methods of mass production are refined, prices will continue to drop.
- Traditional forms of regulation at both the electric distribution and transmission level tend to favor continuously supplied centralized fossil fuel generation over renewable generation, that is often more distributed and intermittent, causing challenges discussed below.

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<sup>68</sup> Sawin, *op. cit.*, at 15, Figures 1-2.



- Many environmental and public health benefits of renewable energy – and particularly its value in combating global warming pollution – are currently externalized and not reflected in electricity prices.
- Electric utilities tend to oppose all distributed generation because they perceive it to be harder to manage its distribution, it requires the availability of back-up power, and, where it is installed on customer side, it can lead to loss of utility revenue in jurisdictions where utility revenues are tied to sales.
- Lastly, the producers of fossil fuels and fossil fuel generated electricity have a strong incentive to oppose increase use of renewable energy in political and regulatory forums.

Fortunately, there are a number of legislative and regulatory tools that countries, states and municipalities throughout the world have deployed that can be useful in overcoming these barriers and encouraging the use of renewable energy. These policy tools have been employed successfully by countries such as Denmark, Germany, India, Japan, Spain and the United States – which account for about 80 percent of global photovoltaic (PV) and wind power capacity.<sup>69</sup> They have been used in many states and cities as well.

Despite the obstacles, use of renewable energy technologies is growing rapidly. Wind and solar power are the fastest-growing energy sources in the world.<sup>70</sup> The European Union has set a target of achieving 22 percent of Europe's electricity by 2010.<sup>71</sup> China aims to reach 4,000 MW of wind by 2010, with 20,000 MW of wind by 2020. India has proposed that 10 percent of annual additions to electric capacity come from renewables by 2012.<sup>72</sup> South Africa will target producing 4% (approximately 10,000 gigawatt-hours) of the country's electricity from renewable sources by 2013.<sup>73</sup>

This section of the Handbook will explore the legislative tools that are available and have been used around the world to promote renewable energy, including citations to full text and some legislative excerpts.

## II. LEGISLATIVE AND REGULATORY STRATEGIES TO ENCOURAGE THE USE OF RENEWABLE ENERGY FOR ELECTRICITY

This chapter will give an overview of the legislative and regulatory measures available to encourage the use of, and overcome the barriers to use of renewable energy for electricity. The subsequent chapters in this section will go into depth on the measures pertaining to hydroelectric, solar, wind, biomass and geothermal energy. There is included a short chapter on the use of renewable energy for transportation, with more in depth covered in the energy efficiency section.

There are four broad categories of tools that have been widely deployed in jurisdictions around the world, often with considerable success, to promote renewable energy for electricity production.

<sup>69</sup> *Id.* at 8.

<sup>70</sup> *Id.* at 17-19, Figure 3.

<sup>71</sup> Sawin, *op cit*, at 48,

<sup>72</sup> *Id.*

<sup>73</sup> UNEP COMMUNICATION

The tools to promote renewable energy are:

1. **Renewable Portfolio Standards (RPS's)** – renewable energy purchase or set-aside requirements;
2. **Economic Tools** – support programs including research and development funding, public benefit programs and tax credits;
3. **Distributed Generation Measures** – programs designed to support distributed forms of renewable energy, such as solar panels and small wind systems that can be installed on a customer's premises, which include:
  - a) net metering programs that allow customers with on-site renewable resources to be charged only for their net use of utility electricity
  - b) streamline interconnection requirements to allow renewable distributed resources to connect with the utility distribution grid; and
  - c) the establishment of fair and non-burdensome standby and backup rates for renewable distributed generation; and
4. **Disclosure and Green Marketing Measures.**

The strategies discussed in this section can be achieved through the legislative process (statutory enactment by a legislative body) or through the regulatory process (e.g. regulatory action by utility or energy regulators), or through a combination of these techniques. Whether a legislative or regulatory approach should be used in any jurisdiction will depend on political considerations (whether elected officials or appointed agency officials are more likely to take action quickly and be favorable to renewable energy), and legal issues (for instance, whether regulatory agencies have a broad grant of jurisdiction which enables them to undertake renewable energy policies without specific new statutory authority). In many cases, both statutory and regulatory action will be necessary, with legislation required in the first instance to establish the requirement or program, and regulation then required to fill in the details and implement the legislation.

## **A. Introduction to Renewable Portfolio Standards**

A renewable portfolio standard ("RPS") is a policy mechanism to increase the amount and/or proportion of renewable energy purchased in a particular jurisdiction, which could be a country, state, province or city. An RPS typically places a requirement upon covered retail electric suppliers to supply a designated portion of their retail load with eligible sources of renewable energy. The RPS requirement typically increases over time until it reaches a specified level. An RPS also often includes a market-based system of tradable renewable energy credits as a compliance mechanism. In the United States, as of November 2004, at least 18 states, as well as Washington, D.C. have adopted an RPS and several other states are considering adoption of this mechanism. Other states

have adopted voluntary renewable energy goals.<sup>74</sup> Federal RPS legislation seeking to adopt a national RPS has been introduced in the United States Congress, passed twice by the United States Senate, but has not yet been enacted.<sup>75</sup>

As is discussed below, RPS requirements and/or similar renewable energy requirements have been adopted internationally, including in the United Kingdom, Austria, Australia, Denmark, Germany, Italy, the Netherlands, Poland and Japan.<sup>76</sup> The European Union has adopted union wide renewable energy requirements,<sup>77</sup> and China is presently considering the adoption of a new renewable energy law that includes strong renewable energy purchase requirements.<sup>78</sup>

Typically, an RPS is developed by legislation, but not always. In the United States, most statewide RPS programs have been enacted by state legislation.<sup>79</sup> However, in Arizona and New York, statewide RPS programs have been developed by administrative action by utility regulators. See Case 03-E-0188, Proceeding on Motion of the Commission Regarding a Retail Renewable Portfolio Standard, Order Regarding Retail Renewable Portfolio Standard, Sept. 24, 2004 (New York)<sup>80</sup>; Ariz. Admin. Code R14-2-1618.<sup>81</sup> In Pennsylvania, utility regulators have adopted RPS-like renewable energy purchase requirements on particular utility service territories on a utility-by-utility basis. See [www.ucsusa.org/documents/State\\_Renewable\\_Energy\\_Standards.pdf](http://www.ucsusa.org/documents/State_Renewable_Energy_Standards.pdf).

In Colorado, voters recently approved a statewide RPS via a ballot initiative. See [www.renewableenergyyes.com](http://www.renewableenergyyes.com); [http://www.dsireusa.org/library/includes/GenericIncentive.cfm?Incentive\\_Code=CO24R&currentpageid=3](http://www.dsireusa.org/library/includes/GenericIncentive.cfm?Incentive_Code=CO24R&currentpageid=3).

Internationally, most national RPS requirements have been adopted legislatively.

Some cities also are undertaking renewable energy initiatives. The City of Toronto in Ontario, Canada, has committed to reduce its carbon dioxide emissions by 20 percent, relative to 1988 levels, by the year 2005. Toronto established an Energy Efficiency Office in 1990 to develop a comprehensive energy efficiency and conservation strategy for the City, as well as encouraging use

<sup>74</sup> As of November 2004, the following are the 18 States in the United States that have adopted some form of RPS or RPS-like requirement: Arizona, California, Colorado, Connecticut, Hawaii, Iowa, Maine, Maryland, Massachusetts, Minnesota, Nevada, New Jersey, New Mexico, New York, Pennsylvania (designated an "alternative energy standard"), Rhode Island, Texas and Wisconsin. Illinois has non-binding renewable energy goals. Additionally, Delaware and Illinois are currently considering adoption of statewide RPSs. Maps and descriptions of RPS requirements in the United States can be found at [http://www.ucsusa.org/documents/State\\_Renewable\\_Energy\\_Standards.pdf](http://www.ucsusa.org/documents/State_Renewable_Energy_Standards.pdf) and at <http://www.dsireusa.org/summarytables>.

<sup>75</sup> The energy bill approved by the U.S. Senate in both 2002 and 2003 included an RPS provision requiring that 10% of U.S. electricity come from renewable energy sources by 2020. See <http://www.awea.org/news/news030801nrps.html>. Text of the 2003 bill available at <http://thomas.loc.gov/cgi-bin/query/F?c108:1::/temp/~c108vFFWpc:e125879>.

<sup>76</sup> Richard Ottinger, Rebecca Williams, Renewable Energy Sources for Development, 32 *Envtl. L.* 331, 250 (Spring 2002), <http://www.law.pace.edu/energy/documents.html>; Haas, Eichhammer et al, How to Promote Renewable Energy Systems Successfully and Effectively, *Energy Policy* 32 (2004) at 833-839, available at <http://www.sciencedirect.com/science/journal/03014215>

<sup>77</sup> Directive 2001/77/EC of the European Parliament and of the Council (Sept. 27, 2001), available at: [http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l\\_283/l\\_28320011027en00330040.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_283/l_28320011027en00330040.pdf).

<sup>78</sup> Under the direction of the National Development and Reform Commission, China's Center for Renewable Energy Development has been given the task of drafting this law, entitled the Renewable Energy Development and Utilization Promotion Law. Renewable Energy Policy in China: Overview, National Renewable Energy Laboratory (April 2004), available at [http://www.nrel.gov/international/china/pdfs/35786\\_policy.pdf](http://www.nrel.gov/international/china/pdfs/35786_policy.pdf).

<sup>79</sup> Fourteen of the eighteen states that have adopted RPSs have done so through legislation. [http://www.ucsusa.org/documents/State\\_Renewable\\_Energy\\_Standards.pdf](http://www.ucsusa.org/documents/State_Renewable_Energy_Standards.pdf) and at <http://www.dsireusa.org/summarytables>.

<sup>80</sup> Available at [http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/85D8CCC6A42DB86F85256F1900533518/\\$File/301.03e0188.RPS.pdf](http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/85D8CCC6A42DB86F85256F1900533518/$File/301.03e0188.RPS.pdf)

<sup>81</sup> Available at [http://www.azsos.gov/public\\_services/Title\\_14/14-02.pdf](http://www.azsos.gov/public_services/Title_14/14-02.pdf)

of green power and renewable energy development. See <http://www.city.toronto.on.ca/energy/> <http://www.city.toronto.on.ca/energy/>. In 2001, San Francisco voters recently approved a \$100 million Solar Bond Initiative to purchase renewable energy for public facilities.<sup>82</sup>

As noted above, in the United States, federal legislation to establish a national RPS has been introduced but has so far failed to be enacted. Until and unless a uniform federal standard is established, the U.S. RPS effort will continue on a state-by-state basis. Renewable energy advocates hope that eventually, state and local efforts will create pressure for the U.S. Congress and the Administration to act, but not in such a way as to preclude stronger state action.

The success of a renewable portfolio standard in promoting renewable energy growth and environmental benefits will depend on several factors. These include: 1) How are RPS eligible resources defined? 2) Is the size of the RPS mandate achievable, yet ambitious enough to provide real incentives for renewable energy growth in the jurisdiction? 3) Is the RPS fairly administered and applied? 4) Is the RPS enforceable? and 5) Does the RPS provide flexible mechanisms for compliance such as renewable energy trading credits? Each of these factors present important drafting issues, which are discussed below.

The RPS program in the United States that has so far been judged to be the most successful is that of Texas. The Texas RPS, enacted in 1999,<sup>83</sup> requires 2000 megawatts ("MW") of new renewable energy capacity by 2009, provides stringent penalties for non-compliance and uses flexible credit trading mechanisms to lower costs. Thanks to Texas' ample wind resources, 915 MW of new wind resources came on line in 2001 in response to the RPS, exceeding the 850 MW interim standard set for 2005 four years early. Wind contracts have been signed for less than 2.5 cents/kWh.<sup>84</sup> Other statewide programs that are often cited with a strong prognosis for success include Arizona, Nevada and New Jersey. Maine's RPS program is often cited as an example of what legislative drafters should avoid: although it technically imposes a 30% renewable energy requirement, the RPS has failed to lead to the development of any new resources because of over-broad eligibility (the definition of eligible resources supply is defined so broadly that it includes fossil-fuel cogeneration), percentage requirements are non-binding and there are no provisions to encourage new renewables.<sup>85</sup>

<sup>82</sup> Sawin, *op cit.* at 39. Text of the bond measure is available at [http://sfpl4.sfpl.org/pdf/files/November6\\_2001.pdf](http://sfpl4.sfpl.org/pdf/files/November6_2001.pdf)

<sup>83</sup> SB 7, <http://capitol.state.tx.us/cgi-bin/flo/>.

<sup>84</sup> Grace, Wisner, Bolinger, *Renewable Portfolio Standards: Background and Analysis for New York State*, (May 2002) at 6, available at <http://www.dps.state.ny.us/rps/rpsbackgroundpaper.pdf>

<sup>85</sup> Grace, Wisner, Bolinger, *supra*, at 3.

## B. Key RPS Drafting Issues

This paragraph provides a brief overview of some of the most important and complex drafting issues for any RPS legislation or regulation.

### 1. How broad a set of energy resources will the RPS cover?

The definition of RPS eligible resources is a crucial initial issue, which requires several sets of critical decisions to be made.

Will the RPS provide incentives only to energy resources that meet a strict definition of renewable energy, or will it cover a range of other energy resources? The answer to this question may depend on whether policy makers are seeking to use the RPS as primarily a tool to provide environmental, public health and global warming benefits, or whether it is primarily a fuel diversification tool. As is discussed below, many jurisdictions carefully define RPS eligible resources in order to ensure that only environmentally beneficial renewable resources are included; others frame their RPS legislation as an “alternative” rather than a “renewable” energy standard, suggesting that the latter goal of fuel diversity is more important.

The issue of inclusion of electricity produced from municipal solid waste incineration plants (MSW) in an RPS program also has been hotly debated in the political arena, with varying results. In the United States, at least eight states, most recently New York, have chosen to exclude MSW incineration from RPS programs, reflecting either a judgment that MSW is not a renewable resources and/or environmental and public health concerns about air pollution emission rates from MSW incineration call for its exclusion.<sup>86</sup> The New York Public Service Commission determined that a comparison of air emission rates from Waste to Energy facilities in New York showed that in the year 2000, the average mercury emission rate from New York’s waste-to-energy plants was six times higher than the average emission rates for those pollutants from New York’s coal burning plants.<sup>87</sup> Other states, including New Jersey, Connecticut, Maine and Nevada, have included MSW incineration, often as part of secondary tier in a tiered approach to eligibility.

In Europe, most countries with RPS-type renewable energy standards focus on “new renewables” (e.g. wind, PV, biomass, biogas, and geothermal). Of the seventeen European countries with RPS or feed-in tariff programs, only two (France and Italy) include MSW incineration within their program. Most also exclude large hydro.<sup>88</sup>

<sup>86</sup> Other states that have excluded MSW incineration from their RPS include California (with an exemption for a single pre-existing MSW facility); Massachusetts, Texas, Wisconsin, New Mexico, Arizona, Rhode Island and Colorado.

<sup>87</sup> New York Public Service Commission, Case 03-E-0188, Order Regarding Retail Renewable Portfolio Standard (Sept. 24, 2004) at 39, available at [http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/85D8CCC6A42DB86F85256F1900533518/\\$File/301.03e0188.RPS.pdf](http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/85D8CCC6A42DB86F85256F1900533518/$File/301.03e0188.RPS.pdf)

<sup>88</sup> Haas, Eichhammer et al, op cit, at Table 2.

## 2. Will all renewable energy resources be eligible for the RPS program?

Many jurisdictions may wish to limit the eligibility of even renewable energy resources in their RPS programs.

First, some jurisdictions have chosen to focus RPS programs on stimulating new renewable resources rather than using the RPS to support existing renewable technologies, which may be mature and not require further support.

Second, some legislators may choose to support particular forms of renewable resources that are indigenous to the jurisdiction. For instance, Arizona and Nevada's RPS programs focus on solar power<sup>89</sup> in recognition of the dry and sunny climate in these states.

Third, if jurisdictions are primarily motivated by environmental goals, they may choose to either exclude from the RPS renewable resources that can have adverse environmental impacts or define eligibility in a way that minimizes these impacts. For instance, hydroelectric projects, although traditionally classified as renewable, can cause a range of serious environmental problems from fish kills to widespread ecosystem destruction through the construction of dams. The Low Impact Hydro Institute is a resource that can be used to provide more environmentally meaningful, site-specific and targeted definitions of "low impact" hydro. See <http://www.lowimpacthydro.org>.

Similarly, biomass projects can have either high or minimal environmental impacts (chiefly air emissions) depending on what type of biomass is used, how it is grown and harvested and how it is utilized (e.g. Brazil produces ethanol from sugar cane fuel crops for use as a non-polluting vehicle fuel). Some jurisdictions have chosen to limit biomass eligibility in RPS programs on this basis.

Finally, a focus on environmental goals sometimes may lead to the inclusion of energy resources that are not traditionally classified as renewable. For instance, several states, such as New York, Connecticut and Maine, include natural-gas powered fuel cells as RPS eligible, both because fuel cells have extremely low air emission rates and because they can be viewed as a bridge to renewable energy since the hydrogen required to produce electricity from fuel cells can be produced from renewable resources as well as natural gas.

## 3. What Are the Considerations re the Use of RPS Program Tiers?

Another approach that policy makers can consider is to establish resource tiers, sometimes known as "technology bands," for RPS eligibility. Under this approach, policy makers create tiers of preferable and less preferable resources and then allow each tier to meet a certain percentage of the RPS mandate. For instance, New Jersey's RPS created a two-tiered standard with two sets of eligible resources. Class I resources include wind, solar, landfill gas and "sustainable" biogas, geothermal, wave, tidal and fuel cells. Class II resources include hydropower up to 30 MW and solid waste incineration that meets certain specified environmental standards. One tier is open to both Class I and Class II resources and remains flat at 2.5 percent of total retail sales. The second tier is open only to Class I resources and begins at 0.5 percent, with gradual incremental increases following.<sup>90</sup>

<sup>89</sup> [http://www.azsos.gov/public\\_services/Title\\_14/14-02.pdf](http://www.azsos.gov/public_services/Title_14/14-02.pdf); <http://www.leg.state.nv.us/nac/nac%2D704.html#NAC704Sec8831>

<sup>90</sup> Rader, *op. cit.* at 36—37; UCS, *State Minimum Electricity Requirements*, *op. cit.*

A potential benefit of this approach is to provide policy makers with the ability to pursue varying goals simultaneously through individual tiers (e.g. environmental benefits and resource diversity). Potential downsides to this approach include that it: creates an additional level of complexity that may make compliance and enforcement more difficult; provides a temptation to solve political problems by creating a niche for non-renewable energy resources in a policy intended to promote renewable energy; and may create consumer confusion by suggesting that there are “shades of green” within the definition of renewable energy. These disadvantages are considerable.

Another approach for legislators who wish to emphasize stimulation of a particular form of renewable energy is to provide multiple REC credits (described below) per kilowatt hour. For example, Arizona offers extra credits for in-state manufacture, in-State installation, and early installation of distributed solar technologies. Nevada’s RPS grants 2.4 credits for off-grid photovoltaics. New Mexico provides 3 credits for solar technologies and 2 credits for biomass, geothermal, landfill gas, and fuel cells.<sup>91</sup>

#### **4. What Are the Considerations re Imported Renewable Energy Eligibility for RPS’s?**

Policy makers must determine whether RPS eligibility will be limited to renewable electricity produced within the jurisdiction or whether eligibility will extend to renewable electricity that is imported from outside the jurisdiction. If renewable projects outside the jurisdiction are RPS eligible, and the RPS program provides for trading of Renewable Energy Credits (“REC”), discussed below, policy makers also must decide whether a delivery requirement should be imposed for out-of-jurisdiction renewable energy or whether RECs may be freely traded without regard to whether electricity is delivered within the jurisdiction.

Policy tradeoffs presented by these questions include the following. Restricting RPS eligibility to renewable projects within a jurisdiction may help ensure that the jobs and other economic benefits of renewables deployment will be realized in-state. It may also help to ensure that renewable electricity will be generated in state and thus displace fossil-fuel generation. On the other hand, regional air quality improvements brought about by allowing out-of-state renewables to be RPS eligible is also likely to benefit in-state air quality, and developing a vigorous regional trading system may also reduce the cost of the RPS program and ultimately help to support a thriving in-state renewable industry.<sup>92</sup>

In the United States, most state RPS programs (e.g. Arizona, Connecticut, Nevada, New Jersey, New York, Texas) impose some form of delivery requirement on imported renewable electricity for RPS eligibility.<sup>93</sup> In the United States, the Commerce Clause of the U.S. Constitution<sup>94</sup> likely limits a state’s ability to prohibit entirely the participation of out-of-state renewable electricity in a state RPS program, but delivery requirements are likely to pass constitutional muster.

There also are great potential environmental and economic benefits to a broader, more seamless regional REC trading program where RECs are freely traded without a delivery requirement. A

<sup>91</sup> Petersik, *op cit.*, at 2.

<sup>92</sup> Rader, *op cit.*, 32-36.

<sup>93</sup> Grace, Wiser, Bolinger *op cit* at 24-25,

<sup>94</sup> Article I, Section 8, Clause 3, [www.usconstitution.net/otherdocs.html](http://www.usconstitution.net/otherdocs.html)

state RPS program that makes out-of-state RECs eligible from a region that is carefully defined to ensure that air quality benefits will inure to the state also will also likely meet Commerce Clause requirements.

## **5. What are the Factors in Defining RPS Goals and Targets?**

Policymakers must also design the end goal and interim targets for an RPS. An RPS typically establishes a required end goal for renewable energy. This can be expressed through establishing a requirement for the amount (MWh) of renewable electricity that must be produced, or a renewable electricity capacity (MW) requirement, or the percentage of electricity sold in a particular jurisdiction that must be renewable. An approach that focuses on the actual amount (MWh) of renewable electricity to be produced will maximize the environmental benefits of RPS legislation. An RPS also typically includes a start date for RPS initial compliance, which is then ramped up through interim targets until the ultimate RPS goal is met. Some RPS programs sunset after a particular date; others have an infinite duration or are subject to discontinuation after a particular date only there is a regulatory determination that the requirement is no long necessary. Finally, many jurisdictions have developed RPS cost caps as a means to limit the cost of RPS programs.<sup>95</sup>

Policy makers need to ensure that the ultimate goal, as well as the target goals, of the RPS is both technically and economically achievable, given available renewable resources, and ambitious enough to produce the desired additional renewable energy demand that will drive commercialization of renewable resources, with ultimately greater availability and lower prices.

## **6. How Can Responsibility be Assigned for Meeting RPS Goals?**

Policymakers must decide with whom responsibility for meeting RPS goals will lie. Spreading RPS obligations among the broadest group of energy providers makes the most sense from the perspective of fairness and fully capturing opportunities for renewable deployment. In the United States, states thus far have assigned RPS requirements to retail electricity providers, chiefly investor-owned utilities (privately owned utilities rather than government owned public power authorities). Public power authorities, which are typically (but not exclusively) wholesale suppliers, have generally not been subject to RPS requirements.

Exempting certain types of load serving entities from the RPS can increase costs for those who are not exempt, make RPS goals harder to meet and create a politically damaging sense of unfairness. On the other hand, there may be political or jurisdictional problems presented by imposing RPS obligations on entities such as municipal utilities.

## **7. How Can RPS Compliance Be Achieved?**

Drafters of RPS legislation or regulations need to determine the methods to assure compliance with RPS obligations. There are three basic options here, that can be combined: 1) retail electricity providers may be required to generate electricity from their own renewable energy facilities; 2) retail electricity providers may be allowed to purchase electricity from renewable energy projects

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<sup>95</sup> Petersik, *op cit.* at 3.



owned by others (the “contract path”); or 3) retail electricity providers may be able to comply with the RPS by purchasing tradable renewable energy credits (“RECs”) from renewable energy facilities separate and apart from electricity purchases.

The first option – requiring covered electricity providers to generate their own electricity – presents numerous problems, including higher costs, locational difficulties (some utilities may have service territories with far fewer renewable resources than others) and related equity issues. Few RPS jurisdictions, if any, have imposed such a requirement.

The second option – verifying compliance using a contract-path accounting system – requires that the renewable attributes of electricity remain bundled with the electricity, meaning that the renewable attributes and the energy cannot be sold separately, so that only the buyer of the financial contract covering the energy may claim the attribute. Supporters of this form of RPS compliance believe that unbundling renewable energy attributes from the electricity and allowing each to be sold separately may create consumer confusion.

The third option – allowing RPS compliance through a tradable REC program – presents numerous benefits, including promoting a competitive renewables market, increasing efficiency, and reducing RPS costs.<sup>96</sup> Under this compliance system, renewable electricity generators receive certification as RPS-eligible generators from the RPS administrator. The administrator then provides the generator with the number of REC tradable credits that correspond to the amount of renewable electricity produced by that facility over a given compliance period. The generator thus has two products: “generic” electricity (meaning “generic” megawatt hours that can be sold to meet electricity needs just like any other form of electricity, with no special renewable attributes) and RECs. The generator can then sell each product separately. Retail electricity sellers are obligated to purchase RECs to meet their RPS compliance obligations. REC prices are determined by the market (although in some instances price caps are imposed).

## **8. What Are the Considerations for RPS Enforcement?**

Enforcement provisions are critically important for RPS legislation or regulation, including the ability to assess penalties on RPS covered electricity sellers who fail to meet their RPS responsibilities, as well as on RPS certified renewable energy generators who violate the applicable rules.<sup>97</sup> Non-monetary penalties can include license revocation.

## **9. What are the Options for RPS Administration?**

Drafters of RPS legislation or regulation will need to clearly assign implementation of the RPS to a regulatory agency. Typically, the agency with central RPS implementation responsibility will be a public utility commission or a state energy office. An independent third-party administrator could also be selected. Selection of the most appropriate agency to oversee and implement the RPS implementation will depend on which agency has the most expertise and interest in, and broadest jurisdiction over, renewable energy. More than one agency may also be designated to implement the RPS jointly. The implementing agency (or agencies) needs authority to undertake

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<sup>96</sup> Rader, *op. cit.*, at 56-57,

<sup>97</sup> Rader, *op. cit.*, at 72-78.

the following RPS implementation tasks: certification of RPS eligible generators; verification of renewable generation by certified facilities; provision of public information; enforcement of the RPS, and possible establishment and management of a “cost cap.”<sup>98</sup>

### III. ECONOMIC TOOLS TO PROMOTE RENEWABLE ENERGY

There are a number of economic support and incentive mechanisms that policy makers can deploy to support renewable energy. These are described below in three categories: 1) government support and investment, commonly called “feed-in tariffs” (including removal of subsidies for polluting fuels and research and development support), that have been used worldwide to promote renewable energy; 2) public benefit programs, used in many parts of the United States, under which electricity users typically pay a small “systems benefit charge” per kilowatt hour of electricity used that is collected by utilities and goes into a public benefit fund to support renewable energy, energy efficiency, and low-income energy efficiency programs; and 3) tax mechanisms that can be used both to support renewable energy both by removing fossil fuel tax subsidies and by providing tax credits to renewable energy manufacturers and/or customers.

#### A. Feed-In Tariffs

Many countries, most prominently Germany, Spain and Denmark, have implemented “feed-in” tariffs to provide government economic support for renewable energy. Italy, Austria and the Netherlands, among others, have also established these tariffs. See <http://www.renewable-energy-policy.info/relec/italy/policy/feed-in.html>; <http://www.renewable-energy-policy.info/relec/austria/policy/feed-in.html>; <http://www.renewable-energy-policy.info/relec/netherlands/policy/feed-in.html>. A feed-in tariff is a provision that allows all eligible generators to receive a fixed and known price for their renewable electricity sales.<sup>99</sup> The costs of these tariffs are covered by increased electric rates that sometimes take the form of regional or national surcharges (similar to those established for public benefit programs, see below); they are sometimes simply embedded in rates. This approach in some sense combines the legal mandate approach of the RPS (described above), with the public benefit fund approach discussed below. Note, however, that the feed-in tariff approach used alone differs in important ways from the RPS approach: under a feed-in tariff, utilities are required to pay a specified price for renewable energy technologies, but the quantity is decided by the market; under an RPS approach, the quantity (or percentage) of renewable energy is set and the price is decided by the market.<sup>100</sup>

Under the German Renewable Energy Sources Acts of 2000 and 2004, grid operators pay a feed-in tariff, which is charged as part of electricity rates. Energy companies are legally required to purchase renewable energy sources and there is a fixed price scheme, with specific per-kilowatt hour payments for each renewable energy technology based on the real costs of generation. (<http://www.renewable-energy-policy.info/relec/germany/policy/feed-in.html>); ([http://www.bmu.de/files/eeg\\_en.pdf](http://www.bmu.de/files/eeg_en.pdf)).<sup>101</sup> Through its feed-in tariffs, initially adopted in 1990, Germany has

<sup>98</sup> Rader at 79-82.

<sup>99</sup> Wisner, Murray, Hamrin, Weston, *International Experience with Public Benefit Funds: A Focus on Renewable Energy and Energy Efficiency* (October 2003), available at <http://www.resource-solutions.org/Library/librarypdfs/IntPolicy-China.PBF.pdf>.

<sup>100</sup> Haas, Eichhammer et al, *op cit*, at 2.

<sup>101</sup> See also Wisner, *op.cit.* n. 46 at 14, 65.

transformed itself in just five years from a country with sparse renewable energy generation into a world renewable energy leader, with twice as much installed wind capacity as the United States and large amounts of PV as well.<sup>102</sup> German wind capacity has increased from 56 MW in 1990 to more than 14,600 MW in 2003, with wind power now meeting more than 6 percent of German's total electricity demand.<sup>103</sup> Similarly, Germany now has 417 MW of PV capacity, second only to Japan.<sup>104</sup>

Likewise, Spain's Royal Decree 2818 of 1998 guarantees the purchase of renewable energy sources at a fixed price or a fixed premium on top of the market price, resulting in a total amount paid in the range of 80 to 90% of the average electricity price. (<http://www.renewable-energy-policy.info/relec/germany/policy/feed-in.html>); ([http://www.appa.es/dch/spanish\\_market.html](http://www.appa.es/dch/spanish_market.html)). Spain generated 5 percent of its electricity in wind in 2003.<sup>105</sup> Spain just required the use of PV in all newly constructed homes.<sup>106</sup>

Since 1993, Denmark has mandated electricity purchases, which require power companies to pay 85% of the retail electricity price for wind energy purchased from privately, owned wind turbines, with a deduction for administrative costs. Feed-in tariffs continue in Denmark, but support has been reduced with the introduction of an RPS-like green certificate market in 2001. ([http://solstice.crest.org/repp\\_pubs/articles/issuebr14/02Denmrk.html](http://solstice.crest.org/repp_pubs/articles/issuebr14/02Denmrk.html)); (<http://www.renewable-energy-policy.info/relec/denmark/policy/feed-in.html>). Denmark now generates more than 20 percent of its electricity from wind.<sup>107</sup>

China's Renewable Energy Law allocates government funding for research and development of renewable energy:

## THE RENEWABLE ENERGY LAW – THE PEOPLE'S REPUBLIC OF CHINA

### Chapter 3 Industry Guidance and Technology Support

**Article 12** - The government lists scientific and technical research in the development and utilization of, and the industrialized development of, renewable energy, as the preferential area for hi-tech development and hi-tech industrial development in the national program, and allocates funding for the scientific and technical research, application demonstration and industrialized development of the development and utilization of renewable energy so as to promote technical advancement in the development and utilization of renewable energy, reduce the production cost of renewable energy products and improve the quality of products.

**Source:** [http://www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

<sup>102</sup> Sawin, *op cit*, at 27.

<sup>103</sup> *Id.* at 29.

<sup>104</sup> *Id.* at 29-30.

<sup>105</sup> *Id.* at 35.

<sup>106</sup> See <http://www.pointcarbon.com/article.php?article ID=5286&categoryID=147>.

<sup>107</sup> Sawin, *op.cit.*, at 35

Uganda has implemented tariffs to encourage renewable energy systems:

### **UGANDA - THE ELECTRICITY ACT, 1999.**

#### **Part VI - Licenses.**

56. (1) The Authority shall designate a person holding a transmission license to be a System Operator and license that person—

- (g) in consultation with the Authority, to publish standardized tariffs based on the avoided cost of the system for sales to the grid of electricity generated by the renewable energy systems of up to a maximum capacity of twenty megawatts;

Source: [www.uedcl.co.ug/newframework.html](http://www.uedcl.co.ug/newframework.html)

KENYA has developed a variety of policies that include:

- Exemption of duty of solar panels.
- Private sector involved in energy production and distribution, by coordinating with state agencies for the sale of PV panels and in wind energy pilot schemes
- Photovoltaic Market Transformation Initiatives of the GEF Programme
- Zero-rated VAT and reduced duty on PV Panels
- Exemption from VAT on the first 200Kwh consumed to ensure that low-income households benefit
- Currently developing Wind Resource Atlas<sup>108</sup>

### **B. Public Benefit Funds (“PBFs”)**

Policy makers may also choose to create public benefit or system benefit charge (“SBC”) programs to support renewable energy. Under this policy, which has been established by legislation and by regulation, electricity customers typically pay a small systems benefit charge per kilowatt hour of electricity used that is collected by utilities and goes into a Public Benefit Fund (PBF) to support public or system benefits, which generally includes renewable energy and energy efficiency. Although the majority of PBF funds in the United States go to support energy efficiency, a substantial portion is also directed to renewable energy. In all, fifteen U.S. states and the District of Columbia have established public benefit fund programs that provide economic support for renewable energy. The Union of Concerned Scientists estimates that these U.S. state public benefit funds collectively now provide about \$291 million per year for renewable energy, building to total of \$4.3. billion by 2017.<sup>109</sup>

<sup>108</sup> UNEP communication

<sup>109</sup> UCS, Table D-1, updated as of July 2004 from Powerful Solutions: Seven Ways to Switch America to Renewable Electricity, Union of Concerned Scientists, available on-line at [http://www.ucsusa.org/clean\\_energy/renewable\\_energy/page.cfm?pageID=135](http://www.ucsusa.org/clean_energy/renewable_energy/page.cfm?pageID=135).

Outside of the United States, PBF programs of this type are used in Ireland and Brazil, and to some extent, in Germany and the Netherlands.<sup>110</sup> The United Kingdom also had a successful PBF program in place from 1990-1998, known as the Non-Fossil Fuel Obligation (“NFFO”).<sup>111</sup> Under the NFFO, renewable generators were able to bid for above-market power purchase agreements in auctions. Electric utilities were mandated to accept power under these contracts, but were reimbursed for their above-market costs through a levy, or wires charge, on electricity rates.<sup>112</sup> The UK’s NFFO program was replaced effective April 1, 2000 with a Renewable Obligations program that utilizes tradable Renewable Obligations Certificates. Power producers who fail to meet their obligation can buy out the obligation at a price of 30 British pounds/MWh (approximately \$.048/kWh), with the proceeds distributed to companies that have met their obligations.<sup>113</sup>

Some EU states, including Germany, already rely at least in part on PBF programs—though they most often are part of a hybrid system used to support the feed-in tariff systems discussed above.<sup>114</sup>

In establishing a public benefit fund program to support renewable energy, policy makers must address several key issues, including:

### 1. What will be the funding level of the PBF program?

In the United States, PBF funds for renewable energy are typically set at up to 0.75% of retail electricity sales on an annual basis.<sup>115</sup> The several PBF programs outside of the U.S. have typically been larger: the UK NFFO was funded at up to 0.9% of retail electricity sales; the surcharge in Italy in 2001 totals about 6% of retail sales; and the surcharge in the Netherlands at 4% of retail sales.<sup>116</sup>

### 2. How long will the PBF program remain in place?

Some programs are established on a permanent basis. Others last five to ten years, and some have the possibility of renewal (e.g. New York’s System Benefits Charge was initially established for three years, has been extended once for five years, with another extension under consideration. <http://www.dps.state.ny.us/sbc.html>). If too limited in duration, or if there is too much uncertainty about duration, PBF programs will not succeed in promoting renewable energy. The German PBF was expressly instituted to extend beyond a single legislative period and has been expanded since its introduction in 1999.<sup>117</sup> Although the future of the program will depend somewhat on the EU directive on harmonization, it appears that it will endure.

<sup>110</sup> Wiser, *supra* note 46, at 17.

<sup>111</sup> [http://www.dti.gov.uk/energy/renewables/policy/nffo\\_obligation.shtml](http://www.dti.gov.uk/energy/renewables/policy/nffo_obligation.shtml)

<sup>112</sup> Wiser, *supra* note 46, at 16.

<sup>113</sup> See <http://www.renewable-energy-policy.info/relec/unitedkingdom/policy/greencertificate.html>

<sup>114</sup> Wiser, *supra* note 46.

<sup>115</sup> Wiser, *supra* note 46, at 7, 29.

<sup>116</sup> *Id.* at 29.

<sup>117</sup> Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, The Ecological Tax Reform: Introduction, Continuation, and Development into an Ecological Fiscal Reforms (“The Ecological Tax Reform”, 3, 5, 9 (Feb. 2004), available at [http://www.bmu.de/files/oekost\\_en.pdf](http://www.bmu.de/files/oekost_en.pdf).

### 3. What kind of renewable energy programs will the PBF program support?

There are an almost limitless variety of programs and incentives for renewable energy that PBFs can support. The text of PBF legislation or regulation needs to be broad enough to allow the program administrator sufficient discretion to determine which will be the most successful. Historically re renewables, PBF-type programs have concentrated on capital grants to renewable energy projects, including rebates, and research, development and demonstration programs.<sup>118</sup> Other more recent and innovative types of programs include fixed production incentives, low-cost consumer loans, favorable financing terms for renewable energy projects, and grants to help commercialize and build the market infrastructure for renewable energy.<sup>119</sup>

Over the period from 1992 to 2002, Japan successfully used a PV rebate program, combined with net metering laws, low-interest loan programs, and education programs to lead to the installation of more than 144,000 residential systems. Installed PV capacity in Japan now totals 887 MW.<sup>120</sup>

### 4. Who will administer the PBF program?

There are basically three options for program administration: 1) utility administration; 2) administration by a government agency; and 3) administration by an independent, non-utility non-governmental entity. In the United States, most renewable energy PBFs are administered by government agencies, with a few by electric utilities and non-profits. In choosing a program administrator, policy makers should be aware that all three approaches have worked should be guided by the political realities and institutional attitudes toward renewable energy in their jurisdiction.

## C. Tax approaches

Tax approaches can be used in several ways to encourage the use of renewable energy.

Both the production and use of renewable energy can be directly encouraged by providing tax credits or deductions (tax credits are reductions from payable taxes, thus of greatest benefit to low income taxpayers; tax deductions are reductions from the amount of income subject to taxation, thus the greater the income, the larger the deduction). In the United States, the most successful federal tax program has been the Renewable Energy Production Tax Credit, which provides eligible renewable project owners with cash payments based on electricity production on a dollars per kilowatt hour basis. Qualifying facilities are eligible for annual incentive payments of 1.5 cents per kilowatt-hour (1993 dollars and indexed for inflation) for the first ten-year period of their operation, subject to the availability of annual appropriations in each Federal fiscal year of operation. Qualifying facilities must use solar, wind, geothermal (with certain restrictions as contained in the rulemaking), or biomass (except for municipal solid waste combustion) generation technologies. Fuel cells using hydrogen derived from eligible biomass facilities also are considered an eligible technology. Congress recently renewed the U.S. production tax credit after a sunset in 2003.<sup>121</sup> However, the short periods of time for which Congress has typically authorized the production tax credit has

<sup>118</sup> *Wiser*, supra note 46, at 37.

<sup>119</sup> *Id.* at 37-38.

<sup>120</sup> *Id.* at 31-32.

<sup>121</sup> [www.awea.org/library/includes/statesearch.cfm?State=US&back=fintab&CurrentPageID=7&Search=TableState](http://www.awea.org/library/includes/statesearch.cfm?State=US&back=fintab&CurrentPageID=7&Search=TableState).

brought uncertainty to the wind industry, and has created “boom and bust” cycles of investment rather than building steady increases.

Many U.S. states also offer tax incentives, including state production incentives, as well as corporate tax incentives to allow corporations to receive credits or deductions against the cost of equipment or installation to promote renewable energy equipment; personal income tax credits or deductions to cover the expense of purchasing and installing renewable energy equipment; property tax provisions that provide that the added value of renewable energy systems are not included in the valuation of property for taxation purposes; and exemptions from sales tax for renewable energy equipment. A table of state tax incentives for renewable energy can be found on the website of Database for State Incentives for Renewable Energy. See <http://www.dsireusa.org/summarytables/financial.cfm?&CurrentPageID=7>

India has used a combination of investment tax credits, financing assistance and accelerated depreciation to spur a boom in renewable energy. India is now the world’s fifth-largest producer of wind power.<sup>122</sup>

China’s Renewable Energy Law creates incentives through tax benefits:

## THE RENEWABLE ENERGY LAW – THE PEOPLE’S REPUBLIC OF CHINA

### Chapter 6 - Economic Incentives and supervisory measures

**Article 26** - The Government grants tax benefits to projects listed in the renewable energy industrial development guidance catalogue, and specific methods are to be prepared by the State Council.

**Source:** [http://www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

Conversely polluting forms of electricity generation can be taxed in order to make the polluters disgorge the externality costs of the damage to society from their pollution. By raising the price of highly pollution forms of electric generation, pollution taxes allow market forces to encourage the adoption of renewable resources. Pollution taxes (including carbon emission taxes), are assessed in Brazil, Denmark, Finland, Italy, Latvia/Lithuania, Sweden and the United Kingdom,<sup>123</sup> In the United Kingdom, for example, the sales of electricity, coal, natural gas and liquefied petroleum gas are taxed; renewable energy is exempt. (<http://www.renewable-energy-policy.info/relec/unitedkingdom/policy/fiscal.html>). Similarly, in Sweden, households and the service sector are subject to an energy tax, but exemptions are provided for small-scaled electricity production based on renewable energy sources. (<http://www.renewable-energy-policy.info/relec/sweden/policy/fiscal.html>).

In Germany, electricity, motor fuels, and heating fuels are taxed, with the goal of supporting social security to boost the economy and lower unemployment while reducing energy consumption. Hoerner, J. Andrew and Benoit Bosquet, *Environmental Tax Reform: The European Experience*,

<sup>122</sup> Sawin, *op cit* at 38.

<sup>123</sup> Ottinger, Williams, *op. cit.*, at 347 and fns. 62-63.

3, 17, 41, Center for Sustainable Economy (Feb. 2001), available at <http://www.rprogress.org/programs/sustainableeconomy/eurosurvey.pdf> Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, *The Ecological Tax Reform: Introduction, Continuation, and Development into an Ecological Fiscal Reforms*, 2 (Feb. 2004), available at [http://www.bmu.de/files/oekost\\_en.pdf](http://www.bmu.de/files/oekost_en.pdf). Under the German program, the level of taxation varies by energy source—for example, in 2003 electricity was taxed at 2.05% while diesel fuel and petrol were taxed at 15.34%. Federal Ministry for the Environment, 2. Of all the revenue generated by the German ecological tax, approximately 13% goes towards environmental programs or tax reductions to benefit the environment. **The Ecological Tax Reform** at 3, 16, ([http://www.bmu.de/files/oekost\\_en.pdf](http://www.bmu.de/files/oekost_en.pdf)). Much of this funding goes toward tax breaks for environmentally friendly programs, such as a reduced tax rate for public rail systems and an exemption for efficient combined heat power generating systems. Federal Ministry for the Environment, 11-15. Some of the revenue is used to actively promote renewables. For example, grants are also provided for solar, photovoltaic, and biomass units in schools and for consultation with homeowners to reduce heat consumption. (<http://www.bafa.de/1/en/tasks/energy.html>).

In 1992, the European Commission's proposal for a European Union-wide energy tax failed, largely due to international trade concerns given the lack of any such tax in the United States. Richardson, Benjamin J. and Kiri L. Chanwai, *The UK's Climate Change Levy: Is it Working?*, 15 *J. Envtl L.* 39, 40 (2003).<sup>124</sup> However, after ten years of negotiations, EU environmental ministers approved a directive to harmonize energy taxation that became effective in January 2004. Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety, *The Ecological Tax Reform: Introduction, Continuation, and Development into an Ecological Fiscal Reforms*, 4 (Feb. 2004), available at [http://www.bmu.de/files/oekost\\_en.pdf](http://www.bmu.de/files/oekost_en.pdf). The directive applies to all accession countries, with transition periods. Id. As a result, many EU countries will implement new or higher energy taxes.

#### IV. RENEWABLE DISTRIBUTED ENERGY GENERATION

Particular attention is needed on the question of how to promote on site renewable generation, often referred to as distributed generation. Distributed renewable generation has many benefits: it can be deployed in urban areas, where air pollution problems are often severe and where larger renewable energy projects may be difficult to site; it can be installed on a customer's premises and used to reduce customers' electricity bills through net metering mechanisms, as is discussed below; and it can be deployed in targeted areas to delay or avoid expensive enhancements to utility transmission and distribution system. Outlined below are three tools that policymakers can use to promote renewable distribution: 1) net metering policies that allow customers who install renewable energy projects on-site to pay utility bills only for the net electricity used on their premises; 2) policies to ensure a swift and straightforward process for interconnecting renewable energy projects to the utility electric grid; and 3) policies to ensure that the backup rates charged by utilities to customers with on-site renewable distributed generation are fair and appropriate.

A major barrier to adoption of renewable distributed generation is the issue of utility regulatory financial incentives: in many states, utilities' revenues are determined by the amount of electricity that

<sup>124</sup> <http://jel.oupjournals.org/cgi/reprint/15/1/39>



they distribute. Hence, customer investments in energy efficiency and distributed generation cause utility revenues to drop. This important source of utility resistance to distributed generation can be solved by adopting electric revenue adjustment mechanisms, which make utilities indifferent to the amount of electricity that they sell. An effective adjustment mechanism is a “revenue cap” by which regulatory commissions determine the appropriate revenue needs of the utility and assure recovery of fixed costs without regard to the volume of electricity sales or deliveries.<sup>125</sup>

## A. Net Metering

Net metering allows consumers who have on-site renewable generation units to reduce their utility electricity bills by the amount of renewable electricity that they produce on site. Net metering typically allows for the flow of electricity both to and from the customer through a single meter that moves backward when the on-site system is producing electricity. In effect, the customer is using the generation from its on-site system to offset the cost of the electricity that they would otherwise have purchased from the utility at the utility’s retail electricity rate.<sup>126</sup>

In the United States, thirty-nine states, as well as the District of Columbia, have some form of net metering program.<sup>127</sup> In Europe net metering laws have been adopted in Belgium, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=995>; the Czech Republic, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=1368>; Denmark, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=838>; Greece, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=1601>; Spain, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=316>; Italy, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=1081>; and Switzerland <http://www.nrel.gov/ncpv/documents/switzerland.html> have established net metering policies. In Asia, Korea, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=1293>; Japan<sup>128</sup> [http://www.nrel.gov/ncpv/thin\\_film/pdfs/world\\_pv\\_status\\_rpt\\_2003.pdf](http://www.nrel.gov/ncpv/thin_film/pdfs/world_pv_status_rpt_2003.pdf); and Thailand <http://netmeter.org/> also have adopted net metering laws. As a result of Japan’s net metering law, between April 2001 and March 2002 alone, Japanese electric power companies bought more than 124 GWh of surplus PV power at retail rates.<sup>129</sup>

While use of net metering policies is widespread, legislators and regulators should be aware that getting the details right is very important to ensure that net metering legislation is successful in promoting renewable energy. Net metering legislation is often met with strong opposition from utilities, who fear that the growth of distributed generation will lead to loss of sales and revenues (for those utilities whose revenues are tied to sales. The following are some of the key questions

<sup>125</sup> In California, for instance, the legislature enacted Assembly Bill 29x in 2001, which established Public Utility Code Section 739.10, providing that the Public Utility Commission “must ensure that errors in estimates of demand elasticity or sales do not result in material over or under collections of the electrical corporation.”

<sup>126</sup> [www.dsireusa.org/glossary](http://www.dsireusa.org/glossary)

<sup>127</sup> UCS Summary of State “Net Metering” Programs (as of September 2004), updated from Powerful Solutions: Seven Ways to Switch America to Renewable Electricity (Jan. 1999), available online at [http://www.dsireusa.org/library/docs/NetMetering\\_Map.doc](http://www.dsireusa.org/library/docs/NetMetering_Map.doc) Accessed October 28, 2004

<sup>128</sup> Arnulf Jager-Waldau, PV Status Report 2003, European Commission, DG JRC, Institute for Environment and Sustainability, Renewable Energies Unit, September, 2003, available at [http://www.nrel.gov/ncpv/thin\\_film/pdfs/world\\_pv\\_status\\_rpt\\_2003.pdf](http://www.nrel.gov/ncpv/thin_film/pdfs/world_pv_status_rpt_2003.pdf).

<sup>129</sup> Sawin, *op cit*, at 32.

that policy makers must address: 1) Which forms of renewable energy units will be eligible for net metering? In some jurisdictions (e.g. Belgium, <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=995>; Korea <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=1293>; Delaware and Texas [http://www.eere.energy.gov/greenpower/docs/metering\\_0604.doc](http://www.eere.energy.gov/greenpower/docs/metering_0604.doc)), all renewables are eligible. In others (e.g. Denmark <http://library.iea.org/dbtw-wpd/textbase/pamsdb/detail.aspx?mode=re&id=838> and Arizona [http://www.eere.energy.gov/greenpower/docs/metering\\_0604.doc](http://www.eere.energy.gov/greenpower/docs/metering_0604.doc)), only solar photovoltaics are eligible; 2) which customer classes are eligible? In some jurisdictions (e.g. Connecticut and Hawaii Id.), net metering is limited to residential, small commercial and/or agricultural customers; 3) Have policy makers prohibited utilities from imposing high backup rates or interconnection fees on net metering customers? As is discussed in the sections below, this is a crucial issue.

## B. Interconnection

For renewable distributed generation to flourish, customers must be able to interconnect their on-site renewable energy systems to the utility electric grid with ease. In many areas, interconnection standards that vary from utility to utility and many utilities make interconnection to the grid an unnecessary cumbersome and expensive process. Experts identify inappropriate interconnection standards as a major barrier to distributed generation.<sup>130</sup> This is an important issue both for net metered systems, discussed above, and other forms of distributed generation.

It is crucial to establish uniform state, regional or national interconnection standards that ensure electric safety and reliability but that are not overly onerous, expensive, or time consuming to meet. An excellent alternative to utility-specific requirements is to include appropriate safety and power quality protection through manufacturing specifications, with requirements based on consensus-based technical standards developed by independent standards organizations such as in the U.S., the Institute of Electrical and Electronics Engineers (IEEE), Underwriters Laboratories (UL), and the National Fire Protection Association, which publishes the National Electric Code (NEC).<sup>131</sup>

With the growing awareness of the importance of protective yet fair interconnection standards, many states are attempting to develop uniform interconnection standards that address these issues. At least six states –California, Delaware, Hawaii, New York, Ohio, Texas and Wisconsin have completed distributed generation interconnection rules, and many others are in the process of doing so.<sup>132</sup> At the U.S. federal level, the Federal Energy Regulatory Commission (FERC) has instituted a proceeding aimed at standardizing the interconnection process for interconnections subject to FERC jurisdiction. In the U.S., the National Association of Regulatory Utility Commissioners has developed model interconnection procedures for small distributed generation resources,<sup>133</sup> as has the Interstate Renewable Energy Council.<sup>134</sup> This is happening internationally as well. As part of its program

<sup>130</sup> Alderfer, Eldridge, Starrs, *Making Connections: Case Studies of Interconnection Barriers and their Impact on Distributed Power Projects*, prepared for DOE's National Renewable Energy Laboratory (July 2000) at 6-7,35, available at <http://www.nrel.gov/docs/fy00osti/28053.pdf>; Larsen, Cook, *Connecting to the Grid: A Guide to Distributed Generation Interconnection Issues*, Interstate Renewable Energy Council ("IREC") (Fourth Edition, 2004) at 1, available at <http://www.irecusa.org/pdf/guide.pdf>.

<sup>131</sup> Alderfer, Eldridge, Starrs, at 87.

<sup>132</sup> Larsen, Cook, at 2-3.

<sup>133</sup> *Model Interconnection Procedures and Agreement of Small Distributed Generation Resources*, NARUC, October 2003.

<sup>134</sup> [http://www.irecusa.org/connect/model\\_interconnection\\_rule.pdf](http://www.irecusa.org/connect/model_interconnection_rule.pdf).

to promote the growth of renewable energy, Switzerland has developed national interconnection standards. Portugal has also promulgated laws designed to facilitate interconnection of distributed power sources (including renewables), though apparently without advancing a technical standard, Decree-Law no.68/2002 of March 25, Ministry of Economy. (<http://www.jrc.es/cfapp/eneriure/Tables/PRTtables.pdf>) Similarly, Germany has passed legislation mandating that renewable power producers receive priority in connection to the grid, including requirements that studies necessary for interconnection of new sources be carried out within eight weeks, (<http://www.elaw.org/resources/text.asp?id=2594>).

### C. Utility Back-Up Tariffs

Regulatory ratemaking can also create barriers to renewable distributed generation. Utilities often assess excessive supplemental, back up and standby charges (often referred to collectively as “back-up tariffs”) for customers utilizing on-site generation that require backup electricity from the utility grid at certain times. “Supplemental Charges” refer to charges for service for loads that regularly require more power than that supplied by the customer’s distributed generation. “Back-up Rates” refer to charges for occasional foreseeable requirements for additional utility power, such as during scheduled outages and maintenance of distributed power equipment. “Standby Charges” refer to charges for emergency supply necessary during unscheduled outage of distributed generation. Overly high back-up tariffs – which are sometimes assessed at prices near or even exceeding the prices previously charged for full electrical service – can discourage distributed power, outweighing the customer and electric system benefits from distributed generation.<sup>135</sup>

In the context of net-metered systems, some states have banned utilities from imposing backup charges. See, e.g., N.Y. Pub. Serv. Law § 66-j(3)(b)<sup>136</sup> Another solution is for jurisdictions to develop uniform back-up rates that properly balance the economic, environmental and system reliability benefits of distributed generation with the utilities’ economic needs.

## V. ENVIRONMENTAL DISCLOSURE AND GREEN MARKETING

Legislators and regulators can create policies that will support and encourage voluntary green marketing programs to provide additional support for renewable energy. These include: 1) environmental disclosure programs that require electric utilities to provide customers with information about the sources and environmental characteristics of the electricity that they provide; and 2) green marketing measures ensuring that customers have the access to retail green marketing choices which provide customers with the ability to purchase some or all of their electricity from renewable resources.

### A. Environmental Disclosure

Environmental disclosure programs provide or direct utilities to provide their customers with information about the energy they are supplying. Disclosure programs seek to help consumers

<sup>135</sup> Alderfer, Eldridge, Starrs at 21, 36.

<sup>136</sup> <http://assembly.state.ny.us/leg/?cl=95&a=5>

make informed decisions about the energy and supplier they choose. This information often includes fuel mix percentages and emissions statistics. Fuel mix information, for example, can be presented as a pie chart on customers' monthly bills. Disclosure may be viewed as a policy tool to help educate customers about the environmental impacts of electricity and thereby possibly to prepare markets in advance of retail competition, (<http://www.dsireusa.org/glossary/glossary.cfm?&CurrentPageID=8>).

Environmental disclosure programs operate internationally. In 2003, the European Parliament adopted a directive requiring that energy suppliers disclose fuel mix data and a reference to a publicly available source of information on the environmental impact of the particular fuel mix with their bills and promotional materials, (<http://www.electricitylabels.com/directive.html>); Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003, available at ([http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l\\_176/l\\_17620030715en00370055.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2003/l_176/l_17620030715en00370055.pdf)).

## B. Green Choice Programs

Traditionally, electric utility companies throughout the world have operated as monopolies. But since 1997, 18 U.S. states have restructured, opening their electricity markets to competition, giving outside companies, including suppliers that draw all or a significant portion of their power from renewable resources, the right to compete for customers.<sup>137</sup> Restructuring also has occurred in other countries, with the United Kingdom a prominent example, See generally (<http://www.eia.doe.gov/emeu/pgem/electric/ch2.html>). In Sweden, consumers are able to select from over 50 companies offering green power options, Bird, Lori, et al. National Renewable Energy Laboratory, Green Power Marketing Abroad: Recent Experiences and Trends, 37 (May 2002, <http://www.eere.energy.gov/greenpower/resources/pdfs/32155.pdf>). About six percent of Swedish residential customers purchase green energy, (<http://www.thegreenguide.com/reports/productprint.mhtml?id=60>), while nonresidential customers constitute a significant proportion of green power purchasing, Bird, Lori, et al., 37, (<http://www.eere.energy.gov/greenpower/resources/pdfs/32155.pdf>). While retail competition has not attracted a substantial number of residential customers in many U.S. states, retail competition does at least provide the opportunities for marketers of renewable energy to compete with traditional fossil fuel electricity producers.

Under restructuring in consumers have the potential to be confused about which energy service companies are offering renewable energy options. Certification programs have arisen to address this problem. Certification programs, most notably the Green-e certification program, assess green power offerings to ensure e that they are indeed utilizing the type and amount of renewable energy as advertised. The Green-e program establishes technical criteria that electricity products must meet to be eligible for Green-e certification, (<http://www.green-e.org>). Additionally, the Power Scorecard™ website, established by a number of environmental organizations and led by the Pace Law School's Energy Project, provides very helpful and detailed ratings of the environmental impacts of electricity products offered in several states with retail electric competition, including New Jersey, Pennsylvania and Texas, (<http://www.powerscorecard.org/ratings.cfm>). Sweden has three certification programs for green power, Bird, Lori, et al., 39 <http://www.eere.energy>.

<sup>137</sup> <http://www.nrdc.org/air/energy/gcleanen.asp>.

*gov/greenpower/resources/pdfs/32155.pdf*. The most popular, run by the Swedish Society for Nature Conservation, certifies wind, solar, biofuels, and hydro resources and has certified over 50 companies, *Id.*; see also <http://www.snf.se/bmv/english-more.cfm>.

### C. Green Pricing Programs

In some jurisdictions, instead of choosing a specific electricity supplier other than the traditional utility, consumers can support renewable power by paying a small premium on their electric bills. This practice is called green pricing. More than 80 U.S. utilities have either implemented or announced plans to offer a green pricing option.<sup>138</sup> In addition to its Green-e certification, the Center for Resource Solutions runs a green pricing accreditation program to set standards for green pricing and ensure that utility companies are delivering on their promises to invest in renewable resources, *Id.* In Japan, all energy providers give customers the option to contribute to a green power fund for the development of wind and solar systems, and some companies will match the contribution,<sup>139</sup> Bird, Lori, et al., 30, <http://www.eere.energy.gov/greenpower/resources/pdfs/32155.pdf>.

## VI. RENEWABLE FUEL

Although the focus of this introductory chapter has been renewable electricity, many countries also are working to promote renewable fuels in an effort to reduce the substantial adverse environmental impacts of vehicle fossil fuels, which, like fossil-fueled power plants, are huge contributors to smog and global warming pollution.

Clean-energy vehicles offer the benefits of reduced emissions of CO<sub>2</sub> and other exhaust gases. These “green vehicles” either use traditional fuels more efficiently such as hybrid cars running on both oil or diesel fuel and electricity – or use entirely energy sources other than petroleum, including electricity, methanol, hydrogen, or solar energy. While some vehicles are already in operation, further development for others requires solutions to problems including limited traveling ranges and high initial and/or operating costs.

Hybrid cars using petroleum fuels and electricity are commercially available today and a fast-growing segment of the vehicle market. They get anywhere from 35-65 mpg depending on their technology and weight. A number of cities throughout the world are using buses propelled by liquid natural gas or propane, fuels that are less polluting and release much lower carbon dioxide emissions than petroleum fueled vehicles.

Fuel cell-powered vehicles are electric vehicles equipped with fuel cells that function like batteries. The process involves the conversion of hydrogen gas into negatively charged electrons and positively charged hydrogen ions. The hydrogen ions then combine with oxygen and the electrons to produce water. Fuel-cell vehicles fueled by hydrogen are pollution-free and, unlike batteries, fuel cells never run out. These vehicles still are generally in the developmental stage, A U.S. Department of Energy contract with Ford resulted in the development of the first fuel-cell power system with enough power to propel a lightweight mid-sized car. However, several cities throughout the world are using fuel

<sup>138</sup> <http://www.resource-solutions.org/greenpricing.htm>.

<sup>139</sup> <http://www.eere.energy.gov/greenpower/resources/pdfs/32155.pdf>.

cell and a number of countries have experimental hybrid passenger cars.

The solar car is another type of electric vehicle. It uses solar cells to generate electricity to drive its motor. The process involves the collection of solar energy from solar panels. The solar panels are made up of solar cells that are small electricity-generating devices. The sunlight hits the solar cell causing electrons to “jump” from one state to another. The electric connector in the solar cell captures these electrons and uses them as electricity. While there has been much success in manufacturing solar cars for international solar-car races, some solar cars also have been developed specifically for use on public roads. However, solar cells do not yet offer adequate performance for widespread use as energy efficient automobiles because they are expensive and occupy substantial space. Nevertheless, solar cars are extremely attractive because they use the cleanest source of energy available—the sun. It is therefore hoped that the performance of solar cells will be significantly improved in future. These clean-energy vehicles offer the potential for reduced harmful emissions, increased fuel efficiency, and less dependence on petroleum. However, low cost components and high volume manufacturing methods are necessary for these systems to be effective. Effective incentives can increase competition, which will, in turn, speed up the development rate of energy efficient vehicles.

The following are examples of countries and regions that are undertaking programs to further alternative or cleaner fuels.

## A. United States

The United States under the Bush administration has focused on long-term plans to develop and produce hydrogen fueled vehicles at some point in the future, with little focus on fuel efficiency or other forms of cleaner fuels that are more readily available. Innovative near-term programs to move to cleaner-fueled vehicles have been spearheaded instead by the states, led by California, which has statutory authority under the Clean Air Act to develop its own end of pipe car emissions standards in order to address its own unique air quality problems, if California first obtains a waiver from EPA. 42 U.S.C. § 7543(b).<sup>140</sup> Several states, including New York, Massachusetts and Vermont, have adopted the California clean cars program, under a provision of the federal Clean Air Act that allows other states to opt into the California programs.<sup>141</sup> Most recently, California has become the first governmental entity in the world to establish end-of-pipe global warming standards for cars.<sup>142</sup>

The federal government in the United States also has established the National Low Emission Vehicle Program, (<http://www.epa.gov/otaq/lev-nlev.html>), through which

nine northeastern states and 23 manufacturers have opted into this voluntary clean car program and the opt-ins have met the criteria set forth by EPA in its National LEV regulations. The goal of the program is to ensure that light-duty vehicles and light light-duty trucks cleaner than those available today will be produced and sold in the coming years. It also has adopted a Clean Bus Program designed to promote utilization of busses driven by alternative fuels.<sup>143</sup>

<sup>140</sup> <http://uscode.house.gov/download/pls/42C85.txt>

<sup>141</sup> 42 U.S.C. § 7505, <http://uscode.house.gov/download/pls/42C85.txt>

<sup>142</sup> 2002 Cal. Assembly Bill No. 1493, <http://www.arb.ca.gov/cc/ab1493.pdf>

<sup>143</sup> <http://www.epa.gov/cleanschoolbus/>

Additionally, the United States Department of Energy has established a Clean Cities Program, (<http://www.eere.energy.gov/cleancities/>), which seeks to advance the nation's economic, environmental, and energy security by supporting local decisions to adopt practices that contribute to the reduction of petroleum consumption. Clean Cities carries out this mission through a network of more than 80 volunteer coalitions, which develop public/private partnerships to promote alternative fuels and vehicles, fuel blends, fuel economy, hybrid vehicles, and idle reduction.

## B. Canada

Canada established its Canadian Natural Gas Vehicle Research and Development Fund in 1986 to remove impediments to the development of the Canadian natural gas vehicle market. Between 1986 and 1998 the Fund initiated over 100 projects at a cost of more than \$1.5 million in research and development to which the members contributed about \$8 million to the common pool. ([http://cleanenergy.gc.ca/canada/initiative\\_e.asp?item=400](http://cleanenergy.gc.ca/canada/initiative_e.asp?item=400))

## C. India: Hydrogen Energy Project

India's hydrogen energy program is part of what India's Ministry of Nonconventional Energy Sources ("MNES") calls its New Technologies Initiative. This Initiative funds research in hydrogen energy, geothermal energy, ocean energy including tidal and wave energy, and fuel cells. In the hydrogen sector, the strategy has been to help laboratories acquire expertise on the production, storage, and utilization of hydrogen as an alternative fuel. A major outcome of this program has been a hydrogen-powered motorbike that uses a novel metallic hydride hydrogen storage system that could also be used in cars. The MNES is also supporting research to find new and potentially inexpensive ways to produce hydrogen. (<http://www.atip.org/public/atip.reports.98/atip98.060r.html>).

## D. Philippines: Natural Gas Vehicle Program

The Philippines government has issued Executive Order. 290 implementing a Natural Gas Vehicle Program for Public Transport. The goals of this program are to enhance energy supply security in the transport sector through fuel diversification using indigenous natural gas; and to use compressed natural gas (CNG) as a clean alternative fuel for transport. (<http://www.doe.gov.ph/ngv/photos/executive%20order/eo%20290.pdf>).

## E. Europe

In Europe, the CIVITAS Initiative addresses the challenge to achieve a radical change in urban transport through the combination of technology and policy based instruments and measures. (<http://www.civitas-initiative.org/civitas/home.cfm>). Eight measures have been identified as the basic building blocks of a strategy:

1. Energy-efficient, cost-effective and clean public and/or private vehicle fleets and the necessary fixed infrastructure (e.g. fuelling) can be considered as a core measure that is to be combined with a wider package of measures in order to cover both the transport demand and the supply side

2. Demand management strategies based upon access restrictions to the inner city areas and other sensitive zones, permitting access only to clean and energy efficient vehicles and to cycling and walking.
3. Demand management and revenue raising strategies based upon integrated pricing strategies by means of area wide or city wide pricing schemes.
4. Stimulation of collective passenger transport and its quality of service by means of introducing clean and energy efficient vehicle fleets; non-conventional transport systems; innovative organizational, financing and management schemes, improved accessibility, security and safety; and integration with walking, cycling and other modes.
5. New forms of vehicle use and/or ownership and lifestyle by means of introducing new mobility services based upon clean and energy efficient vehicle fleets; car free housing; shared use/ownership of cars, motorized two-wheelers and bicycles.
6. New concepts for the distribution of goods by means of introducing innovative logistics services using clean and energy efficient vehicle fleets dedicated infrastructure and information services.
7. Innovative measures for managing mobility demand by means of introducing new approaches to integrated planning; promoting green transport plans, safe walking and cycling, mobility marketing and awareness.
8. Integration of transport management systems, including related information systems, and passenger services, such as those for intermodal travel information, transport pricing and payment, vehicle location and guidance and traffic management.

Pilot cities participating in CIVITAS implement a policy mix taking on board packages of several measures, with leading cities implementing large-scale schemes and follower cities implementing more restricted schemes.

## F. Brazil

Brazil's 27-year-old ethanol program displaces about 220,000 barrels of oil daily, and has saved Brazil more than \$52 billion in avoided fuel imports, many times the total investment in ethanol production.<sup>144</sup> Overall, energy policy in Brazil over the last 25 years has focused on reducing the country's dependence on foreign energy supplies and stimulating the development of domestic energy resources.<sup>145</sup> Fuel substitution and conservation efforts, particularly the ethanol fuel program, have limited growth in petroleum products over the past quarter century. Because of Brazil's high percentage of energy derived from hydroelectricity and biomass, renewable energy resources accounted for about 56 percent of total energy supply in 2000.<sup>146</sup>

<sup>144</sup> Sawin, *op. cit.* at 13

<sup>145</sup> Geller, Schaeffer, Szklo, Tolmasquim, *Policies for Advancing Energy Efficiency and Renewable Energy Use in Brazil*, 32 *Energy Policy* 1437-1450 (2004) at 1439.

<sup>146</sup> *Id.* at 1438. See also Ottinger, *op cit* at 361-62.



## VII. CONCLUSION

There are many effective legislative and regulatory strategies to encourage the development of renewable energy that have proven track records of success in both developed and developing countries. Policy makers should determine which of the policy tools outline above will be most productive, given their region's natural resources, economics and political climate. Time and effort put into development of the necessary policies to encourage renewable energy will be rewarded by substantial environmental and economic benefits.

## CHAPTER B. HYDROELECTRIC POWER

Phillip Musegaas and Julia Rinne

### I. INTRODUCTION

The use of hydropower as a renewable source of energy generation enjoys several major benefits. First, it is a relatively pollution free form of energy production. Second, the operational costs are low, since no fuel is required and the technology typically used is relatively simple. Third, the construction of a hydropower facility may, in many cases, be the most beneficial method of providing electricity where the natural environment favors the use of hydropower, such as in Central and South America, Southeast Asia and parts of Sub-Saharan Africa. However, the construction and use of large hydropower projects in developing countries has often resulted in significant, long term detrimental effects on the environment, and the indigenous populations of areas affected by the dam's presence.

The construction of smaller hydroelectric projects generally results in less of an environmental impact than large dams, due to the fact that they rely on the diversion of a certain percentage of the river's entire flow into a catchment basin, rather than the blockage of the entire waterway. The use of small hydro generating facilities is often appropriate for use in rural regions that have nearby rivers and remain unconnected from the country's power grid, due either to a general lack of infrastructure or the remoteness of the region, and the difficulty of transmitting power from a larger facility. The construction time is much less for smaller hydro facilities and the permitting approval requirements may be simpler, allowing them to be less expensive, and more closely tailored to the energy needs of the local community. However, there is a dearth of empirical knowledge regarding the possible cumulative effects of multiple small hydro projects within a discrete ecosystem. The support of large dam projects by international development agencies and lending institutions during the 1970s and Eighties has resulted in a much closer examination of their impacts on the environment.

In November of 2000, the World Commission on Dams published its findings from a two year global review of the contributions and impacts of the development of dams, entitled "Dams and Development: A New Framework for Decision-Making."<sup>147</sup> The Report outlines the effectiveness of

<sup>147</sup> WORLD COMMISSION ON DAMS, DAMS AND DEVELOPMENT: A NEW FRAMEWORK FOR DECISION-MAKING (2002), available at <http://www.dams.org>.

large dams and proffers guidelines and standards for the planning and operation of dams. The Commission's findings include the conclusion that dams built to deliver hydropower tend to perform close to but below targets for power generation and demonstrate variable economic performance. The Report also includes extensive findings on the ecological impacts of dams and the viability of some mitigation techniques. Mitigation techniques examined include physically rescuing animals from areas to be flooded, environmental flow releases, fish passes, and managed floods. Offered recommendations for dam development are based on a "rights and risk approach" which focuses on the idea that those adversely affected should participate in the planning process and receive a share in project benefits. The Report delineates seven strategic priorities for decision-making throughout the development process: gaining public acceptance, comprehensive options assessment, addressing existing dams, sustaining rivers and livelihoods, recognizing entitlements and sharing benefits, ensuring compliance, and sharing rivers for peace, development, and security.

## II. ENVIRONMENTAL IMPACTS OF AND LEGISLATIVE RESPONSES

The following are some of the primary environmental impacts that have traditionally resulted from the construction of large dams.

### A. How can legislation address habitat loss caused by inundation of the reservoir?

The loss of habitat upstream of the impoundment is often caused by the flooding of the river basin and the resulting reservoir. This has resulted in deleterious effects on biodiversity, particularly when a project is built in a rainforest riverine ecosystem, where the biodiversity is very high.

Attempts to offset these environmental impacts on biodiversity include legal requirements that forests flooded by reservoirs be replanted elsewhere.

#### **India, National Forest Policy, Resolution No. 3A/86-FP, Section. 4.4.1**

Projects that involve the construction of dams include funds in the investment budget for regeneration or compensatory afforestation. <http://envfor.nic.in:80/legis/forest/forest1.html>

#### **Philippines, Presidential Decree No. 1515, Section. 2(5), (7), (8)**

Ministry of Energy shall prescribe, adopt, and issue rules regarding the development and conservation of existing vegetative cover and the afforestation and reforestation in "critically denuded watershed areas." <http://faolex.fao.org/docs/html/phi23048.html>

#### **Bangladesh, Water and Power Development Boards Order, Article. 18(b)(2)**

The Water Board may direct the owner of any public land to undertake conservation of forests and re-afforestation. <http://faolex.fao.org/docs/pdf/bgd19943.pdf>

General provisions are included in legislation to allow the entity in charge of development to promulgate regulations regarding the protection of wildlife and habitat.

**Canada, Province of Alberta, Hydro and Electric Energy Act, 5(1)(i)**

The Board may make regulations regarding the protection of wildlife. <http://faolex.fao.org/docs/html/al40446.html>

**United States, Federal Power Act, 16 U.S.C. § 803(a)(1)**

Specifications are to be developed regarding the “adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat).” <http://www4.law.cornell.edu/uscode/16/ch12.html>

**Uzbekistan, Water and Water Use, Article. 12**

Siting, design, and construction of water projects are conditioned upon ensuring the compensation of damage to fish stocks, other aquatic animals, flora and the conditions for their preservation, rehabilitation and reproduction. <http://faolex.fao.org/docs/pdf/uzb5255.pdf>

**Republic of South Africa, National Water Act, Article. 26(1)(g)**

The Minister may promulgate regulations to protect riparian habitat. <http://faolex.fao.org/docs/texts/saf18718.doc>

**B. What provisions should be included to mitigate damage due to disruption of the river flow?**

Disruption of the natural river flow can lead to excessive siltation in the reservoir, as well as downstream erosion of the riverbanks, further damaging the surrounding habitat.

Attempts to mitigate the impacts of disruption of the river flow include provisions that require the developer to pay compensation to those injured.

**China Water Law, Art. 20**

When building a water project having adverse effects on the flow in the navigation waterway, the construction unit of the project shall take remedial measures or pay compensation. (<http://faolex.fao.org/docs/pdf/chn1317.pdf>)

**Vietnam, The Law on Water Resource, Art. 23(1)**

Organizations that have the right to use water resources for electricity generation are obligated to financially compensate for any damage caused in the exploitation of the resource. (<http://faolex.fao.org/docs/pdf/vie14294.pdf>)

Legislation also includes legal provisions requiring the developer to mitigate erosion in the development area.

**Uzbekistan, Water and Water Use, Article. 103**

Enterprises shall carry out activities necessary to prevent and abate the erosion of banks, embankments, and other works. <http://faolex.fao.org/docs/pdf/uzb5255.pdf>

**Nepal Electricity Act, Article. 24**

Electricity generation shall be carried out such that no substantial adverse effect will be made on the environment by way of soil erosion. <http://faolex.fao.org/docs/texts/nep40799.doc>

**Bangladesh, Water and Power Development Boards Order, Article. 18(b)(2)**

The Water Board may direct the owner of any private land to undertake anti-erosion operations. <http://faolex.fao.org/docs/pdf/bgd19943.pdf>

**C. How can legislation address the impacts caused by affected fisheries?**

Negative impacts on both migratory and freshwater fisheries in the affected water body result in the decline and, in some cases, the eradication of viable fisheries. This negatively impacts both biodiversity and the livelihoods of indigenous people who previously depended on the fishery for trade and sustenance.

Nations have attempted to encourage migratory fish species to successfully bypass the dam structure by constructing fish ladders.

**China Water Law, Article. 18**

Where there is serious impact on fishery resources, the construction unit for the dam shall build fish passage facilities. <http://faolex.fao.org/docs/pdf/chn1317.pdf>

**Republic of Lithuania, Law on Water, Article. 20(2)**

Free migration of fish shall be guaranteed through installation of facilities for fish migration. <http://faolex.fao.org/docs/texts/lit19801.doc>

**Kenya, The Water (general) Rules, Article. 99**

Water Apportionment Board may authorize a permit holder to construct temporary works designed to improve the conditions of fish life, including fish ladders or other means of ingress and egress for fish. <http://faolex.fao.org/docs/pdf/ken2494.pdf>

**Moldova, Water Code, Article 12(e)**

Hydro-technical constructions are conditioned upon approved projects for the passage of fish. <http://faolex.fao.org/docs/texts/mol9890.doc>

## D. What provisions should be included to mitigate water quality problems caused by decomposition?

Water quality problems are related to the decomposition of large amounts of organic matter, particularly where the area to be flooded was not properly cleared of vegetation prior to impoundment. The decaying of this biomass results in oxygen depletion, which if severe can lead to fish kills and increased GHG emissions (particularly methane and CO<sub>2</sub>). Nutrient loading may also result from unregulated agricultural runoff or domestic sewage discharges into the dam reservoir, affecting the utility of the water supply for drinking water and irrigation purposes.

Efforts to minimize the impacts of changes in flow regime have included measures to restore the stream flow regime through the setting of environmental flow releases.

### **Uzbekistan, Water and Water Use, Art. 59**

The energy institutions shall "provide sanitary and environment protection releases." (<http://faolex.fao.org/docs/pdf/uzb5255.pdf>)

General provisions requiring water quality monitoring are enacted to mitigate the effects on the water supply.

### **Moldova, Water Code, Article. 75**

Those in charge of the filling and maintenance of reservoirs are responsible for preventing water logging of land and eutrophication of water. <http://faolex.fao.org/docs/texts/mol9890.doc>

### **New Zealand, Clutha Development (Clyde Dam) Empowerment Act, Part I (12)**

The Minister of Energy must monitor and record the water quality of the lake and any climactic changes in the area. <http://faolex.fao.org/docs/texts/nze36991.doc>

### **Ghana, Volta River Development Act, Part II, Section. 11**

The Volta River Authority is required to control the dam so as to prevent the harmful penetration of salt water up the river to a greater degree than preceding the construction of the dam. <http://faolex.fao.org/docs/pdf/gha41043.pdf>

Provisions requiring proper clearing of vegetation are enacted to prevent water quality problems that result from the decomposition of organic matter.

**Canada, Regulations Respecting Dominion Water-Powers, Art. 34(3)** "Every licensee shall, to the satisfaction of the Minister, clear and keep clear from timber, brush and other material, all lands which are to be flooded." <http://faolex.fao.org/docs/html/can23871.htm>

**New Zealand, Clutha Development (Clyde Dam) Empowerment Act, Part I (13)** Before filling the water body, the Minister must remove all trees and shrub that would interfere with the upper 7 meters of the lake. <http://faolex.fao.org/docs/texts/nze36991.doc>

### **E. What provisions should be included to compensate local residents who have been displaced or who have lost necessary resources?**

The creation of the dam reservoir has often resulted in the forced displacement of local residents from their communities, the loss of valuable agricultural land, and the destruction of sites with cultural, archaeological and historic significance.

Funds required for the resettlement of residents are often included in the investment plan of the proposed hydropower project.

## **III. GENERAL PROVISIONS THAT ADDRESS ALL ENVIRONMENTAL IMPACTS**

There are three major areas of energy and environmental legislation that address the environmental problems posed by hydroelectric dams:

### **A. How can environmental impact statements be utilized to mitigate environmental impacts?**

The large scale, complexity and potential scope of environmental effects all suggest that an extremely thorough EIA process be followed before a large hydro project is allowed to proceed. The requirements of public participation in the EIA process, full consideration of public comments in the final approval process, and post approval monitoring and compliance measures are particularly important. In addition, the assessment of alternatives for a proposed project often includes consideration of the economic, social and cultural effects of the project on local communities. In the case of small-hydro projects, the EIA process may be modified to reflect the different level of impacts from single facilities. For example, legislation may require that the potential cumulative impacts of multiple sites in a discrete region be assessed in a single EIS, in order to promote the expedient development of such projects.

#### **Indonesia Government Regulation No. 27/1999, Article. 3(1)(b)**

Analysis of environmental impacts is required for activities likely to give rise to major and significant impacts on the environment, including the exploitation of natural resources, either renewable or non-renewable. <http://faolex.fao.org/docs/pdf/ins36671.pdf>

#### **India Environmental Impact Assessment Notification, Article. 2(II)(c)**

Hydropower projects are required to obtain environmental clearance to be evaluated by the Impact Assessment Agency. <http://faolex.fao.org/docs/pdf/ind4656.pdf>

#### **Belize, Environmental Protection Act, Part V Section. 20**

Any person intending to undertake a project that may significantly affect the environment shall cause an environmental impact assessment to be carried out by a suitably qualified person. <http://www.belizelaw.org/lawadmin/index2.html>

### **Latvia, Annex to the Law on Environmental Impact Assessment, Article. 21**

Dams or other hydro installations where the water amount held back exceeds 10 million cubic meters require an impact assessment. [http://www.vdm.gov.lv/ivnvb/ivnvb/likumd/Eivn\\_lik.html](http://www.vdm.gov.lv/ivnvb/ivnvb/likumd/Eivn_lik.html)

## **B. How can permitting and licensing requirements implement measures to mitigate environmental damage?**

### **1. Consultation with other agencies/statutes**

The government agency or ministry responsible for issuing a license or permit, or the renewal of a license or permit, is generally required to consult with all government agencies that will potentially be affected by the proposed project. This can include not only the agency responsible for environmental protection, but also federal agencies or ministries of agriculture, forestry, and health, for example. In addition, legislation may require that the license contain conditions for the protection and conservation of affected fish and wildlife.

### **Samoa Water Act, Article. 13**

If the water supply will affect any State forest land, the Director of the Water Supply Committee will submit a scheme plan to the Minister of Agriculture, Forests, and Fisheries or if any other public lands, to the Minister of Lands. <http://faolex.fao.org/docs/texts/sam42117.doc>

### **Belize, Macal River Hydroelectric Development Act, Article. 6**

The Minister charged with the responsibility for the Environment may consult with such Government departments and agencies as he may deem necessary in making regulations regarding the design, financing, construction, and operation of the Chalillo

#### **Project**

<http://www.belizelaw.org/lawadmin/index2.html>

### **Vietnam, The Law on Water Resource, Article. 63(2)**

National Water Resource Council will be composed of a Deputy Prime Minister, a member of the Minister of Agriculture and Rural Development, and other members "who represent a number of Ministries, branches, and localities together with a number of scientists and specialists." <http://faolex.fao.org/docs/pdf/vie14294.pdf>

**Turkey,** Law Concerning the Organization and Duties of the General Directorate of State Hydraulic Works, Art. 21

The undertaking of projects involving the generation of power from water resources will be “determined jointly by representatives of the Prime Ministers Office, and the Ministries of Finance, Public Works, Economy and Commerce, Agriculture, Health and Social Welfare, and Enterprises on the basis of their productivity or in view of the exigencies.” <http://faolex.fao.org/docs/texts/tur30975.doc>

**Philippines**, Memorandum Order No. 421, Creating the Lake Lanao Watershed Protection and Development Council and for Other Purposes, Sec. 1 The Lake Lanao Watershed Protection and Development Council will consist of members from the Department of the Environment and Natural Resources, the National Power Corporation, Armed Forces, Chamber of Commerce and Industry. <http://faolex.fao.org/docs/pdf/phi19936.pdf>

## 2. Dam safety regulations

Regulations usually require that the project applicant comply with the licensing agency’s engineering and safety guidelines for the project during its complete life cycle, from construction to operation to abandonment. The applicant may also be required to submit plans for safety training of personnel, public safety, and the safe operation of the dam under all projected modes of operation, including during flood conditions.

### **South Africa, National Water Act, Ch. 12**

The owner of a dam with a safety risk must register that dam and an approved professional person must be appointed to carry out a dam safety evaluation. [http://www-dwaf.pwv.gov.za/Documents/Legislature/nw\\_act/NWA.doc](http://www-dwaf.pwv.gov.za/Documents/Legislature/nw_act/NWA.doc)

### **United States Federal Power Act, 16 U.S.C. § 808(a)(2)(B)**

When granting a new license, the Commission will take into consideration the plans of the applicant to “manage, operate, and maintain the project safely.” <http://www4.law.cornell.edu/uscode/16/ch12.html>

### **Vietnam, The Law on Water Resource, Article. 39(2)**

Organizations that manage water reservoirs must implement a plan for safety of construction and prevention of damage from floods. <http://faolex.fao.org/docs/pdf/vie14294.pdf>

## C. What types of provisions should be included regarding monitoring, compliance, and enforcement?

Post-project” monitoring and evaluation-legislation may require that the licensing agency continue to monitor the licensee’s compliance with the conditions of the project. Failure to fully comply could result in financial penalties or, in the case of willful non-compliance, rescission or suspension of the license altogether.



**Guyana, Hydro-Electric Power Act, Art. 12**

Any license under the Act can be cancelled in whole or in part upon failure of the licensee to make beneficial use of the water or non-compliance or non-observance of any terms contained in the license. <http://faolex.fao.org/docs/pdf/guy39221.pdf>

**Vietnam, Law on Water Resources, Art. 71(1)**

Persons who cause serious deterioration or depletion of the water source may be subject to discipline, administrative fine, or examined for penal liability. <http://faolex.fao.org/docs/pdf/vie14294.pdf>

**United States, Federal Power Act, 16 U.S.C. § 823b(a)**

The Commission is required to monitor and investigate compliance with the license and permit. <http://www4.law.cornell.edu/uscode/16/ch12.html>

**Tanzania, Water Utilization (Control and Regulation), Art. (30)(1)**

A Water Officer may require any person who has constructed any works contrary to the provisions of the Act to "modify, demolish, or destroy such works within such period, not being less than thirty days." <http://faolex.fao.org/docs/texts/tan1277.doc>

## CHAPTER C. SOLAR AND WIND ENERGY

Alexandra S. Wawryk

### I. SOLAR ENERGY

#### A. Introduction

'Solar energy' refers to a number of ways of using the light of the sun to produce electricity with photoelectric cells and the heat of the sun for thermal applications. Solar energy most frequently is used to provide electricity and hot water or space conditioning to homes and commercial buildings. Solar photovoltaics and thermal energy also can be used in large arrays to produce central station electricity, but these applications are not yet economic.

A major benefit of solar energy systems is that they give off no noise or pollution. Solar photovoltaic and thermal systems are usually placed on the rooftops of buildings. These types of systems are known as 'active solar energy systems'.

Solar energy also may be utilized by siting or orienting buildings toward the sun in order to increase winter heating potential and reduce heating requirements in summer, thereby reducing the need for electricity and boiler fuels for heating and cooling. Also demand for electricity for heating and cooling can be reduced by designing buildings to store the natural heat of the sun or use skylights, a usage known as 'passive solar systems'.

## B. Solar Energy Systems Protected By Legislation

Most legislation is directed at active solar energy systems rather than passive solar energy systems. Typical definitions of covered solar systems include the following examples.

### California Shade Control Act: Public Resources Code § 25981

"Solar collector" means a fixed device, structure or part of a device or structure, which is used primarily to transform solar energy into thermal, chemical, or electrical energy. The solar collector shall be used as part of a system which makes use of solar energy for any or all of the following purposes: (1) water heating, (2) space heating or cooling, and (3) power generation. <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25980-25986>

### New Mexico Solar Rights Act § 47-3-3

"Solar collector" means any device or combination of devices or elements which rely upon sunshine as an energy source, and which are capable or collecting not less than twenty-five thousand Btu's on a clear winter solstice day. The term also includes any substance or device that collects solar energy for use in:

- (1) the heating or cooling of a structure or building;
- (2) the heating or pumping of water;
- (3) industrial, commercial or agricultural processes; or
- (4) the generation of electricity.

<http://www.conwaygreene.com/nmsu/lpext.dll?f=templates&fn=main-h.html&2.0>

### Wisconsin Code § 5 (66.032(1)(j) of the statutes)

"Solar collector" means a device, structure or part of a device or structure a substantial purpose of which is to transform solar energy into thermal, mechanical, chemical, or electrical energy. <http://www.legis.state.wi.us/acts89-93/81Act354.pdf>

### **City of Boulder, Colorado, Ordinance, chapter 8, solar access, § 9-8-2(h)**

“Solar energy system” means any human-made system that relies upon sunshine as an energy source and is capable, through physical, chemical or biological means, of collecting, distributing, storing (if appropriate to the technology), and applying solar energy to beneficial use so as to reduce the amount of nonsolar energy that would otherwise be used by at least ten percent.  
<http://www.sustainable.doe.gov/codes/boldera2.shtml>

## **C. Solar Access**

Solar energy users require unobstructed access to sunlight. Unobstructed access to sunlight is necessary for the optimum performance of both active and passive solar energy systems. Active solar energy systems such as rooftop hot water heaters and photovoltaic arrays require large initial up-front costs to purchase and install the equipment, and this cost is recouped over a number of years through savings on energy bills such as electricity and natural gas. Legal systems must provide investors in solar systems with a legal right to unobstructed access to sunlight; otherwise potential developers will not invest in solar energy systems. The obstruction of sunlight is a particular problem in built-up urban or suburban areas, where buildings and trees on neighboring properties that may block the path of sunlight to a solar energy system. A number of legislative options to protection of solar access are described below.

### **1. Express Agreements Between Landowners**

A statute may regulate the right of neighboring landowners to enter into agreements to convey the right to use the airspace above their property as an unobstructed path for sunlight. In countries such as the United States, the United Kingdom and Australia, these agreements are known as easements. The airspace overlying the property neighboring the solar collector's property will be described in an instrument of conveyance. The right conveyed is to an 'adjoining solar use'. The statute will set out the features that must be contained in such an agreement. These differ between jurisdictions in the US, but may include a number of matters.

First, such legislation ordinarily requires a description of the airspace to be used above the neighboring property. Statutes vary in the descriptive detail they require. The more precisely drawn the agreement, the less airspace must remain unobstructed, and the less burden is placed on the landowners rights to use their property. Clauses may require that:

- The airspace be 'sufficiently described';
- The dimensions of the portion of airspace that is the subject of the right be included in The conveyance through the inclusion of the vertical and horizontal angle of the airspace used, expressed in degrees;
- The airspace be described in the form of a height restriction about the land over which the agreement exists – the neighboring landowner may not obstruct airspace above a certain distance over his or her property;

- The description may include the hours of the day and days of the year when the solar collector is to remain unobstructed and possibly may not require 100% unobstructed access at all times of the year and at all times of the day.

Second, provisions concerning remedies may be required to be inserted in the agreement. New and unforeseen circumstances may arise where the neighbor may be required to violate the agreement, or there may be more beneficial use of the neighbor's property than protecting access to sunlight. The usual requirement is for money compensation should access to sunlight be obstructed.

Third, the legislation may specify that certain legal formalities are to be observed, for example, the agreement must be in writing, or the agreement must be registered with the relevant government agency as a property right where legal procedures exist for registration.

#### **Iowa Code Ch. 564A.7: Solar Access Easements**

1. Persons, including public bodies, may voluntarily agree to create a solar access easement. A solar access easement whether obtained voluntarily or pursuant to the order of a solar access regulatory board is subject to the same recording and conveyance requirements as other easements.
2. A solar access easement shall be created in writing and shall include the following:
  - a. The legal description of the dominant and servient estates.
  - b. A legal description of the space that must remain unobstructed expressed in terms of the degrees of the vertical and horizontal angles through which the solar access easement extends over the burdened property and the points from which these angles are measured.
3. In addition to the items required in subsection 2 the solar access easement may include, but the contents are not limited to, the following:
  - a. Any limitations on the growth of existing and future vegetation or the height of buildings or other potential obstructions of the solar collector.
  - b. Terms or conditions under which the solar access easement may be abandoned or terminated.
  - c. Provisions for compensating the owner of the property benefiting from the solar access easement in the event of interference with the enjoyment of the solar access easement, or for compensating the owner of the property subject to the solar access easement for maintaining that easement.

Source: <http://www.legis.state.ia.us/IACODE/2003SUPPLEMENT/564A/7.html>.

### California Civil Code § 801.5 regarding solar easements

801.5(a) The right of receiving sunlight as specified in subdivision 18 of Section 801 shall be referred to as a solar easement. "Solar easement" means the right of receiving sunlight across real property of another for any solar energy system.

(b) Any instrument creating a solar easement shall include, at a minimum, all of the following:

- (1) A description of the dimensions of the easement expressed in measurable terms, such as vertical or horizontal angles measured in degrees, or the hours of the day on specified dates during which direct sunlight to a specified surface of a solar collector, device, or structural design feature may not be obstructed, or a combination of these descriptions.
- (2) The restrictions placed upon vegetation, structures, and other objects that would impair or obstruct the passage of sunlight through the easement.
- (3) The terms or conditions, if any, under which the easement may be revised or terminated.  
*<http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=00001-01000&file=801-813>.*

California, City of Berkeley Municipal Code, § 21.36.040, solar access easements *[http://www.ci.berkeley.ca.us/bmc/berkeley\\_municipal\\_code/title\\_21/36/040.html](http://www.ci.berkeley.ca.us/bmc/berkeley_municipal_code/title_21/36/040.html)*

## 2. Statutory Nuisance

The law may provide a statutory remedy for the user of a solar collector where a neighboring landowner undertakes specific activities that obstruct access to sunlight. Certain activities specified in the legislation are declared to be a 'nuisance', in this case activities that would unreasonably obstructing access to sunlight for a solar energy system, and a remedy is provided under the separate law of nuisance. Nuisances are particular types of breaches of the law, in common law Western countries including the UK, Australia and the United States.

### California Public Resources Code §§ 25980-25986, which codifies the Solar Shade Control Act

Section 25982 of the statute prohibits a person owning or in control of property from allowing a tree or shrub to be placed or to grow so as to cast a shadow greater than 10% of the collector absorption area upon the solar collector surface installed on a neighboring property between the hours of 10am and 2pm. The prohibition only applies to trees or shrubs to be placed or grown after the installation of the solar collector, that is, the solar collector must be 'first in time'. The statute sets out requirements for the location of a solar collector in terms of minimum setback requirements from the property boundary and minimum height restriction of the location of the solar collector.

Source: *<http://www.leginfo.ca.gov/cgi-bin/displaycode?section=prc&group=25001-26000&file=25980-25986>*

A person who breaches § 25982 may receive a written notice from the district or city or prosecuting attorney (the government lawyer responsible for undertaking prosecutions and enforcing the law) giving reasonable notice to remove the tree or shrub (an abatement notice). A person who fails to abide by the notice is declared guilty of a public nuisance. A public nuisance is defined in §§ 370 and 371 of the Penal Code and in § 3480 of the Civil Code.

The complainant must establish to the satisfaction of the prosecutor that a violation has occurred before the prosecutor will issue an abatement notice. Reasonable notice is defined as 30 days from receipt of the notice. Upon expiration of the 30-day period, the complainant may take an action for public nuisance after filing an affidavit with the prosecutor, seeking a remedy of abatement or damages under the Penal/Civil Codes.

The Statute provides that the continuing violation of § 25982 for each and every day after a notice is received is a separate and distinct offence, and makes it a duty of the government lawyer to prosecute the offender. The Act establishes a maximum fine of \$1,000 per offence.

Source: Penal Code, §§ 370 and 371: <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=pen&group=00001-01000&file=369a-402c>

Civil Code, § 3480: <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=03001-04000&file=3479-3484>.

### 3. Prior Appropriation

A statute may create a legal right for unobstructed access to sunlight based on the solar collector being the first-in-time user of the airspace for the collection of sunlight.

Solar Rights Act of **New Mexico**, USA, [47-3-1 to 47-3-5 NMSA 1978]

The Act declares the right to use the natural resource of solar energy as a property right, known as a solar right. The Act provides for 'prior appropriation', that is, in disputes involving solar rights, priority in time shall have the better right. A 'solar right' is defined in § 47-3-3B to mean a right to an unobstructed line-of-sight path from a solar collector to the sun, which permits radiation from the sun to impinge directly on the solar collector. These rights are freely transferable. Any person claiming a solar right must be record the right under the Solar Recordation Act [47-3-6 to 47-3-12 N.M.S.A. 1978] by filing a solar right declaration with the county clerk of the county in which the property is situated.

<http://www.conwaygreene.com/nmsu/lpext.dll?f=templates&fn=main-h.html&2.0>

**Wyoming, Wyo. Stat. §§ 34-22-101-106 (Supp. 1983), 'Solar rights'**

<http://legisweb.state.wy.us/statutes/titles/title34/chapter22.html>.

**Pennsylvania, House Bill No 668 of 1983, s4 (a)**

<http://www.legis.state.pa.us/WU01/LI/BI/BT/1983/0/HB0668PO745.HTML>.

#### 4. Permits or Administrative Allocation

Solar access may be protected through the establishment of a permit or administrative system, whereby a regulatory board reviews applications for solar access permits, which protect access to sunlight.

When legislating for this type of administrative procedure, there are a number of matters that the statute may address. The statute may:

1. Define 'solar collector' (see above for alternative definitions)
2. Set out the matters the application must address - for example, the Iowa code requires the following:
  - A statement of the need for a solar access easement/permit;
  - A legal description of the properties; the name and address of the property owners;
  - A description of the solar collector; the size and location of the collector, including heights, its orientation with respect to south, and its slope from the horizontal;
  - An explanation of how the applicant has done all reasonable to design and locate the collector so as to minimize the impact on the neighboring property;
  - A legal description of the solar access easement which is sought and a drawing that is a spatial representation of the area of the estate burdened by the easement illustrating the degrees of the vertical and horizontal angles through which the easement extends over the burdened property and the points from which those angles are measured;
  - A statement the applicant has voluntarily tried to negotiate an easement but failed; and
  - A statement that the space to be burdened by the solar easement is not obstructed at the time of filing the application by anything other than vegetation that would shade the collector;
3. Set out notice procedures –the Iowa Code requires the board to schedule a hearing once the application has been received, serve a copy of the application and notice of the hearing on the owners of the property over which the easement is sought within 20 days prior to the hearing, and specify the information to be included in the notice, such as the role of the board and the right of the property owner to contest the application before the board;
4. Set out the conditions under which a board may grant or refuse to grant an easement/permit – the Iowa Code makes the following provisions:
  - The board shall grant an easement if the board finds that there is a need for a solar collector, that the space to be burdened by the solar easement is not obstructed at the time of filing the application by anything other than vegetation that would shade the collector, that the proposed location of the collector minimizes the impact of the easement on development of the property to be burdened, and that the applicant voluntarily tried to negotiate an easement but failed;
  - The board shall not grant an easement if the board finds the owner of the burdened property, at least 6 months prior to the application, made a substantial financial commitment to build a structure that would shade the collector; and

- The board may refuse to grant an easement if the easement would require the removal of trees that provide shade or a windbreak to a residence on the burdened property.
5. Require compensation to be paid to the burdened landowner by the user of the solar collector – under the Iowa Code, this is the difference between the fair market value of the property prior to and after granting the solar access easement;
  6. Establish rules for termination of solar access rights - under the Iowa Code, the owner of the burdened land may petition the board or the district court for removal of the easement if: the solar collector is not installed and operational within 2 years of the grant of the easement; or if the owner of the collector ceases to use it for more than one year; or if the solar collector is destroyed or removed and not replaced within one year.
  7. Establish remedies for interference with the easement – the usual remedy will be damages to compensate for the reduced efficiency of the solar collector and/or the need to use energy from other sources.

Iowa Solar Energy – Access and Use Act [81 Acts, ch. 184 §§ 3-11], now codified in the Iowa Code 2003, Supplement: Sections 564A.1 – 564A.9.

The Iowa Code establishes a ‘solar access regulatory board’ to receive and act on applications for solar access easements. The easement will give the solar collector user the right to use the airspace above their neighbor’s property as an unobstructed path for sunlight. An owner of property may apply to the board for an order granting a solar access easement. The application must be filed before the installation or construction of a solar collector. The board will only grant an easement where the applicant has attempted to voluntarily negotiate an agreement but failed. See: <http://www.legis.state.ia.us/IACODE/2003SUPPLEMENT/564A/1.html>.

**Wisconsin allows property owners to apply for a permit for solar protection.** <http://www.legis.state.wi.us/acts89-93/81Act354.pdf>.

Boulder, Colorado Rev. Code, Title 9, Chapter 8 Solar Access (1981), §§ 9-8-7 to 9-8-10, requiring an application for a permit for solar protection in Solar Access Area III. <http://www.sustainable.doe.gov/codes/boldera2.shtml>.

## 5. Solar Envelopes

Legislation may protect solar access by the use of ‘solar envelopes’. This is a 3-dimensional ‘envelope’ of space, the dimensions of which are drawn over a neighboring property to land on which a solar collector is situated. Should the owner of the neighboring property construct a building outside the bounds of the envelope that blocks sunlight to the existing solar collector on the adjoining property, the user of the collector is entitled to seek compensation.

Solar Access Act of the State of Wisconsin, USA. Wis. Stat. Ann. § 700.40 (1981), Solar Access, codified in Wis. Code, Ch 354, §10.

The legislation allows installers of an active or passive solar system to receive compensation for an obstruction of solar energy by a structure outside a neighbor’s ‘building envelope’. A ‘building envelope’ is a 3-dimensional area on a lot, and is defined by the existing ground level and



height restrictions, setback requirements, and side yard requirements or rear yard requirements. The building envelope is defined by zoning restrictions in force at the time the solar collector is installed. The legislation defines 'obstruction' to mean the portion of a building or other structure which blocks solar energy from a collector surface between the hours of 9am and 3pm standard time, if the portion of the building or structure is outside the building envelope. (<http://www.legis.state.wi.us/acts89-93/81Act354.pdf>).

## 6. Solar Fences

The concept of 'solar fences' can be used to protect access to sunlight.

### **City Ordinance of Boulder, Colorado, USA. See Boulder, Colo. Rev. Code, Title 9, Chapter 8 Solar Access, §§ 9-8-1 to 9-8-15 (1981)**

The Boulder, Colorado city ordinance divides the city into three 'Solar Access Areas': SA Area I, SA Area II and SA Area III. These areas are delineated on a map of the city. The purpose of dividing the city into solar access areas is to provide maximum solar access consistent with different planned densities, topography and lot configurations and orientations of the city. A different level of protection for solar access is provided in the three areas.

SA Areas I and II are designed to protect solar access principally for south yards, south walls, and rooftops in areas where, because of planned densities, topography and lot configurations and orientations, the majority of lots in the Area currently enjoy solar access and where protecting solar access should not unduly restrict permissible development. The Ordinance specifically allocates certain zoned districts to SA Areas I and II. SA Area I includes outer suburban areas with large blocks and low development, while SA Area II is the inner suburban area, and mainly comprises 2 storey buildings. SA Area III includes all areas not specifically identified in SA Areas I and II. SA Area III includes areas where, because of planned densities, topography and lot configurations and orientations, uniform solar access protection for south yards, south walls, and rooftops may unduly restrict permissible development. SA Area III is the inner city, characterized by high-rise development.

In SA Areas I and II, 'solar fences' are hypothesized. A solar fence is a conceptual device, an imaginary fence running along the boundary of a property, which completely encloses the lot in question; it is absolutely vertical and lacks any thickness. The lower the solar fence, the less area may be shaded and the greater the area of protection. The Ordinance provides that in SA Area I, no person shall erect a structure or object that would shade a protected lot to a greater degree than the lot would be shaded by a solar fence 12 feet in height, between 2 hours before and after local solar noon on a clear winter solstice day. In SA Area II, no person is permitted to erect a structure or object that would shade a protected lot to a greater degree than the lot would be shaded by a solar fence 25 feet in height, between 2 hours before and after local solar noon on a clear winter solstice day. In SA Area III, no solar fences are hypothesized, but protection is available through applications for permits.

Source: <http://www.sustainable.does.gov/codes/boldera2.shtml>.

## New Mexico Solar Recordation Act, §47-3-11 NMSA 1978

The prior appropriation rule is qualified by the use of hypothetical solar fences where the land burdened by the solar right could have improvements constructed to certain defined maximum heights. For example, if the property burdened by the solar right could have improvements constructed to a maximum height of 24 feet, the solar right is limited to the shadow cast by a hypothetical solar fence 10 feet in height. (<http://www.conwaygreene.com/nmsu/lpext.dll?f=templates&fn=main-h.html&2.0>).

## 7. General Planning Law

General planning law may provide laws against overshadowing at certain times of the day. For example, in the Australian states, each local council area has a local development plan, incorporated under the state planning law, which contains objectives and principles of development. These local development plans may contain a principle of development that solar collectors or buildings in general may not be subject to overshadowing at certain times of the day. When deciding whether or not to give consent to a new development, the local council must take into account the principles of development control. One feature of this type of control is that the principle of overshadowing is only one of many principles to be taken into account by a decision-maker when deciding whether or not to grant consent to a new development.

### Australia, State of Victoria, Melbourne Planning Scheme

As a general design and land use principle for the South Carlton precinct Development should not cause a significant loss of amenity to any nearby or adjacent dwellings by way of overshadowing, overlooking or massing. It should not result in any significant loss of sunlight at street level in streets with high pedestrian use and in adjoining residential properties between 11.00 am and 2.00 pm on 22 September or 22 March. (<http://www.dse.vic.gov.au/planningschemes/melbourne/home.html>)

Under Ordinance of the Village of Soldiers Grove, Wisconsin, 1980, s 2.06, site restrictions, Solar Access is protected in the following manner: No structure, and no plants materials, whether trees, shrubs or other, and no permanently fixed equipment shall be of such a height that it would cast a shadow during daylight between 9 AM and 3 PM of the winter solstice on any portion of another building or the buildable area of a parcel if no building exists. Compliance with this standard must be graphically shown in Application for Zoning Permit. (<http://www.sustainable.doe.gov/codes/soldiers.shtml>).

## 8. Prohibiting Restrictions on Solar Collectors

Solar energy devices can be seen as ugly and visually distinct, and agreements known as restrictive covenants may seek to prevent a landowner from installing rooftop solar panels. The owners of homes in subdivisions may enter into restrictive covenants, or aesthetic covenants, that prevent the installation of solar energy devices on aesthetic grounds. Various state laws in the United States prohibit counties, towns and villages from placing any restrictions on the installation or use of a solar energy system, on aesthetic or other grounds.

Under **Wisconsin** Code ch. 354 §4m (§66.031 of the Statutes),

no county, city, town or village may place any restriction, either directly or in effect, on the installation or use of a solar energy system. There are exceptions, namely if the restriction serves to preserve or protect the public health or safety, if it does not significantly increase the cost of the system or significantly decrease its efficiency, or if the restriction allows for an alternative system of comparable cost and efficiency. (<http://www.legis.state.wi.us/acts89-93/81Act354.pdf>)

Iowa Code 564A.8.

Under **Iowa** law, City councils and county boards of supervisors may include in ordinances relating to subdivisions a provision prohibiting deeds of property located in new subdivisions from containing restrictive covenants that include unreasonable restrictions on the use of solar collectors. (<http://www.legis.state.ia.us/IACODE/2003SUPPLEMENT/564A/1.html>).

#### **California Civil Code, 714(a)-(b)**

- (a) Any covenant, restriction, or condition contained in any deed, contract, security instrument, or other instrument affecting the transfer or sale of, or any interest in, real property that effectively prohibits or restricts the installation or use of a solar energy system is void and unenforceable.
- (b) This section does not apply to provisions that impose reasonable restrictions on solar energy systems. However, it is the policy of the state to promote and encourage the use of solar energy systems and to remove obstacles thereto. Accordingly, reasonable restrictions on a solar energy system are those restrictions that do not significantly increase the cost of the system or significantly decrease its efficiency or specified performance, or that allow for an alternative system of comparable cost, efficiency, and energy conservation benefits.

Source: <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=00001-01000&file=707-714.5>.

## D. Warranty Provisions

The main consumer complaints against solar energy manufacturers and sellers include: the installation of faulty devices; the improper installation of the solar collector, leading to leaks, roof damage and collectors being blown off the roof during storms; and false claims concerning the potential energy savings of the solar installation. Where consumers are unfamiliar with solar technology and the purchase and installation of solar equipment is still relatively expensive compared to other forms of energy, legislation is required to instill confidence in the solar industry. In particular, consumers need to be assured that the solar devices they purchase will be of a high quality, will be installed correctly, and that the initial up-front costs of purchase and installation will be recovered by savings in their energy bills over a certain period of time. If consumers cannot be assured of these things, then they will be reluctant to invest in solar energy technology. Should any problems occur with installation or should false claims be made, consumers need to be able to claim compensation from the manufacturer or seller.

### 1. Prescribed statutory warranties

To promote consumer confidence in renewable energy installations, warranties may be prescribed in legislation. These warranties guarantee that solar collectors will perform according to manufacturers' specifications. The legislation will prescribe a minimum specified period for the statutory warranty. For example:

#### **Maine, USA: Maine Revised Statutes, Title 10, Part 3, Ch 221: Warranties for Sale and Installation of Solar Energy Equipment**

##### § 1493 Express warranty

The Department of Economic and Community Development shall establish an express warranty for the sale and installation of solar energy equipment in Maine. This express warranty shall, at a minimum, include the following: [1989, c. 501, Pt. DD, §30 (amd).]

1. Five-year warranty. A 5-year manufacturer's express warranty against defects in materials or manufacture of solar collectors;
2. One-year warranty. A one-year warranty against failure of the solar system when such failure is the result of improper installation; and
8. Implied warranty. Those implied warranties established in the Maine Uniform Commercial Code, Title 11, sections 2-314 and 2-315.

Source: <http://janus.state.me.us/legis/statutes/10/title10sec1493.html>

(<http://janus.state.me.us/legis/statutes/11/title11sec2-314.html>, <http://janus.state.me.us/legis/statutes/11/title11sec2-315.html>)

### **Solar Energy Products Warranty Act of New York (for solar thermal systems);**

Magnusson-Moss Warranty Act (15 U.S.C. secs. 2301 et seq.) and the rules and regulations issued pursuant thereto.

2. All customers shall be provided with express warranties that shall include at a minimum the following:
  - (a) A full one year warranty by the installer against malfunction or failure of a solar thermal system due to improper installation or a defect in standard pipe, ducts, switchboxes and hardware utilized in installation;
  - (b) A full one year warranty by the system manufacturer and the seller against a defect in materials, manufacture or design of a solar thermal system; and
  - (c) A full three year warranty by the system manufacturer and the seller against a defect in materials, manufacture or design of a solar collector, tank or heat exchanger.
3. No person shall offer a service agreement for a solar thermal system unless such person shall have developed a service capability for such system.

Source: <http://caselaw.lp.findlaw.com/nycodes/c36/a10.html>

### **South Australia, Manufacturers Warranties Act 1974 (SA) § 4**

- (1) Where any manufactured goods—
  - (a) are sold by retail in this State; or
  - (b) are delivered, upon being sold by retail, to a purchaser in this State, the manufacturer warrants—
  - (c) that the goods are of merchantable quality; and
  - (d) where the goods are of a kind that are likely to require repair or maintenance, that spare parts will be available for a reasonable period after the date of manufacture.

Source: [http://www.austlii.edu.au/au/legis/sa/consol\\_act/mwa1974286/s4.html](http://www.austlii.edu.au/au/legis/sa/consol_act/mwa1974286/s4.html).

### **United States Uniform Commercial Code, 15 USC 50 §2304(a). Federal minimum standards for warranties**

In order for a warrantor warranting a consumer product by means of a written warranty to meet the Federal minimum standards for warranty—

- (1) such warrantor must as a minimum remedy such consumer product within a reasonable time and without charge, in the case of a defect, malfunction, or failure to conform with such written warranty;
- (4) if the product (or a component part thereof) contains a defect or malfunction after a reasonable number of attempts by the warrantor to remedy defects or malfunctions in such product, such warrantor must permit the consumer to elect either a refund for, or replacement without charge of, such product or part (as the case may be). The Commission may by rule specify for purposes of this paragraph, what constitutes a reasonable number of attempts to remedy particular kinds of defects or malfunctions under different circumstances. If the warrantor replaces a component part of a consumer product, such replacement shall include installing the part in the product without charge.

Source: [http://assembler.law.cornell.edu/uscode/html/uscode15/usc\\_sec\\_15\\_00002304-000.html](http://assembler.law.cornell.edu/uscode/html/uscode15/usc_sec_15_00002304-000.html)

## **2. Legal formalities of contracts of sale and warranties**

Legislation may prescribe that the contracts for sale of solar systems, and warranties, are set out in writing, and contain certain minimum information for the consumer.

### **Solar Energy Products Warranty Act of New York (for solar thermal systems)**

§ 12-104. Contracts and sales practices.

1. Every agreement for the sale or installation of a solar thermal system shall be in writing and be subscribed by the seller or installer, or his lawful agent, and by the customer or his lawful agent.
2. Every such agreement shall contain or have annexed there to:
  - (a) The name and address of the system manufacturer of the solar thermal system together with the system's name and model number;
  - (b) Operation, maintenance and installation instructions, except that installation instructions need not be provided in an installation agreement;
  - (c) Copies of all express warranties provided to the customer; and
  - (d) Other such information as may be required by the commissioner.

3. Every such agreement shall display the following statement on the face of the agreement in a clear and conspicuous manner: "No specific thermal performance for this solar system is warranted unless stated herein".
4. No seller shall offer for sale a solar thermal system unless such seller makes available to a prospective customer the information specified in subdivisions two and three of this section.

S 12-106. Warranties and service agreements. 1. All express warranties and service agreements pertaining to any solar thermal system or component thereof which is sold in the state shall be in writing and shall be in compliance with rules and regulations to be promulgated by the commissioner. Such rules and regulations shall contain standards no less stringent than those contained in the Federal Magnuson-Moss Warranty Act (15 U.S.C. secs. 2301 et seq.) and the rules and regulations issued pursuant thereto.

Source: <http://caselaw.lp.findlaw.com/nycodes/c36/a10.html>.

### 3. Standards for the manufacture of solar systems

Legislation may also prescribe product standards for solar collectors. The government or another agency will develop certain standards of quality for solar collectors with which all manufacturers must comply. The government or agency will inspect the equipment and issue a certificate that guarantees the solar collector complies with the quality standards. For example:

#### **California Civil Code, 714(c)-(e)**

- (c) (1) A solar energy system shall meet applicable standards and requirements imposed by state and local permitting authorities.
- (2) A solar energy system for heating water shall be certified by the Solar Rating Certification Corporation (SRCC) or other nationally recognized certification agencies. SRCC is a non-profit third party supported by the United States Department of Energy. The certification shall be for the entire solar energy system and installation.
- (3) A solar energy system for producing electricity shall also meet all applicable safety and performance standards established by the National Electrical Code, the Institute of Electrical and Electronics Engineers, and accredited testing laboratories such as Underwriters Laboratories and, where applicable, rules of the Public Utilities Commission regarding safety and reliability.

Source: <http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=00001-01000&file=707-714.5>

China has adopted its own standards for solar energy systems, for example:

### **The Renewable Energy Law - The People's Republic of China**

#### Chapter 3 Industry Guidance and Technology Support

Article 11—Standardization authorities of the State Council shall set and publicize technical standards for renewable energy electric power and the technical standards for relevant renewable technology and products for which technical requirements need to be standardized at the national level.

Source: [http://www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

#### Chapter 4 Promotion and Application.

- Article 17—The Government encourages workplaces and individuals in the installation and use of solar energy utilization systems of solar energy water-heating system, solar energy heating and cooling system and solar photovoltaic system, etc.
- Construction authorities of the State Council shall cooperate with relevant authorities of the State Council in establishing technical economic policies and technical standards with regard to the combination of solar energy utilization system and construction.
- Real estate development enterprises shall, on the basis of the technical standards in the previous paragraph, provide necessary conditions for the utilization of solar energy in the design and construction of buildings.
- For buildings already built, residents may, on the condition that its quality and safety is not affected, install solar energy utilization system that conform to technical standards and product standards, unless agreement has been otherwise reached between relevant parties.

Source: [http://www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

In 1999, the Chinese Academy of Science established the Quality Assessment Center for Wind and Solar Energy.

GB/T 12915-1991: Test methods to determine the thermal performance of domestic solar water heaters.

GB/T 15405-1994: Specifications and testing method of thermal performance for passive solar houses.

GB/T 15513-1995: Solar water heaters-Elastomeric materials for absorbers, connecting pipes and fittings-Method of assessment.

Source: <http://www.cnaec.com.cn/guifan/02/F10-19.html> (in Chinese, current as of 1999)



More, recently, China has established the National Solar Water Heater Testing and Certification Program. The Program and the Chinese National Institute for Standardization created four new standards for performance and qualification testing of solar water heater components and systems, which received approval from the Chinese government in October 2003.

GB/T 18708-2002: Test Methods for Thermal Performance of Domestic Solar Water Heating Systems.

GB/T 18713-2002: Design, Installation, and Commissioning of Solar Water Heating Systems.

GB/T 18674-2002: Indoor Methods for Testing Thermal Performance of Solar Collectors.

GB/T 19141-2003: Domestic Solar Water Heater System Specifications.

Source: National Development and Reform Commission (NDRC) and UNDP/GEF, Capacity Building for the Rapid Commercialization of Renewable Energy in China, Project Brief No. 6, Solar Water Heater Component, May 2004.

China has also established a National Solar Water Heater Certification Center at Beijing Jianheng, under the Institute of Meteorology, to develop a certification and labeling program.

See: China Renewable Energy Project website <http://www.ccre.com.cn/>

See also: Minnesota Statutes 2004, s 216C.25 Solar energy system standards <http://www.revisor.leg.state.mn.us/stats/216C/25.html>

#### **4. False claims or information about the performance or energy savings of solar collectors**

Legislation may prohibit manufacturers or sellers of solar equipment from making false claims about the quality of solar collectors or the energy-saving potential of the installation. These prohibitions can be contained in general legislation that prohibits businesses from making false claims about their products or services. For example:

##### **Australia, Trade Practices Act 1974 (Cth) ss 52 and 53**

52 Misleading or deceptive conduct

(1) A corporation shall not, in trade or commerce, engage in conduct that is misleading or deceptive or is likely to mislead or deceive.

53 False or misleading representations

A corporation shall not, in trade or commerce, in connection with the supply or possible supply of goods or services or in connection with the promotion by any means of the supply or use of goods or services:

- (a) falsely represent that goods are of a particular standard, quality, value, grade, composition, style or model or have had a particular history or particular previous use;
- (aa) falsely represent that services are of a particular standard, quality, value or grade;
- (e) make a false or misleading representation with respect to the price of goods or services;
- (g) make a false or misleading representation concerning the existence, exclusion or effect of any condition, warranty, guarantee, right or remedy.

Source: [http://www.austlii.edu.au/au/legis/cth/consol\\_act/tpa1974149/](http://www.austlii.edu.au/au/legis/cth/consol_act/tpa1974149/).

## 5. Enforcement and remedies

Legislation is needed to give consumers effective legal remedies when the solar collector fails to perform to the manufacturers' specifications or when the manufacturer or seller makes false claims about the performance of a solar collector. The most common remedy for consumers is compensation ('damages') for any loss or damage suffered. The law may also give courts the power to award any other remedy that is appropriate in the circumstances. Because taking legal action in the courts is expensive, it is important that legislation make provision for a consumer to recover the reasonable costs of hiring a lawyer (attorney) to represent him or her in court. If consumers cannot afford to go to court to obtain a remedy, and/or the cost of legal fees is greater than the compensation sought, the legislation will be ineffective in protecting consumers' rights. Some examples of legislative provisions:

### Solar Energy Products Warranty Act of New York

S 12-110. Violations. 1. Whenever the attorney general has reason to believe that any violation of this article is a repeated or persistent practice, he may bring an action to enjoin such practice and to obtain restitution for any aggrieved party or parties.

2. Any owner of a solar thermal system injured by a violation of any provision of this article issued pursuant thereto may bring an action in his own name to enjoin such violation and to recover his actual damages. In such action, there may be awarded reasonable attorney's fees and costs to the plaintiff. Provided, however, that such individual action shall be precluded if, prior to its commencement, the attorney general has commenced an action for an injunction and restitution pursuant to the provisions of subdivision one of this section.

Source: <http://caselaw.lp.findlaw.com/nycodes/c36/a10.html>

**California** Civil Code, 714(f)-(g)

- (f) Any entity, other than a public entity, that willfully violates this section shall be liable to the applicant or other party for actual damages occasioned thereby, and shall pay a civil penalty to the applicant or other party in an amount not to exceed one thousand dollars (\$1,000).
- (g) In any action to enforce compliance with this section, the prevailing party shall be awarded reasonable attorney's fees. (<http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=00001-01000&file=707-714.5>).

## US Clean Air Act, s 304(d)

- (d) The court, in issuing any final order in any action brought pursuant to subsection (a) of this section, may award costs of litigation (including reasonable attorney and expert witness fees) to any party, whenever the court determines such award is appropriate. (<http://www.epa.gov/oar/caa/caa304.txt>).

**United States Uniform Commercial Code**, 15 USC 50 §2310(d). Remedies in consumer disputes

- (2) If a consumer finally prevails in any action brought under paragraph (1) of this subsection, he may be allowed by the court to recover as part of the judgment a sum equal to the aggregate amount of cost and expenses (including attorneys' fees based on actual time expended) determined by the court to have been reasonably incurred by the plaintiff for or in connection with the commencement and prosecution of such action, unless the court in its discretion shall determine that such an award of attorneys' fees would be inappropriate. ([http://assembler.law.cornell.edu/uscode/html/uscode15/usc\\_sec\\_15\\_00002310-000-.html](http://assembler.law.cornell.edu/uscode/html/uscode15/usc_sec_15_00002310-000-.html)).

Legislation may also prescribe a penalty against the manufacturer when the manufacturer fails to comply with legislation.

**Maine, USA:** Maine Revised Statutes, Title 10, Part 3, Ch 221: Warranties for Sale and Installation of Solar Energy Equipment

## § 1494. Civil forfeiture; Unfair Trade Practices Act violation

Any person who fails to provide the purchaser of solar energy equipment, as defined in this chapter, with a minimum warranty, as established by law, shall be deemed to have committed a civil violation for which a forfeiture of not less than \$200 nor more than \$500 for the first offence and not less than \$500 nor more than \$1,000 for each subsequent offence shall be adjudged. In addition to the civil penalty provided in this section, any violation of this chapter shall constitute a violation of Title 5, chapter 10. (<http://janus.state.me.us/legis/statutes/10/title10sec1493.html>).

**California** Civil Code, 714(h)

- (h) (1) A public entity that fails to comply with this section may not receive funds from a state-sponsored grant or loan program for solar energy. A public entity shall certify its compliance with the requirements of this section when applying for funds from such a grant or loan program. (<http://www.leginfo.ca.gov/cgi-bin/displaycode?section=civ&group=00001-01000&file=707-714.5>).

## II. WIND ENERGY

### A. Mapping the Wind Resource

The first step in developing a wind energy facility is identifying an appropriately windy site. An important initiative is the measurement of wind speed and subsequent mapping of wind resources in the form of a wind energy atlas, also called a wind resource study or wind resource map. Wind energy companies will consult the wind atlas (if any) to broadly identify possible areas for development. Governments can assist the development of a wind energy industry by sponsoring the development of wind atlases, either by arranging for a government department to develop the wind resources map, or by funding a quasi-government agency or independent research organization to develop the wind atlas. Governments may seek funding from an international lending institution as the World Bank to finance the development of a national or regional wind energy atlas.

See: **US** Pacific Northwest Laboratory, Wind Energy Resource Atlas of the United States <http://rredc.nrel.gov/wind/pubs/atlas/maps.html>.

Wind Energy Resource Atlas of **New South Wales (Australia)** [http://www.seda.nsw.gov.au/ren\\_wind03.asp](http://www.seda.nsw.gov.au/ren_wind03.asp).

Wind Energy Resource Atlas of **Victoria (Australia)** [http://www.seav.vic.gov.au/renewable\\_energy/wind/atlas/](http://www.seav.vic.gov.au/renewable_energy/wind/atlas/).

International Bank for Reconstruction and Development, Asia Alternative Energy Program (ASTAE), Wind Energy Resource Atlas of South Asia, covering **Cambodia, Laos, Thailand, and Vietnam**, <http://www.worldbank.org/astae/werasa/>.

Wind Energy Resource Atlases for **Armenia, Chile, South East China, Dominican Republic, Indonesia (Sumba and West Timor), Mexico and Oaxaca (Mexico), Mongolia, the Philippines and Sri Lanka and the Maldives**. Links to the Atlases are provided at [http://www.rsvp.nrel.gov/wind\\_resources.html](http://www.rsvp.nrel.gov/wind_resources.html).

**China:** Meteorology Law of the People's Republic of China 1999, Article 34 Competent meteorological departments at all levels shall arrange for climatic feasibility studies relating to city planning, key national construction projects, major regional economic development projects and large projects for the exploitation of climatic resources such as solar and wind energy. <http://www.zhb.gov.cn/english/chanel-3/index.php3?chanel=3>.

### B. The Assessment of Wind Speed at Particular Sites

#### 1. Measurement of wind speed

After identifying possible areas for development from a wind resource atlas, to gather more specific information about a potential site, the developer may gather long-term wind data collected from a wind measurement station located closest to the site if such a station exists. The developer may also use computer models to assess wind speed at the site.

While wind atlases, databases and computer models can give an approximate estimate of wind speed, the sensitivity of energy yield to wind speed can only be accurately determined by actual on-site measurements. The developer will usually collect data for at least one full year to determine annual average wind speed. The instrumentation used for wind assessment includes 3 major components: anemometers, which are sensors to measure wind speed and direction; equipment to log the data; and a meteorological mast or tower.

Anemometers continuously record and measure wind speed. These are the first structures to be built at a potential location to determine whether there are sufficient wind resources for cost-effective development. The towers may be temporary and moveable when collecting data prior to construction of the wind farm. Once the wind farm is constructed and under operation, permanent anemometers may be used to transmit information about wind speed and direction to each turbine and to a control facility, where data about the wind is stored. The anemometers may be placed on the turbines, which will begin operating once the anemometers have detected sufficient wind speed. Anemometers may be mounted on towers as high as 100 meters, although in practice, companies will usually use a lower tower (50m in height), which is much less expensive. Because wind speed varies with height above ground level ('wind shear'), developers can erect shorter towers and then use wind shear information to extrapolate wind speed to turbine height.

P. Coppin, K. Ayotte and N. Steggle, *Wind Resource Assessment in Australia – A Planners Guide*, Australian Community and Scientific Independent Research Organization Wind Energy Unit, CSIRO Land and Water, 2003 ([http://www.clw.csiro.au/products/windenergy/plannersguide\\_final.pdf](http://www.clw.csiro.au/products/windenergy/plannersguide_final.pdf)).

## **2. Planning approval for anemometers**

Depending on the height of the anemometry tower, planning approval may need to be sought to erect the tower. Governments should consider the height of towers for which planning permission must be sought and the period of time for which approval will be given. To encourage measurement of wind speeds, some governments, such as the state of Victoria in Australia, do not require companies to obtain planning approval for anemometer masts. In populated areas, publicity should be given to the erection of anemometry equipment, so that local communities are made aware of the possibility of the equipment being erected and a wind farm being constructed. More discussion on planning laws and wind energy, including the relationship of government wind energy guidelines to legislation, is given at Heading C below.

### **Ireland: Department of Environment, Heritage and Local Government, Draft Wind Energy Planning Guidelines 2004, 4.2 Wind Anemometers, p15**

Planning applications for wind anemometers (measurement masts) are generally sought for a limited period only. Permissions should be granted for at least a two-year period in consultation with the developer to allow a wind resource analysis to be carried out. It would be inadvisable for the planning authority to grant planning permission for a wind anemometer in an area where there is a presumption against wind energy development either in the wind energy strategy or in the development plan. In a case where a developer wishes to exceed the period of the permission an application must be made to the planning authority to retain the anemometer otherwise the developer should be required to remove it.

Source:[http://www.environ.ie/DOEI/doi/pub.nsf/0/9077dc4f1acf8f1c80256ee60031c31b/\\$FILE/Draft Wind Energy.pdf](http://www.environ.ie/DOEI/doi/pub.nsf/0/9077dc4f1acf8f1c80256ee60031c31b/$FILE/Draft%20Wind%20Energy.pdf).

**Australia:** Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria 2002, as amended May 2003, p16

An anemometer, which is a device used to measure the wind speed and wind direction on a site, is not a wind energy facility. An anemometer mast may be erected on a site for up to 36 months to monitor the suitability of the wind resource for a potential wind energy facility. (<http://www.auswea.com.au/downloads/Vicguidelines.pdf>).

### **3. Gaining access to the land**

In order to conduct these on-site investigations, the developer must gain access to the land. In the United States and Australia, developers may secure options for long-term leases or simple anemometer agreements (also known as wind monitoring agreements) from the landowner. During the option period the developer obtains the landowner's permission to erect anemometers to conduct site-specific wind measurements. The agreements specify the terms and conditions of the arrangement between the parties, including matters such as:

- liability for damage to equipment or damage caused by equipment;
- the right to enter the land for installation and maintenance;
- the conduct of the developer on the site;
- ownership of data recorded;
- the duration of the agreement; and
- details of any payments to be made.

As these are contractual or private agreements, they are usually confidential and copies are not made publicly available.

## C. Assessment and Approval Procedures For Wind Farms

### 1. What are the general legal procedures for assessing and approving wind farms?

Wind turbines are large installations. Most turbines have 3 blades, which are generally around 30m in length. The towers of a turbine are typically between 3 and 5 meters in diameter and taper to about 2 meters at the top. While the height of the tower varies with the size of the generator and the length of the blades, a common size is around 70m. A 70m high tower with 30m blades gives a total height of 100m, which is roughly the equivalent of a 23-storey building. The number of turbines depends on the location and capacity of turbines, and can vary from a very few turbines to over 100 turbines.

The construction of a wind farm has the potential to cause significant environmental impacts, including social and cultural impacts. These impacts need to be identified, assessed and properly managed. The usual way for this to occur is through environmental impact assessment (EIA), which requires the prediction, avoidance or mitigation, and monitoring, of the environmental, social and cultural impacts of a proposed wind energy facility. In many countries EIA processes are legally mandated as part of planning or development law. This means the developer of the wind farm must submit an Environmental Impact Statement (EIS) as part of the process of seeking development approval for the project. The EIS will, at a minimum:

- describe the details of the proposed wind farm
- describe the possible impacts on the environment,
- suggest measures to avoid, minimize or mitigate the impacts, including consideration of alternative sites, and
- contain measures for about monitoring the impacts.

After considering the EIS, and any public comments on the EIS, the relevant government decision-maker will determine whether or not to grant development consent for the proposed wind farm. Where consent is granted, conditions will usually be attached to the planning approval to ensure the environmental impacts of the wind farm are properly managed.

Some jurisdictions have put in place different EIA requirements for wind energy projects, depending on the size of the project. In some countries an EIA is discretionary for small wind power projects but mandatory for large projects. The definition of 'small' and 'large' differs between countries. See for example:

*The Town and Country Planning (Environmental Impact Assessment (England and Wales) Regulations 1999, reg 2(1) and Sched. 2, Table item 3(i).*

EIA should be considered where a development consists of two or more wind turbines, or where the hub height of any individual turbine exceeds 15m. Small developments of single turbines, or pairs of machines, can be exempt from the need for EIA.

<http://www.hmso.gov.uk/si/si1999/19990293.html#end>.

<http://www.hmso.gov.uk/si/si1999/99029305.html#sch2>.

The UK Department of Trade and Industry will assess the need for an EIA on a case-by-case basis for wind energy facilities with a capacity of greater than 50MW but less than 300MW: The Electricity Works (Environmental Impact Assessment (England and Wales) Regulations 2000, reg 2(1) and Sched. 2 <http://www.legislation.hmso.gov.us/si/si2000/20001927.html>.

The Texts of the Regulations on Environmental Impact Assessment in the Netherlands, March 2000, Part D of the Environmental Impact Assessment Decree 1994, Column 1, item 22.2

EIA is required for 'the creation, change or extension of one or more interconnected installations for harnessing wind power for electricity generation' in cases where the activity relates to (a) a total capacity of 10MW (electrical) or more, or (b) 10 wind turbines or more. EIA is otherwise discretionary. See: [http://www2.vrom.nl/Docs/internationaal/The\\_text\\_of\\_the\\_regulations.pdf](http://www2.vrom.nl/Docs/internationaal/The_text_of_the_regulations.pdf).

Planning Act in Denmark, Consolidated Act No. 763 of 11 September 2002

[http://www.lpa.dk/Topmenuen/Publikationer/Andre\\_Sprog/2002/planning-act-2002.pdf](http://www.lpa.dk/Topmenuen/Publikationer/Andre_Sprog/2002/planning-act-2002.pdf).

Wind energy projects must be located in accordance with the spatial planning process set out in the Planning Act, regional plans and municipal plans. For projects outside the EIA process, local plans establish the final location and content of specific wind energy projects.

See: Spatial Planning for Wind Energy: lessons from the Danish Case, May 2004, p32. [http://diggy.ruc.dk:8080/bitstream/1800/402/1/Spatial\\_Planning\\_For.pdf](http://diggy.ruc.dk:8080/bitstream/1800/402/1/Spatial_Planning_For.pdf).

Note: Local and regional plans appear to be unavailable in English.

Most developing countries do not have specific EIA requirements for wind farms. Examples of general EIA legislation in developing countries are contained in Chapter I of the book.

## **2. Who is responsible for assessing proposals and giving planning consent?**

Some jurisdictions have put in place different planning procedures for wind energy projects, depending on the size of the project. In the case of smaller scale development, the local council is usually the decision maker. For large-scale and/or politically sensitive wind developments, applications will be lodged with (and assessed by) the relevant state department and the relevant Minister is responsible for granting or refusing development consent. The relevant department and Minister may be the Department/Minister for Planning, for Environment, for Trade, or for Energy. A key reason for this is the complexity of issues raised by large-scale wind farms. Large wind farms require the consideration of a range of economic, environmental and social effects, and opportunity must be provided for a wide range of people and organizations to make submissions on the proposed facility. The definition of 'large-scale' differs between jurisdictions. For example:

**US, Oregon** Revised Statutes 2003, Chapter 469

Developers of large energy facilities must obtain a site certificate from the Oregon Energy Facility Siting Council (ORS 469.320), which is staffed by members of the Energy Resources Division of



the Oregon Office of Energy. For wind facilities, a large energy facility is defined as a facility with an average electrical generating capacity of 35MW or more (ORS 469.300 (11) (a) (J)). Applications to construct a wind energy facility with an average electrical generating capacity of less than 35MW will be dealt with by the local land use planning authority, <http://www.leg.state.or.us/ors/469.html>.

**US, Minnesota** Statutes 2003, §§ 116c191-697

The Environmental Quality Board is the body with the authority to issue site quality permits to construct a Large Wind Energy Conversion System (LWECS). A LWECS is defined as any combination of wind turbines and associated facilities with the capacity to generate 5 MW or more of electricity. Applications to construct Small Wind Energy Conversion Systems are dealt with by local government bodies. <http://www.revisor.leg.state.mn.us/stats/116C/691.html>.

**England and Wales:** Electricity Act 1989 § 36

Development consents are required from the Secretary of State for the construction of onshore electricity generating stations of over 50 MW, including wind energy facilities. The UK Department of Trade and Industry is the administrative body for applications under s 36. Applications for wind energy facilities of less than 50MW capacity are dealt with by the local planning authorities. [http://www.legislation.hms.gov.uk/acts/acts1989/Ukpga\\_19890029\\_en\\_2.html#mdiv36](http://www.legislation.hms.gov.uk/acts/acts1989/Ukpga_19890029_en_2.html#mdiv36).

**India:** State Electricity Bodies and State Nodal Agencies are responsible for the clearance of wind power projects and the issuance of 'No Objection Certificates'.

Source: Government of India, Ministry of Non-Conventional Energy Sources, Revised Guidelines for Wind Power Projects, 13 June 1996. <http://www.mnes.nic.in/wp14.html>.

**Germany**, Federal Building Code [Baugesetzbuch – BauGB], in the version amended by the Act to Amend the Federal Building Code and to Reorder Spatial Planning Law [BauROG], issued on August 18th 1997 (BGBl. I p. 2081), s 35. <http://www.iuscomp.org/gla/statutes/BauGB.html>.

Under German zoning laws, only certain structures may be placed in the remote countryside. Para 35 of the Building Code was amended in 1996 so that wind turbines are permitted structures in the remote countryside, and evidence must now be given as to why turbines should not be permitted rather than the other way around, significantly streamlining the approvals process.

W. Rickerson, J. Twele and B. Berlin *Germany and the European Wind Energy Market*, p. 4. <http://www.cler.org/predac/IMG/pdf/reviewGermany.pdf>.

### 3. How is guidance given to decision-makers?

Because wind energy developments raise complex issues and involve the assessment of a number of impacts, governments may develop guidelines to assist local councils in assessing proposals for wind energy facilities. These guidelines may be introduced directly into legislation, or introduced through the amendment of local council development plans, or the legislation may refer to guidelines contained in a separate document. Usually the guidelines will contain a statement of the government's policy in relation to the promotion of renewable energy, and contain principles by which specific

environmental impacts are to be assessed and weighed. The specific major environmental impacts are discussed in more detail at Heading D below. Some examples re guidelines:

**Minnesota Rules**, Chapter 4401

This chapter provides rules for the consideration of applications for site permits for large wind energy conversion systems by the Minnesota Environmental Quality Board. <http://www.revisor.leg.state.mn.us/arule/4401/0100.html>.

**South Australia:** Planning SA, Plan Amendment Report by the Minister, Draft for Public Consultation, August 2002

This document amends all local council Development Plans, which are incorporated into law under the Development Act 1993 (SA), to include guidelines for councils in the Development Plans. <http://www.planning.sa.gov.au/windfarms/index.html>.

In addition, Planning SA, Planning Bulletin, Wind Farms, Draft for Public Consultation, August 2002, provides additional guidance for councils. [http://www.planning.sa.gov.au/windfarms/pdf/wind\\_farm\\_bulletin\\_web.pdf](http://www.planning.sa.gov.au/windfarms/pdf/wind_farm_bulletin_web.pdf).

**Victoria, Australia:** the Victorian Planning Provisions establish standard, mandatory provisions for inclusion in every local council planning scheme. Clause 52.32 of every local council planning scheme contains decision guidelines and factors the local authority must consider when making a decision on whether to grant approval for a wind energy facility. [http://www.dse.vic.gov.au/planningschemes/aavpp/52\\_32.pdf](http://www.dse.vic.gov.au/planningschemes/aavpp/52_32.pdf).

In addition, the Victorian government has published the Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria 2002 (as amended May 2003), which, as an incorporated document all planning schemes through listing in the Schedule to Clause 81 of the planning schemes, must be taken into account by the decision-making authority. <http://www.dse.vic.gov.au/planningschemes/aavpp/81.pdf>.  
<http://www.auswea.com.au/downloads/Vicguidelines.pdf>.

See also:

Department of Environment, Heritage and Local Government, **Ireland**, Draft Wind Energy Planning Guidelines 2004 (revising 1996 guidelines) [http://www.envron.ie/DOEI/doi/pub.nsf/0/9077dc4f1acf8f1c80256ee60031c31b/\\$FILE/Draft Wind Energy.pdf](http://www.envron.ie/DOEI/doi/pub.nsf/0/9077dc4f1acf8f1c80256ee60031c31b/$FILE/Draft%20Wind%20Energy.pdf).

**New Zealand** Energy Efficiency and Conservation Authority, Guidelines for Local Authorities – Wind Power, August 2004

[http://www.eeca.govt.nz/uploadedDocuments/guidelines\\_for\\_local\\_authorities\\_wind\\_power.pdf](http://www.eeca.govt.nz/uploadedDocuments/guidelines_for_local_authorities_wind_power.pdf)

**Western Australia**, Planning Bulletin No 67, Guidelines for Wind Farm Development, May 2004. <http://www.wapc.wa.gov.au/cgi-bin/index.cgi?page=/publications/policies/Policies.html>.

**United Kingdom**, Office of the Deputy Prime Minister, Planning Policy Statement 22: Renewable Energy, August 2004 [http://www.odpm.gov.uk/stellent/groups/odpm\\_planning/documents/pdf/odpm\\_plan\\_pdf\\_030334.pdf](http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/pdf/odpm_plan_pdf_030334.pdf).

Government of **India**, Ministry of Non-Conventional Energy Sources,

*Revised Guidelines for Wind Power Projects*, 13 June 1996 <http://www.mnes.nic.in/wp14.html>.

**Note:** these Guidelines address technical issues rather than environmental issues.

**United States** National Wind Coordinating Committee, *Permitting of Wind Energy Facilities*, Revised Handbook 2002 <http://www.nationalwind.org/pubs/permit/permitting2002.pdf>.

#### 4. How is guidance given to developers?

To provide greater certainty and consistency, governments may consider issuing standardized EIA requirements for wind farms. These requirements will stipulate the matters to be addressed by a wind developer in an EIS. Options for introducing EIA guidelines for developers include the following:

##### a. Government guidelines

The EIA guidelines may be set out in separate, specific government EIA guidelines for wind farms, providing a non-binding guide to developers as to how the legislative requirements in EIA legislation may be addressed in relation to wind energy facilities.

Australia, Tasmanian Department of Primary Industries, Water and Environment, *General Guidelines for the Preparation of a Wind Farm Development Proposal and Environmental Management Plan (DPEMP) for Wind Energy Projects*, July 2004 [http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/CDAT-5KZVPN/\\$FILE/Wind Farm DPEMP Guidelines.pdf](http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/CDAT-5KZVPN/$FILE/Wind Farm DPEMP Guidelines.pdf).

To be read in conjunction with Tasmania, Department of Primary Industries, Water and Environment, *Wind Energy Projects in Tasmania: Key Issues and Requirements* [http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/CDAT-5KZVUA/\\$FILE/Wind farms - key issues and requirements.pdf](http://www.dpiwe.tas.gov.au/inter.nsf/Attachments/CDAT-5KZVUA/$FILE/Wind farms - key issues and requirements.pdf).

##### b. Policy guidelines

EIA Guidelines for developers may be included as part of Policy Guidelines for decision-makers. Planning legislation will make reference to the Policy Guidelines, giving them legislative force. Examples of Policy Guidelines for decision-makers are listed above.

EIA Guidelines may incorporate or be based upon industry best practice guidelines.

See:

**Australian** Wind Energy Association and Australian Greenhouse Office, *Best Practice Guidelines for Implementation of Wind Energy Projects in Australia*, March 2002 <http://www.auswea.com.au/downloads/AusWEAGuidelines.pdf>.

**British** Wind Energy Association (BWEA), *Best Practice Guidelines for Wind Energy Development*, November 1994 <http://www.bwea.com/ref/bpg.html>.

These guidelines are currently under review to incorporate both changes in energy and planning policy, and also the industry's ten years of experience since the original publication date. The revised Guidelines are expected to be published in early 2005 and the Guidelines still stand in the interim.

European Wind Energy Association (EWEA), European Best Practice Guidelines for Wind Energy Development. <http://www.ewea.org/>.

In other jurisdictions such as South Australia, there are no standard requirements for environmental assessment for wind farm proposals, with the content of environmental assessments or impact statements agreed between proponents and the relevant decision-maker.

## **5. Is it necessary to amend planning laws and produce wind-specific guidelines?**

Not all jurisdictions choose to amend their planning laws to address wind energy facilities, or publish guidelines for the assessment of wind energy facilities, but leave them to be assessed through the usual planning procedure. An example is the State of Queensland in Australia. However, this is rare.

## **D. Assessing and Managing Specific Environmental Impacts**

### **1. Visual impacts**

Because of the nature of the wind resource, the turbines must be sited where the wind is of sufficient speed to make the farms efficient and economical. Wind farms are often sited in exposed, elevated positions likely to be visible from many locations. In particular, many of the best wind speeds may be along the coast. However, coastal areas are often areas of particularly scenic beauty, and the turbines are exposed and visually intrusive.

The perceived effect of wind turbines on the landscape is subjective and the perception that wind turbines detract from landscape values depends on a range of factors. The technical design of the turbines, their size, color, shape and number of blades affect the visual quality. In developed countries, the effect on visual amenity has been of concern to local residents, not only for aesthetic reasons, with some viewing them as intrinsically ugly, but because of the perceived negative effect on property values and tourism. However, many people perceive that wind turbines enhance the landscape.

Some visual impact is unavoidable and must be accepted or no wind farms will be allowed to proceed, thereby defeating government policy on the promotion of renewable energy. Increasing public education and awareness about the benefits of wind farms, and developing a clear policy and action plan for encouraging wind farms, with the informed participation and support of the community, are key means to increase community acceptance of wind turbines.

There is no consistent legislative approach to dealing with visual impact. Possible options are as follows:

#### **a. “No-go” Areas**

The government may declare particularly sensitive areas to be ‘no go’ areas for wind farms. These areas may be sensitive for a number of reasons – they may be of unique or an “above-average” scenic beauty, of importance for biodiversity, or of particular cultural or religious significance to indigenous peoples. For example, national parks and reserves may be declared to be “no go” areas for wind farms. The remainder of land is available for wind energy development, with proposals assessed under the usual planning laws, so that visual impact is only one of a number of

impacts to be weighed by the decision-maker when deciding whether to grant approval.

See: The State of Victoria, Australia: Victorian Planning Provisions, amended as of 24 July 2003, Planning Schemes, Clause 36.03, Public Conservation and Resource Zones,

'Wind energy facilities must not be located on land reserved under the National Parks Act 1975 (Vic).'[http://www.dse.vic.gov.au/planningschemes/aavpp/36\\_03.pdf](http://www.dse.vic.gov.au/planningschemes/aavpp/36_03.pdf);

Wales, *Draft Technical Advice Note 8: Renewable Energy*, June 2004, p. 4 "National Parks and Areas of Outstanding National Beauty"

The **Welsh** Assembly Government does not consider that the siting of large scale (25MW+) wind farms is appropriate in National Parks and AONBs [Areas of

Outstanding National Beauty], recognizing their designation as areas of value as a result of the landscape they protect, although smaller scale domestic or community-based turbines may be suitable, subject to local planning considerations. <http://www.wales.gov.uk/subiplanning/content/tans/tan08/mipps-tan8-e.pdf>.

#### **b. Identifying 'No-go' areas**

'No go' areas may not be limited to national parks and reserves. Governments, councils and the general public may undertake a process to identify those sites of extraordinary aesthetic values, not necessarily protected areas, where wind farms would have an unacceptable impact on the landscape.

**Australian** Wind Energy Association and Australian Council of National Trusts, *Wind Farms and Landscape Values*, Draft Issues Paper, May 2004

This paper is the outcome of a voluntary, joint initiative between the Australian Council of National Trusts ('ACNT') and the Australian Wind Energy Association ('AusWEA') to assess landscape values across Australia. Independent experts, funded by the federal government, are determining a methodology to assess landscape values, which will enable significant landscapes to be identified and assessed consistently across Australia. <http://www.auswea.com.au/downloads/Wind%20Farms%20&%20Landscape%20Iss%20Web.pdf>.

#### **c. Legislative prohibitions**

Although not identifying 'no go areas', legislation may prohibit wind energy development in sensitive or protected areas if the development is likely to have a significant impact on those areas.

### Oregon US, Oregon Administrative Rules, Chapter 345, Division 22

OAR 345-022-0040. The Energy Facility Siting Council may not issue a site certificate for the construction of energy facilities in designated protected areas listed in the standard, which include national and state parks, national monuments, wilderness areas, wildlife refuges and other areas that have special scenic, natural or environmental value, where the wind energy facility is likely to result in 'significant adverse impacts' on those areas.

OAR 345-022-0080. To issue a site certificate, the Energy Facility Siting Council must find, taking into account design and mitigation measures, that the wind energy facility is not likely to result in 'significant adverse impact' to 'scenic and aesthetic values identified as significant or important in applicable or federal land management plans or in local land use plans in the analysis area.'

Source: <http://www.energy.state.or.us/siting/rules/div22.pdf>.

#### d. 'No-go' areas based on visibility

In some jurisdictions, there are no 'no go' areas for wind farms based on visual impact. The usual planning procedures apply, and the effect on visual amenity is simply one of the factors to be taken into account by the decision maker when deciding whether or not to grant development approval. In such cases the law may provide guidelines to local decision-makers on how to assess the visual impact of the turbines. In some cases the decision-maker may refuse to approve the project; in others, visual impact can be mitigated by careful design and siting and the imposition of permit conditions regarding the color, design and screening of turbines.

See: **South Australia:** Planning SA, Planning Bulletin, Wind Farms, Draft For Public Consultation, August 2002, Appendix 2, 'A Suggested Methodology For Visual Impact Assessment.' [http://www.planning.sa.gov.au/windfarms/pdf/wind\\_farm\\_bulletin\\_web.pdf](http://www.planning.sa.gov.au/windfarms/pdf/wind_farm_bulletin_web.pdf)

## 2. Noise

Noise from wind turbines arises from two sources. The first is aerodynamic noise, caused by the movement of blades relative to the air, described as a "swishing" noise. This is not audible over long distances and, with a suitable minimum (buffer) distance from the turbines to dwellings, is drowned by the noise of the wind itself, and should not be a major cause of complaint. The second type of noise is mechanical noise associated with the operation of the gearbox within the nacelle and the noise of the generator. Complaints about this type of noise regard to the "persistent tonal quality" of the noise. Careful design, siting and operation and the use of acoustic enclosures and gearless turbines can mitigate this noise.

Planning approvals for wind farms are generally subject to permit conditions about noise limits. There are different standards and guidelines for assessment and measurement of noise, and the maximum permissible level of noise. In some jurisdictions, general environmental policies concerning ambient noise levels will apply to wind energy developments. In other jurisdictions, the relevant Environment

Agency has prepared noise guidelines that relate specifically to wind energy. Environment and planning law and wind energy guidelines will direct local councils or other decision-makers to the relevant legal noise standards. Also, once granted, individual permits will refer to the maximum noise limits established by law/guidelines and any conditions to be observed, such as minimum distances between the turbines and dwellings.

Examples of sources of noise and their noise levels at certain distances are as follows:

- Truck at 30 miles per hour at 100 meters: 65 dB (A)
- Vacuum cleaner at 30 meters: 60 dB (A)
- Light traffic at 30 meters: 50 dB (A)
- Large transformer at 60 meters: 40dB(A)
- Soft whisper at 1.5 meters: 30dB(A)

See: Environment Protection Authority, South Australia, Wind Farms Environmental Noise Guidelines, February 2003 <http://www.epa.sa.gov.au/pdfs/windfarms.pdf>.

Note: This standard is also used in the Australian states of New South Wales and Western Australia.

'Wind farm developments should be constructed and designed to ensure that noise generated will not exceed 5dB(A) above the background sound level or 35dB(A) using a 10-minute LA eq, whichever is greater, at the surrounding noise-sensitive premises.' See:

Clause 33 of the draft **South Australian** Environment Protection (Noise) Policy (2003), made under s 28 of the Environment Protection Act 1993 (SA), states that the Wind Farms Environmental Noise Guidelines apply to any person who operates a wind farm. [http://www.environment.sa.gov.au/epa/pdfs/noise\\_policy.pdf](http://www.environment.sa.gov.au/epa/pdfs/noise_policy.pdf) <http://www.parliament.sa.gov.au/Catalog/legislation/Acts/E/1993.76.un.html>.

**New Zealand** Standard NZ 6808:1998 – Acoustics - The Assessment and Management of Sound From Wind Turbine Generators. This standard is not available free on-line – it can be ordered as a hardcopy or PDF electronic file from Standards New Zealand at: <http://shop.standards.co.nz/productdetail.jsp?sku=6808%3A1998%28NZS%29>

Note: This standard is also used in the Australian states of Victoria and Tasmania.

'Sound levels measured at the boundary of any residential site must not exceed the greater of 40dB or background noise plus 5dB'.

ETSU/Dept of Trade and Industry UK, The Assessment and Rating of Noise from Wind Farms, September 1996, 1/Pub URN 96/1192 <http://www.dti.gov.uk/energy/renewables/publications/noiseassessment.shtml>.

International Energy Agency, Recommended Practices for Wind Turbine Testing and Evaluation –4. Acoustic Measurement of Noise Emissions from Wind turbines, 3rd ed., 1999) – Note: superseded by IEC 61400-11 Acoustic Noise Measurement Techniques (see IEC reference directly below)

International Electrotechnical Commission, Wind turbine generator systems - Part 11: Acoustic noise measurement techniques, IEC 61400-11, 2nd ed., 2002-12. Available by purchase only. Table of contents available at <http://domino.iec.ch/webstore/webstore.nsf/artnum/029528>.

This standard is used in Europe and often in the US. The standard is currently under revision. Work in progress: IEC: Amendment 1 to IEC 61400-11: Wind turbine generator systems - Part 11: Acoustic noise measurement techniques. (IEC 61400-11 Amd.1 Ed. 2.0)

### 3. Birds and Bats

Wind farms may impact on birds and bats, especially migratory bird species and birds of prey, through collisions with turbines. The majority of collisions occurred in the U.S. in the 1980s, where turbines were constructed using lattice towers, which provide an area for birds to roost, and/or where turbines were built densely together in the path of migratory birds. The modern design of solid towers eliminates the ability for birds to roost in towers and, as regards migratory birds, the height of the towers and their spacing can be designed so as to minimize the chance of structures being built across migration paths. In countries with little or no experience of wind power, little will be known about the impact of wind turbines on birds, and owners/operators of wind farms should be placed under permit conditions to observe and monitor the impact on birds.

See:

US National Wind Coordinating Committee, Studying Wind Energy/Bird Interactions: A Guidance Document, Metrics or Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites, December 1999 [http://www.nationalwind.org/pubs/avian99/Avian\\_booklet.pdf](http://www.nationalwind.org/pubs/avian99/Avian_booklet.pdf);

Environment Canada, Wind Turbines and Birds: A Guidance Document for Environmental Assessment, Phase III Report, Draft for Consultation, December 2003 [http://www.canwea.ca/downloads/en/PDFS/BirdStudiesDraft\\_May\\_04.pdf](http://www.canwea.ca/downloads/en/PDFS/BirdStudiesDraft_May_04.pdf).

### 4. Electromagnetic Interference

Wind turbines may cause electromagnetic interference with microwave, television and radio signals. If a wind turbine is sited between a transmitter and receiver it can interfere with the signal as it arrives at the receiver. Usually means of mitigation, avoidance and remedy can be found, including changing the location of particular turbines, the choice of generator, tower design or blade material. The best way to identify and address potential adverse effects is to consult with communications operators at an early stage.

Victoria, Australia, Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria 2002 (as amended May 2003), p. 26

'The siting of wind turbines in the 'line of sight' between transmitters and receivers should be avoided.' <http://www.auswea.com.au/downloads/Vicguidelines.pdf>.



## 5. Aviation

Because of the height of turbines, if there is an airport in the vicinity of a wind farm, flight path envelopes must be avoided. Usually the relevant government authority, such as a Civil Aviation Authority should be consulted about a proposed development.

See:

Victoria, Australia, Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria 2002 (as amended May 2003), p. 26

'Consultation with the Civil Aviation Safety Authority is necessary to determine any airfields within a 30km radius and associated requirements. Turbines should not protrude into any obstacle limitation surface for any airfield. The Civil Aviation Safety Authority should be consulted. <http://www.auswea.com.au/downloads/Vicguidelines.pdf>.

See also:

British Wind Energy Association, Wind Energy and Aviation Interests - Interim Guidelines, 2002 <http://www.dti.gov.uk/energy/renewables/publications/pdfs/windwenergyaviation.pdf>.

## E. Issues Relating To Offshore Wind Farms

### 1. Introduction

Offshore wind resources provide a valuable potential source of energy. A key advantage of constructing wind farms offshore is that it may avoid many of the controversies over siting that have occurred in developed countries, particularly in relation to visual impact and construction in or near sensitive areas such as national parks. To date, the relatively higher costs associated with constructing wind farms offshore compared to onshore have meant that only a small number of countries, mainly in Europe, and the USA, have existing offshore wind installations. However, as technology improves, the costs of offshore should fall.

Some of the environmental impacts of offshore wind farms are of a similar type to those of onshore wind energy installations and need to be identified through EIA procedures, and the impacts avoided or mitigated, and monitored. Such impacts include, for example, the impact on birds, sea mammals, and fish, on fauna and the seabed, visual impact, noise, and interference with radar and radio signals.

There are other issues specific to offshore development that also need to be considered. In particular, the rights of other users of the sea must be addressed in legislation. Major issues that should be addressed are conflicts with navigation and fisheries, the safety of installations, and the decommissioning of offshore wind turbines. These are discussed in more depth below.

The rights and obligations of countries wishing to develop offshore wind energy resources, and the rights of other users of the sea, such as rights of navigation, will depend upon international law. Each nation should be aware of its rights and obligations according to which Conventions concerning the sea it has ratified, in particular the 1958 Geneva Convention on the Continental Shelf, and the

1982 United Nations Convention on the Law of the Sea, as well as rules of customary international law. The rights and obligations of states and users of the sea will depend upon the maritime zone in which the offshore wind farm is to be installed, as international law differentiates between rights and obligations in the internal waters of a state (harbors and ports), the territorial sea, the high seas, the Exclusive Economic Zone (if claimed) and the continental shelf.

Few countries have offshore wind energy industry and there is little the way of legislation and regulations that have been translated into English. This section will focus on the legislative regime of the United Kingdom to provide an example of the types of laws that could be considered.

Delft University Wind Research Institute (**Netherlands**), Offshore Wind Energy: Ready to Power a Sustainable Europe, December 2001, providing a description of the impacts of offshore wind energy and a brief summary in English of national planning rules and regulations in Europe as of 2001. [http://www.offshore-wind.de/media/article000425/CA-OWEE\\_Complete.pdf](http://www.offshore-wind.de/media/article000425/CA-OWEE_Complete.pdf)  
<http://www.offshorewindenergy.org/> (for information on offshore wind energy)

## 2. Legislative Example: the Offshore Regime of England and Wales

### a. General Framework

The offshore wind energy regime of England and Wales is established by the Energy Act 2004 (UK) and the Electricity Act 1989 (UK). (<http://www.legislation.hms.gov.uk/acts/acts2004/20040020.html> - *aofs*).

The **UK** government has undertaken a strategic approach to offshore wind energy developments. Three areas within the UK's territorial sea have been identified where offshore development appears most promising. Strategic environment impact assessments have been conducted in relation to these three areas to determine the impact of offshore wind development on the environment and other users of the marine environment.

Strategic Environmental Assessment for Offshore Wind website <http://www.og.dti.gov.uk/offshore-wind-sea/>.

The **UK** has also established a Renewable Energy Zone where offshore renewable energy facilities may be installed in areas beyond the UK's territorial sea.

**Energy Act 2004** ss 84-88.

Development consents are required from the Secretary of State for the construction of all offshore wind energy facilities of 1MW or over. (<http://www.legislation.hms.gov.uk/acts/acts2004/40020-h.html> - 84).

**Electricity Act 1989** (UK) s 36, as amended by the Energy Act 2004 (UK) § 89 'Activities offshore requiring 1989 Act licenses provides that the UK Department of Trade and Industry (DTI) is the co-coordinating administrative body for these applications. The DTI will consult with a range of government departments in regard to the effects of proposed wind energy developments. ([http://www.legislation.hms.gov.uk/acts/acts1989/ukpga\\_19890029\\_en\\_2.html](http://www.legislation.hms.gov.uk/acts/acts1989/ukpga_19890029_en_2.html)) - *mdiv36* (<http://www.legislation.hms.gov.uk/acts/acts2004/40020-h.html> - 84);

UK Department for Trade and Industry, Guidance Notes, Offshore Wind Farm Consents Process (March 2004, as amended August 2004) [http://www.dti.gov.uk/energy/leg\\_and\\_reg/consents/guidance.pdf](http://www.dti.gov.uk/energy/leg_and_reg/consents/guidance.pdf).

## **b. Particular issues in relation to offshore wind energy**

The Energy Act 2004 (UK) regulates key issues associated with offshore wind farms, including the safety of installations, navigation and civil aviation, and the decommissioning of installations. Regulations may be passed under the Act to deal with these matters in more detail.

### **i. Navigation and Civil Aviation**

The construction of offshore wind energy installations may pose a risk to ship and air traffic. To eliminate or minimize the risk of collisions with ships, wind turbines may need to be prohibited from offshore areas where shipping lanes exist and areas where ships lay anchor to enter harbors. Alternatively, navigation routes may be altered, if possible, to minimize collision risks. The marking of turbines in accordance with national or international guidelines will reduce the risk of collisions. Usually collision risk analyses will be required as part of the EIA process.

Countries may wish to regulate the rights of navigation through legislation in order to ensure wind turbines have priority over navigation, although such restrictions should be in accordance with the rights of navigation existing in international law.

#### **Energy Act 2004 (UK), ss 99-101, Navigation and Civil Aviation, inserting the following sections 36A and 36B into the Electricity Act 1989 (UK)**

36A Declarations extinguishing etc. public rights of navigation

- (1) Where consent is granted by the Secretary of State or the Scottish Ministers in relation to-
  - (a) the construction or operation of a generating station that comprises or is to comprise (in whole or in part) renewable energy installations situated at places in relevant waters, or
  - (b) an extension of a generating station that is to comprise (in whole or in part) renewable energy installations situated at places in relevant waters or an extension of such an installation, he or (as the case may be) they may, at the same time, make a declaration under this section as respects rights of navigation so far as they pass through some or all of those places.
- (2) The Secretary of State or the Scottish Ministers may make such a declaration only if the applicant for the consent made an application for such a declaration when making his application for the consent.
- (3) A declaration under this section is one declaring that the rights of navigation specified or described in it-
  - (a) are extinguished;

- (b) are suspended for the period that is specified in the declaration;
- (c) are suspended until such time as may be determined in accordance with provision contained in the declaration; or
- (d) are to be exercisable subject to such restrictions or conditions, or both, as are set out in the declaration.

#### 36B Duties in relation to navigation

- (1) Neither the Secretary of State nor the Scottish Ministers may grant a consent in relation to any particular offshore generating activities if he considers, or (as the case may be) they consider, that interference with the use of recognized sea lanes essential to international navigation-
- (a) is likely to be caused by the carrying on of those activities; or
  - (b) is likely to result from their having been carried on.

Source: <http://www.legislation.hms.gov.uk/acts/acts2004/40020-h.html> - 99.

UK Maritime and Coastguard Agency, Steps Taken to Address Navigational Safety in the Consent Regime for the Establishment of Wind farms off the UK Coast, 8 July 2003, provides that as regards the safety of air traffic, legislation may permit the relevant Civil Aviation Authority to prohibit the construction of wind farms from certain offshore areas where this is required to protect air navigation. The relevant Civil Aviation Act may be amended to allow the Civil Aviation Authority to issue orders where these are required to protect air safety. Orders may concern matters such as interference with radar and radio signals, for example, through the equipping of wind turbines with radar reflectors and fog signaling devices. (<http://www.mca.gov.uk/c4mca/mcga-regs/windfarm>);

#### Energy Act 2004 (UK) s100.

The Energy Act 2004 (UK) amends the Civil Aviation Act 1982 (UK) so that regulations made be made concerning aircraft flying in the vicinity of renewable energy installations offshore. Further more, Air Navigation Orders may be made regarding renewable energy installations located within a Renewable Energy Zone as if those installations were located in a part of the United Kingdom. (<http://www.legislation.hms.gov.uk/acts/acts2004/40020-h.html> - 100)

British Wind Energy Association, Wind Energy and Aviation Interests - Interim Guidelines, 2002 (<http://www.dti.gov.uk/energy/renewables/publications/pdfs/windwenergyaviation.pdf>).

#### ii. Safety Zones for Installations

Countries may consider passing legislation to establish safety zones around offshore wind turbines to ensure the reasonable safety of navigation and of the structures themselves. Legislation may make it an offence to enter a safety zone. Legislation should have due regard to the rights of navigation in international law.

### Energy Act 2004 (UK), §§ 95-98, Safety Zones for Installations

95(2) If the Secretary of State considers it appropriate to do so for the purpose of securing the safety of-

- (a) the renewable energy installation or its construction, extension or decommissioning,
- (b) other installations in the vicinity of the installation or the place where it is to be constructed or extended,
- (c) individuals in or on the installation or other installations in that vicinity, or
- (d) vessels in that vicinity or individuals on such vessels,

he may issue a notice declaring that such areas as are specified or described in the notice are to be safety zones for the purposes of this Chapter.

#### 96 Prohibited activities in safety zones

- (1) A vessel is not to enter or remain in a safety zone except where permission for it to do so is granted-
  - (a) by or in accordance with provision contained in a notice under section 95; or
  - (b) by or in accordance with provision contained in regulations made by the Secretary of State.
- (2) A person must not carry on an activity wholly or partly in a safety zone if his doing so is prohibited by or in accordance with provision contained in a notice under section 95

#### 97 Offences relating to safety zones

- (1) Where a vessel enters or remains in a safety zone in contravention of section 96(1), the vessel's owner and her master are each guilty of an offence.
- (2) Where-
  - (a) a vessel enters or remains in a safety zone with a permission granted for the purposes of section 96, and
  - (b) there is a contravention of a condition of that permission in relation to the vessel or individuals on the vessel, the vessel's owner and her master are each guilty of an offence.
- (3) A person who carries on an activity wholly or partly in a safety zone in contravention of section 96(2) is guilty of an offence.

Source: <http://www.legislation.hmso.gov.uk/acts/acts2004/40020-h.html> - 95.

### iii. Fisheries

The construction of wind farms offshore may cause a conflict of interest with fishing interests. In order to reduce the potential for conflict with fishing interests and to protect fish stocks, governments may consider requiring financial compensation to be paid to fishing interests if fishing is actually reduced, avoiding the construction of turbines in sensitive spawning areas or areas of high commercial or conservation value; and/or avoiding construction during important breeding, nursery or feeding periods.

See: UK Centre for Environment, Fisheries and Aquaculture Science, Offshore Wind Farms: Guidance Note for Environmental Impact Assessment in Respect of FEPA and CPA Requirements, June 2004

**Note:** FEPA is the Food and Environment Protection Act (UK) 1985 and CPA is the Coast Protection Act (UK) 1949. <http://www.cefas.co.uk/publications/files/windfarm-guidance.pdf>

British Wind Energy Association (BWEA), BWEA Recommendations for Fisheries Liaison, 5 August 2004 <http://www.bwea.com/ref/fisheriesBP.pdf>

### iv. Social Acceptance

As with onshore wind turbines, there may be public objections to offshore wind farms, arising from concern over visual impact, conflict with fishing interests, and the protection of birds and the marine environment. Early and transparent consultation and public participation are crucial means to identifying public concerns and achieving public acceptance of offshore wind farms.

See: British Wind Energy Association (BWEA), Best Practice Guidelines: Consultation for Offshore Wind Energy Developments (2002) <http://www.offshorewindfarms.co.uk/reports/bweabpgcons.pdf>

### v. Decommissioning of Installations

The limited lifespan of turbines to some 20 years give rise to the issue of the decommissioning of installations. International obligations exist concerning the decommissioning and removal of offshore installations under the Geneva Convention on the Continental Shelf and the United Nations Convention on the Law of the Sea. Various options exist to decommission offshore installations, including abandoning the structures where they stand, or full or partial removal of the structure. Where the structures are fully or partially removed, disposal becomes an issue. Governments may consider requiring wind energy companies to put in place decommissioning plans before granting approval to construct the wind farm.

### Energy Act 2004 (UK), Chapter 3, Decommissioning of Installations

#### 105 Requirement to prepare decommissioning programs

- (1) This section applies where-
- (a) there is a proposal by a person to construct a relevant object in waters regulated under this Chapter, or to extend a relevant object in such waters;
  - (b) here is a proposal by a person to operate or to use a relevant object in such waters on the completion of its construction, or of any extension of it in such waters; or
  - (c) a person is constructing, extending, operating or using a relevant object in such waters or has begun in such waters to decommission such an object.
- (2) The Secretary of State may by notice require that person to submit to him a program for decommissioning the relevant object (a "decommissioning program").
- (8) A decommissioning program-
- (a) must set out measures to be taken for decommissioning the relevant object;
  - (b) must contain an estimate of the expenditure likely to be incurred in carrying out those measures;
  - (c) must make provision for the determination of the times at which, or the periods within which, those measures will have to be taken;
  - (d) if it proposes that the relevant object will be wholly or partly removed from a place in waters regulated under this Chapter, must include provision about restoring that place to the condition that it was in prior to the construction of the object; and
  - (e) if it proposes that the relevant object will be left in position at a place in waters regulated under this Chapter or will not be wholly removed from a place in such waters, must include provision about whatever continuing monitoring and maintenance of the object will be necessary

#### 109 Carrying out of decommissioning programs

- (1) Where a decommissioning program is approved by the Secretary of State, it shall be the duty of the person who submitted the program to secure-
- (a) that it is carried out in every respect; and
  - (b) that all the conditions to which the approval is subject are complied with.

#### 110 Default in carrying out decommissioning programs

(1) Where-

- (a) a decommissioning program approved by the Secretary of State is not carried out in a particular respect, or
- (b) a condition to which the approval is subject is contravened,

the Secretary of State may, by notice, require a person subject to the duty under section 109(1) in relation to the program to take such remedial action as may be specified in the notice.

- (2) Remedial action required by a notice under this section must be taken within such period as may be specified in the notice.
- (3) A person who fails to comply with a notice given to him under this section is guilty of an offence

Source: <http://www.legislation.hmso.gov.uk/acts/acts2004/40020-i.html> - 105.

### III. CONCLUSION

Solar and wind have tremendous potential as energy resources, but there are significant obstacles to making that potential a reality. They are, however, the fastest growing energy resources in the world, and as they grow, the prices will come down as they are mass produced. The obstacles are being addressed with legislation described in this chapter with a considerable degree of success.



## CHAPTER D. ENERGY FROM BIOMASS

### ENVIRONMENTAL ISSUES AND LEGISLATIVE RESPONSES

Teresa Malyshev\*

#### I. INTRODUCTION

The International Energy Agency estimates that, in 2002, biomass and waste<sup>148</sup> accounted for some 11% of global energy demand.<sup>149</sup> In OECD countries, biomass use is concentrated largely in the pulp and paper sector and to a lesser extent in the residential and transport sectors. In developing countries, biomass is used predominately as a fuel for cooking and heating, but additional uses include brick-making, fish-smoking, food processing and other small industries.<sup>150</sup>

Biomass is expected to play a key role in meeting renewable energy objectives in the European Union, Japan and the United States. Compared with oil, gas and coal, biomass used for energy does not contribute to global warming.<sup>151</sup> Biomass offers a carbon-neutral source of energy that is renewable on a short time scale, and hence provides an attractive means of climate change mitigation. Most of the growth of biomass use in OECD countries will be due to policies that support its use. Except for the industry sector, where biomass technologies are economic, most of the technologies used in the residential and transport sectors are costly compared with fossil fuel ones. Moreover, energy prices in most countries do not reflect negative externalities from fossil fuel use.

In developing countries, demand for biomass is also expected to rise; some 2.8 billion people are expected to continue to rely on traditional biomass to meet their heating and cooking needs in 2030.<sup>152</sup> The technologies used to convert biomass feedstock into energy in OECD countries are considerably more efficient than those used in many developing countries. A major challenge for policymakers is how to tackle the problems posed by the traditional use of biomass, such as low combustion efficiency and health hazards.<sup>153</sup>

Given increased global interest in the role of biomass for meeting energy security and climate change goals, it is important for policymakers and legislators to understand the environmental

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<sup>148</sup> Biomass resources include agricultural crops, agricultural residues, sugar industry wastes, forestry crops, forestry residues, black liquor, animal waste, sewage, industrial waste, and biodegradable portion of municipal solid waste, see [http://www.iea.org/Textbase/subjectqueries/keyresult.asp?KEYWORD\\_ID=4116](http://www.iea.org/Textbase/subjectqueries/keyresult.asp?KEYWORD_ID=4116).

<sup>149</sup> World Energy Outlook 2004, IEA/OECD, Paris, France. <http://www.iea.org>.

<sup>150</sup> Technologies for utilizing biomass sources include direct combustion in cook stoves, boilers or as a fuel in engines or turbines; advanced thermal conversion of biomass to a secondary fuel by thermal gasification or pyrolysis, followed by combustion in an engine or turbine; biological conversion to methane by bacterial anaerobic digestion and chemical or biochemical conversion of organic material to produce methanol, ethanol or biodiesel (Renewable Sources of Energy, IEA, 1987), <http://www.iea.org>.

<sup>151</sup> As they grow, plants use and store carbon dioxide. This is released when the plant material is burned. Other plants then use the carbon dioxide that has been released. Carbon is converted from carbon dioxide in the atmosphere and stored in carbon sinks or forests planted for the purpose. Using biomass closes this cycle of storing carbon dioxide.

<sup>152</sup> International Energy Agency, World Energy Outlook 2002, Paris, France. See <http://www.worldenergyoutlook.org/pubs/weo2002/EnergyPoverty.pdf>

<sup>153</sup> World Energy Council, Survey of Energy Resources, 2004. <http://www.worldenergy.org/wec-geis/publications/reports/ser/wood/wood.asp>.

effects, on soil, water, air and biodiversity, of using biomass for energy. These effects can be mitigated in a proper legislative framework. The environmental impacts of biomass energy can be summarized as follows:<sup>154</sup>

1. Biodiversity (i.e. changes in the use of chemical inputs, changes in crop rotations, possible arable conversion of grassland and forests, potential creation of landscape elements);
2. Soil (organic matter content, soil structure, nutrient content);
3. Quality of water and watersheds;
4. Air and atmosphere (ozone, acidification, particulate emissions, greenhouse gas emissions);
5. Human health (pollution of air and water, allergenic pollen from crops).

Legislation addressing biomass energy is complex because of the interaction between the agriculture, forestry and energy sectors. Laws aimed at mitigating the environmental impact of the production and conversion of biomass feedstock for distribution will differ from laws guiding the final use of biomass energy, such as for power generation or transport. Growing and maintaining agricultural or forestry biomass, particularly sustained production of energy crops on the same surface of land, has an environmental impact on biodiversity, soil and water. Production of biomass for energy may affect the quality of air and human health, either positively or negatively.

Since legislation is a tool to achieve a given set of policy objectives, it is necessary to identify the environmental policy objectives for biomass energy development. Any legislative framework should emphasize coherence among its component laws, rules and regulations vis-à-vis the desired policy objectives; the ease of its enforcement, monitoring and impact measurement; transparency of institutional responsibilities; and implementation costs in terms of data and human resources. This chapter analyses the legislative needs for achieving environmental policy objectives and cites specific legislation in developing and developed countries. First, legislative definitions of biomass are provided. The following two sections address legislative responses to the environmental impacts of cultivating agricultural and forestry biomass. Finally, the chapter focuses on laws impacting final use of biomass energy.

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<sup>154</sup> Jane Feehan and Jan-Erik Petersen, "A Framework for Evaluating the Environmental Impact of Biofuel Use," OECD Workshop on Biomass and Agriculture, 10-13 June 2003, Vienna, Austria. <http://webdomino1.oecd.org/comnet/agr/BiomassAg.nsf>.

## II. DEFINING BIOMASS

### What is an accurate legislative definition of biomass?

Biomass needs to be defined accurately and completely, in order to avoid ambiguity in legislation. It should be defined in such a way as to provide for necessary adjustments with respect to technological developments. A comprehensive definition of biomass will also allow for harmonization of policies and laws among countries and, eventually, to standardization of the characteristics of all biomass types.

#### **United States: Biomass Energy Equity Act of 2003, Bill HR 804, Section 2 (5)**

The term "biomass" means any solid, non-hazardous, cellulosic waste material that is segregated from other waste materials and that is derived from—

- (A) any of the following forest-related resources: mill residues, pre-commercial thinnings, slash, and brush, but not including old-growth timber (other than old-growth timber that has been permitted or contracted for removal by any appropriate Federal authority through the National Environmental Policy Act or by any appropriate State authority),
- (B) solid wood waste materials, including waste pallets, crates, dunnage, manufacturing and construction wood wastes (other than pressure-treated, chemically-treated, or painted wood wastes), and landscape or right-of-way tree trimmings, but not including municipal solid waste (garbage), gas derived from the biodegradation of solid waste, or paper that is commonly recycled, or
- (C) agriculture sources, including orchard tree crops, vineyard, grain, legumes, sugar, and other crop by-products or residues.

Available at: <http://thomas.loc.gov/cgi-bin/query/z?c108:H.R.804.IH>.

**European Union:** European Commission Directive 2001/77/EC in the Official Journal of the European Communities (27.10.2001 L 283) that defines biomass.

"... the biodegradable fraction of products, waste and residues from agriculture (including vegetal and animal substances), forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. " ([http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/L\\_283/L\\_28320011027en00330040.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/L_283/L_28320011027en00330040.pdf)).

Biofuels are transportation or boiler fuels derived from biological sources, such as cereals, grains, sugar crops, rapeseed, soybean, sunflower, grasses, trees and organic waste material. Legislation addressing the environmental impact of biofuels also needs to be based on an accurate and complete definition.

See:

**Canada: Alternative Fuels Act, 1995, c. 20, that defines biofuels as an alternative fuel: “alternative fuel” means fuel that is:**

- (a) for use in motor vehicles to deliver direct propulsion,
- (b) less damaging to the environment than conventional fuels, and
- (c) prescribed by regulation, including, without limiting the generality of the foregoing, ethanol, methanol, propane gas, natural gas, hydrogen or electricity when used as a sole source of direct propulsion energy...”

Source: <http://laws.justice.gc.ca/en/a-10.7/1549.html>.

### III. ADDRESSING THE ENVIRONMENTAL IMPACTS OF BIOMASS ENERGY

#### A. What are the environmental impacts of growing biomass feedstock for energy and how has legislation addressed these impacts?

Bio-energy programs, when coupled with agro-forestry and integrated farming, have the potential to improve food production while growing energy crops and expanding rural incomes. Increasing agricultural production of biomass can be achieved by substituting for other agricultural crops that are in surplus, intermixing energy crops with food or forage crops in an agro-forestry approach, and incorporating into land conservation systems such as windbreaks. There is also potential to increase the use of crop residues, provided this is consistent with the levels of organic matter and control of erosion.<sup>155</sup>

The potential resource from energy crops, such as short rotation trees or other plantations, is estimated to be extremely large. In parallel with the prospects of increased food production, there are large areas of deforested and degraded land that would benefit from the establishment of biomass plantations, with estimates ranging up to over 300 million hectares available for reforestation and agro-forestry.<sup>156</sup> Other studies of the potential cropland resources in developing countries have indicated that these countries will be using only 40% of their potential cropland in 2025.<sup>157</sup> The balance between higher yields in good lands and the benefits of bringing degraded lands back into production is an important issue.

<sup>155</sup> See <http://www.ieabioenergy.com/ourwork.php?t=31#31>.

<sup>156</sup> UN FAO/Netherlands, “Conference on the Multifunctional Character of Agriculture and Land”, Maastricht, September 1999, [http://csdngo.igc.org/agriculture/agr\\_Dutch.htm](http://csdngo.igc.org/agriculture/agr_Dutch.htm). Another study by Hall et. al puts the potential even higher. Assuming that plantations have an average yield of 15 dry tones per hectare per year, with a heating value of 20 gigajoules per ton, and that plantations are established on 10% of the world’s land that is now woodland, cropland and permanent pasture, a total of 890 million hectares of biomass would produce around 260 exajoules per year, equivalent to over 72,000 TWh of electricity generation. (Hall, D.O., Rosillo-Calle, F., Williams, R.H. & Woods, J. (1993) Biomass for Energy: Supply Prospects. Chapter 14 in Renewables for Fuels and Electricity, ed. B.J. Johansson, et al, Island Press, Washington, DC;) To get an idea of how large this potential is, the International Energy Agency estimates that global electricity demand was only some 16,000 TWh in 2002. [http://www.iea.org/Textbase/publications/newfreedetail2.asp?F\\_PUBS\\_ID=582](http://www.iea.org/Textbase/publications/newfreedetail2.asp?F_PUBS_ID=582).

<sup>157</sup> World Agriculture towards 2010, UN FAO, Rome, 1996, <http://www.mindfully.org/Food/FOA-Food-Outlook.htm>.

Erosion is a problem related to the cultivation of annual crops. The best-suited energy crops are perennials, with much better land cover than food crops. During harvest, the removal of soil can be kept to a minimum, since the roots remain in the soil. Another positive effect is that the formation of an extensive root system adds to the organics matter content of the soil. The choice of crop can have a considerable effect on water-use efficiency. Some eucalyptus species have very good water-use efficiency, considering the amount of water needed per ton of biomass produced. Mono-cultural crops also create problems of erosion and loss of biodiversity. But a eucalyptus plantation on a large area could increase the local demand for groundwater and could affect its level. The impacts of the hydrological situation should be evaluated at the local level.

The net affect of growing energy crops on soil quality depends to a large degree on the alternative uses of the land. Converting cropland to energy crops may have minimal impacts. If dedicated energy crops that need little fertilizer or pesticides, such as perennial switch grass, are mown instead of ploughed, they can enrich soil nutrients and provide ground cover, thus reducing erosion. They may also provide better habitats for birds and other wildlife than annual crops. See:

**United States:** The U.S. Farm Security and Rural Investment Act of 2002 (P.L. 107-171, Section 2101, Conservation Title II)

Allows biomass harvesting on Conservation Reserve Program lands where consistent with soil, water, and wildlife habitat goals of the CRP program. CRP payments are reduced by economic value of the biomass activity. <http://bennelson.senate.gov/Crs/Energy%20Provisions.pdf>.

**England:** The Energy Crops Scheme in the United Kingdom

Provides grants for establishing short rotation tree projects. The crops must be grown for power generation, combined heat and power or heat production. <http://www.dti.gov.uk/energy/renewables/index.shtml>

The Energy Crops Regulations (2000), SI 2000/3042, are available at <http://www.legislation.hms.gov.uk/si/si2000/20003042.html>.

The use of biomass for energy has raised the issue of the risk of depletion of soil carbon stocks in biomass production systems, due to a higher proportion of the organic matter and nutrients being removed from the site compared with conventional agricultural and forestry systems. A recent study indicates that although there may be some decline in soil carbon associated with biomass production, this is negligible in comparison with the contribution of bio-energy systems towards greenhouse gas mitigation through avoided fossil fuel emissions.<sup>158</sup> In Sweden, some 15,000 hectares of willow trees are commercially grown.<sup>159</sup> The harvested fuel is used together with forest residues in municipal heat and combined heat and electricity production plants.

<sup>158</sup> The study can be accessed at: <http://www.joanneum.at/iea-bioenergy-task38/projects/task38casestudies>.

<sup>159</sup> For recommendations on how to plan and run a profitable short-rotation coppice plantation, see Birger Danfors, Stig Ledin, Hakean Rosenquist, Short-Rotation Willow Coppice Growers Manual (1998). <http://www.shortrotationcrops.com/taskreports.htm>.

See:

European Union: The E.U.'s "Forestry Strategy" [41z], The Official Journal of the European Communities (26.6.1999 L 160, p. 80).

The European Commission emphasized that the potential of forests as a source of energy, either by short rotation plantation or by the use of forest residues, should be favored. Furthermore, the Commission in its Communication "Directions toward sustainable agriculture" [42] stressed the role of biomass for combating climate change and made a reference in this context to the objectives of the White Paper on renewable energy, thereby introducing the climate change considerations into the concept of sustainable development. It was also underlined that increased biomass exploitation from forest residues would at the same time constitute a means to prevent forest fires, often caused by non- removed residues. The above Communications also provide useful guidance for the selection of projects to be supported in the field of biomass under Community programs in the framework of Rural Development. ([http://europa.eu.int/eur-lex/pri/en/oj/dat/1999/L\\_160/L\\_16019990626en00800102.pdf](http://europa.eu.int/eur-lex/pri/en/oj/dat/1999/L_160/L_16019990626en00800102.pdf)).

Fertilizers and pesticides have an important impact on rivers and other water bodies. While the introduction of low-fertilizer crops, such as certain grasses and trees and sugar cane, will lower nitrogen release and run-off, increasing agricultural activity for grain based biofuels production can increase the use of fertilizers and pesticides during crop production. Then, nitrogen fertilizer run-off increases the nitrification of nearby water bodies. In such cases, best practice fertilizer application should be used, with precision farming methods, geographic information systems, and "little and often" fertilizer application strategies to minimize pollution as well as to lower production costs.<sup>160</sup>

## **B. How does management of forestry resources relate to biomass energy and what legislation is required for sustainable management?**

The development of a legislative framework for wood energy is complex since there is no single set of policies exclusively for wood energy. Legislation is often derived as a corollary of other national and sectoral policies. In many countries environmental goals emphasizing forest conservation have resulted in policy measures that adversely affect the movement and trade of wood and wood fuels derived from sources other than forests. Redirecting such policies to allow the non-detrimental use of wood fuels would require a better understanding of the nature of wood energy and the ways in which it can be promoted without compromising environmental goals. Legislation should address the following key policy issues.<sup>161</sup>

<sup>160</sup> <http://www.pda.org.uk/leaflets/20/no20-print.htm>.

<sup>161</sup> Food and Agriculture Organization of the United Nations, Regional Wood Energy Programme in Asia, Policies, Legislation and Institutions for Sustainable Wood Energy Development, Summary of Proceedings of Expert Consultation on Sustainable Wood Energy Programs: Policy and Institutional Issues, 29-31 July 1998, Hua Hin, Thailand.

## 1. Land ownership, tenure

Land ownership issues often represent the most important political barrier to biomass energy projects. See for example:

**Lesotho:** National Forestry Policy, 1997 and the Forestry Act, 199

The Forestry Act aims to divest the State Forest Reserves to the local level and states, Section 11, that after consulting with the appropriate local authority, the Chief Forestry Officer “shall advise the Minister on the transfer of ownership, control and management of any forest reserve to individuals, groups of individuals, communities, organizations or cooperatives”. Transfer will be embodied in a written agreement “binding on both the parties and shall provide that the Minister shall have a right to reclaim the forest reserve if the said agreement is breached materially.” Liremo and matsema, small natural forest groves and woodlots previously vested in the Basotho Nation and given to local chiefs to administer, will now be declared Community Forests.

Legislation pertaining to the Forestry Act of 1998 is available at <http://faolex.fao.org/docs/pdf/les20800.pdf>.

(See also <http://www.fao.org/docrep/x8080e/x8080e04.html>)

## 2. Access to wood resources

Gambia: Forestry laws in Gambia, since 1998, have covered community forests and community participation in forest management. The laws provide legal encouragement for tree-planting on farmland and pasture and along roadsides. People are allowed the usage of both forest and non-forest trees growing outside the forest but the harvesting and felling of forest trees is regulated by Article 6 of the Forest Bill. Non-forest trees belong to the person or community planting or inheriting them, but the transport of logs from these trees requires a special permit (Article 7).

Legislation pertaining to the Forest Bill, 1998 (Gambia) is available at [http://www.crdfp.org/material/downloads/forest\\_act\\_1998.pdf](http://www.crdfp.org/material/downloads/forest_act_1998.pdf).

(See also <http://www.fao.org/docrep/005/y2328e/y2328e06.html>)

### **India: Legislative responses to forestry offences in the Indian Forest Act 1927**

The Indian Forest Act is the principal legislation regulating the management of forests. While in some states the Act has been brought into force, several others have enacted their own acts that are adapted versions of the Central Act. These Acts provide for penalties for various forest offences. However, with steep increase in prices of forest produce over the years, the incidences of forest offences have increased and an amendment of IFA has been recognized.

The proposed amendments are:

- Increase in penalties for forest offences to match their market prices.
- Delegating more powers to forest officers for confiscating (not just seizing) all tools, arms,

vehicles, etc. used in commission of forest offences.

- Make serious forest offences cognizable and non-bailable.

**Other matters needing special attention are:**

- The existing laws, rules and regulations on different aspects of land use should be combined into a legal framework integrating the principles of comprehensive land use.
- All laws compelling a farmer to obtain permission for felling trees grown on his own land must be repealed.
- Rules and regulations for a farm forester to obtain transit passes for the movement of his forest produce should be withdrawn.

Source: Wood Energy Policy Paper, India, FAO/RWEDP, draft manuscript. For more information on the Indian Forest Act 1927, see <http://www.indialawinfo.com/bareacts/IFA.html>.

### 3. Wood extraction and wood product movement

A ban on harvesting trees to be used in silviculture can be detrimental to the health of forests.<sup>162</sup>

See for example:

**India:** The National Forest Policy 1988 imposed a blanket ban on felling of green trees. This ban led to a rise in the unit prices of wood fuel and an increase in illicit harvesting and trade. Rules on transit of forest produce in most States are detrimental to free trade in wood fuels. Most State Governments are levying charges on fuel wood collected from forests. <http://envfor.nic.in/>

**China:** The Forestry Law of the People's Republic of China, effective from January 2000, lays out the general provisions, forest operation and management, tree planting and afforestation, tree harvesting and legal liabilities for implementation of the law.

(Promulgated by Decree No. 278 of the State Council on January 2, 2000)  
[http://www.zhb.gov.cn/english/law\\_detail.php3?id=54](http://www.zhb.gov.cn/english/law_detail.php3?id=54)

### 4. Wood and wood trade

In India, some states have imposed a complete ban on inter-state movement of certain high value species of wood. For example, there is ban on inter-state movement of red sanders in Andhra Pradesh, rosewood in Karnataka, and sandalwood in Andhra Pradesh, Karnataka and Tamil Nadu.<sup>163</sup> While this ban on certain high value species is affecting their production and effective utilization, it is also giving rise to imports.

<sup>162</sup> See "Wood Energy Policy Paper", India, FAO/RWEDP, draft manuscript.

<sup>163</sup> *Ibid.*



## 5. Wood energy use

Detailed studies in many areas worldwide have rarely documented cases in which fuel demand is a cause of deforestation. Indeed the causation is more often the reverse; the shortage of fuel wood is due to deforestation, rather than the other way around. There are localized cases where fuel wood demand seems to contribute to forest depletion, most prominently in Sub-Saharan Africa where commercial charcoal production is practiced. Temporary kilns, legal or illegal, in forested areas are used until local wood resources are depleted; then the kilns are moved or rebuilt elsewhere.<sup>164</sup> Although energy policy in some African countries favors development and promotion of improved charcoal cook stoves, charcoal making remains illegal. There is a need to officially recognize charcoal as a legal and taxable commodity.

## 6. New Technology Development

Thailand: The Strategic Plan for Energy Conservation ("Strategic Plan 2002-2011") supports technological development of renewable energy, in particular biogas. See also Energy Conservation Promotion Act B.E. 2535, available at <http://faolex.fao.org/docs/texts/tha41045.doc>.

### C. What are the environmental impacts of energy production from biomass and how has legislation addressed these impacts?

#### 1. Construction of solid biomass power generation facilities

Many countries have enacted very specific urban land-use planning laws for the siting of biomass electricity generating plants. In Germany, electricity generation plants are commercial installations. Depending on their disruptive impact on the environment, they may, under the legal provisions applicable to built-up areas, be erected either in all building areas or exclusively in industrial zones.

See:

Germany: See German laws regarding the establishment of biomass facilities in Report of administrative procedures for the admission of plants for the Production of Electricity from Renewable Sources of Energy, available at [http://europa.eu.int/comm/energy/res/legislation/country\\_profiles](http://europa.eu.int/comm/energy/res/legislation/country_profiles).

**Brazil:** It is necessary to acquire permits through Eletrobras for the siting of new biomass plants (text in Portuguese at [www.mme.gov.br](http://www.mme.gov.br))

<sup>164</sup> <http://216.239.59.104/search?q=cache:d93t-OmGR1YJ:www.acts.or.ke/PB%2520-%2520KITUYI-WSSD.PDF+WEC+kilns+illegal+wood+resource+&hl=en>.

## 2. Operating solid biomass power generation facilities

Biomass plants for the production of electricity as well as combined heat and power production plants<sup>165</sup> have been supported by legislation including: minimum tariffs for delivering electricity to the grid; special financial support and subsidies; higher taxation of fossil fuels; and penalizing grid operators that do not meet a minimum amount of biomass-electricity.<sup>166</sup> For example, the United States Internal Revenue Code of 1986 was amended to support open and closed-loop biomass for electricity production.

### United States: Internal Revenue Code of 1986, 26 U.S.C.S. § 45 (a), (c)

(a) The renewable electricity production credit for any taxable year is an amount equal to the product of:

(1) 1.5 cents, multiplied by

(2) the kilowatt hours of electricity-

(A) produced by the taxpayer-

(i) from qualified energy resources, and

(ii) at a qualified facility during the 10-year period beginning on the date the facility was originally placed in service, and

(B) sold by the taxpayer to an unrelated person during the taxable year.

(c) Closed-loop biomass means any organic material from a plant, which is planted exclusively for purposes of being used at a qualified facility to produce electricity. Open-loop biomass means: any agricultural livestock waste nutrients, or any solid, non-hazardous, cellulosic waste material that is segregated from other waste materials.

The installation of a biomass boiler has positive environmental benefits. Apart from the reduction in greenhouse gases compared with fossil fuels, there is reduction in local air pollutants. Use of biomass boilers reduces emissions by substituting fossil fuels with wood as a fuel for power and heat generation and by depleting stockpiles of wood residues. Composting of residues releases methane, a greenhouse gas 27 times more potent than CO<sub>2</sub>.<sup>167</sup>

<sup>165</sup> Combined heat and power is the joint production of both heat and electricity from a single fuel source. Conventional power production converts on average about 35% of the total energy contained in fossil fuels such as coal or natural gas into electricity. The rest of the energy is released from the power plant in the form of heat and is lost. Combined heat and power systems collect and make productive use of this rejected heat energy. This process is sometimes referred to as cogeneration and can result in total efficiencies of more than 70%. The heat energy can be used for many purposes, such as space heating a large commercial building or industrial processing. These systems are appropriate for facilities that require both electricity and heat at the same time. ([http://www.eere.energy.gov/state\\_energy\\_program/topic\\_definition\\_detail.cfm/topic=202](http://www.eere.energy.gov/state_energy_program/topic_definition_detail.cfm/topic=202))

<sup>166</sup> See *Renewable Energy: Market and Policy Trends in IEA Countries*, International Energy Agency, 2003 for a detailed look at policy support in OECD countries for renewable energy. See also the renewable energy policies and measures database at <http://repolicies.iea.org>.

<sup>167</sup> For environmental consequences of composting residues in Asia, see [http://www.rwedp.org/acrobat/p\\_prospects.pdf](http://www.rwedp.org/acrobat/p_prospects.pdf).

The paper and pulp and sugar industries offer excellent opportunities to use biomass resources efficiently and competitively worldwide. In many countries, these sectors use wood waste and bagasse (a byproduct of the sugar cane process) for their internal energy needs, usually inefficient conversions to low-pressure steam and some power. The absence of regulation to ensure reasonable electricity tariffs for independent power producers make it unattractive for industries to invest in more efficient power generation. But the liberalization of energy markets in many countries is removing this barrier, opening a window to reduce production costs and modernize production capacity. Efficient boilers have been installed in many production facilities. Gasification technology could offer even further efficiency gains and lower costs, particularly when applied for converting black liquor, a byproduct of the pulp and paper manufacturing process.<sup>168</sup> The power generated is generally competitive with grid prices.

In Nicaragua, legislation has been adopted that supports electricity production from bagasse using improved boilers to meet demand for electricity.

In Mauritius, the 1985 Sugar Sector Package Deal Act aimed at increasing the production of bagasse for the generation of electricity and the 1988 Sugar Industry Efficiency Act that provides tax incentives towards investment in the generation of electricity and encourages small planters to provide bagasse for this purpose. However,

Mauritius is an energy poor country heavily dependent upon fossil fuel imports. The local sources of Total Primary Energy Requirements are hydro-electric power, bagasse and fuel wood which are largely renewable energies. Bagasse is the residue left after sugar cane has been crushed and its syrup extracted. This by-product of sugar cane is burned for the generation of electric power. Although bagasse burning is classified as a renewable energy source, it is only partly so. The cultivation of sugar cane (the source of bagasse) requires large amounts of fossil fuels such as in the manufacture of fertilizers, transport of workers to and from the fields, transport of sugar canes to factories, and transport of the final product to markets abroad and locally. The percentage for each KWh of electric power generated from bagasse that comes directly or indirectly from fossil fuels is not publicly known. Most probably this percentage varies between 10% and 20%.<sup>169</sup>

Biomass schemes can also offer the possibility of electrification of rural areas not reached by a grid system at lower cost than grid extensions. In remote areas, where the distance from the grid renders it too costly to connect communities to the national or regional grid, decentralised micro-projects are an option. Small biomass plants can offer refrigeration, water pumping, lighting, and communication services.

**Brazil:** Brazil's Electricity Law (Law 10.438), passed in April 2002, created incentives for supplying electricity to rural areas. The Law provides for the reduction of tariffs to low-income consumers, the establishment of targets for concessionaires and the granting of permission to permit-holders to provide full coverage. (<http://www.ieiglobal.org/ESDVol8No4/brazil.pdf>)

<sup>168</sup> See The US initiative, Agenda 2020: Pulp and Paper Industry Roadmap that supports research and development efforts to increase the efficiency of the pulp and paper industry, <http://www.aceee.org/pubs/ie962.htm>.

<sup>169</sup> UNEP communication

### 3. Building and operating biogas facilities

Legislation needs to address the potential environmental impacts, both positive and negative, from the four main ways of obtaining biogas: gas obtained from the anaerobic digestion of municipal solid waste; anaerobic fermentation of manure from animals; sewage treatment with anaerobic digestion; and capture of methane from landfill sites. The impacts include siting of biogas plants and the quantity and quality of substances used for production. For biogas installations, such as large livestock farms, with a major spatial impact, laws must take into account local or regional legislation. Heat and electricity from biogas is environmentally friendly and economically feasible for many applications. Soil improvement can also result from the biogas process when the liquid manure after treatment or the compost is used as a fertilizer. Compost produced as part of the biogas process is a good quality fertilizer. Negative effects from landfills arise mainly from uncontrolled emissions of landfill gas and leachate to the surrounding environment. Leachate is a high strength, aqueous solution and is formed when water introduced with the solid waste or from external sources percolates through the landfill, contacting the waste.<sup>170</sup>

### 4. Gas obtained from the anaerobic digestion

#### a. Anaerobic digestion of the organic fraction of municipal solid waste

European Union: The Communication from the Commission "EU Policies and Measures to Reduce Greenhouse Gas Emissions: Towards a European Climate Change Programme (ECCP)," COM(2000) 88 final, states that one of the proposed measures in the area of waste is the promotion of the biological treatment of biodegradable waste. Regarding landfill gas, the Community Strategy on Waste states that measures should be taken to enhance prevention and recycling, so that the amount of waste that is sent to the landfills, will be reduced: land-filling of waste being the last option in the hierarchy of waste management. Accordingly, the Directive on the landfill of waste that came into force on 16 July 1999 and was transposed into national law on 16 July 2001, lays down specific requirements on the construction, operation and after-care of landfills. ([http://europa.eu.int/smartapi/cgi/sga\\_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=32000L0076&model=guicheti](http://europa.eu.int/smartapi/cgi/sga_doc?smartapi!celexapi!prod!CELEXnumdoc&lg=EN&numdoc=32000L0076&model=guicheti)).

#### b. Anaerobic fermentation of manure from animals

Livestock slurries represent a major potential source of pollution, especially of water sources. Anaerobic digestion of these slurries is therefore an attractive option. Biogas plants can become centers for the management of agricultural manure in rural areas. The plants can be generated from cattle dung and animal wastes. Biogas systems offer multiple benefits. The digester-effluent is usually a good fertilizer, and, if connected to latrines, biogas plants can provide valuable sanitation services. Also, biogas plants can play a role in the recycling of organic waste products from households in cities.

<sup>170</sup> For a guide to environmental monitoring of municipal solid waste facilities, see <http://wlapwww.gov.bc.ca/epd/epdpa/mpp/gfemamsw.html#5>.

**Nepal:** The Biogas Support Programme in Nepal promoted the wide-scale use of biogas as a substitute for other less efficient fuels used for cooking and lighting. Since its inception, the program has installed more than 40,000 family-size biogas units benefiting more than 200,000 members of rural households. A critical element in developing the commercial market for these plants has been the program's innovative financial engineering and consumer subsidies. The subsidy, fixed at three levels, accounted for 35% of the total cost of biogas plants in 1998. At the start of the program, there was only one local manufacturer of biogas plants. Market development increased the number of suppliers to 38 by 1996. As a result of growing competition, technical design modifications, and better quality control measures, the overall cost of biogas plants in Nepal declined by more than 30% from 1992 to 2002. In addition to the institutional improvements, employment for skilled as well as unskilled labor in rural areas was generated.<sup>171</sup>

### c. Sewage treatment with anaerobic digestion

In China, anaerobic digesters producing combustible biogas have been in use since the 1960s. Today, the majority of digesters supply single households. Building on the initial household applications, China has successfully developed digester technology for use with large and medium-sized domestic livestock and industrial and organic waste disposal facilities. There are currently about 6.4 million household-scale biogas systems producing some 1.6 billion m<sup>3</sup> per year of gas and over 600 industrial-scale systems processing 40 million tons of waste annually to make 110 million m<sup>3</sup> of biogas. The industrial systems meet their host factory needs and also supply about 56,000 households with biogas for cooking. The projects are mostly located in the eastern part of the country and in the suburbs of large cities. Their location coincides with areas where there is rapid growth in concentrated animal breeding industries.<sup>172</sup>

At present, there are two technological approaches being pursued in China for utilization of municipal solid waste – incineration and landfill gas extraction. A few MSW incineration demonstration projects have been built, with a total installed capacity of 15 MW in 2000. Utilization of biogas from landfills is still in the early states of demonstration in China.<sup>173</sup>

<sup>171</sup> World Energy Assessment: Energy and the Challenge of Sustainability, UNDP, UNDESA and World Energy Council, 2002, [www.undp.org/seed/eap/activities/wea](http://www.undp.org/seed/eap/activities/wea).

<sup>172</sup> Li Jingjing, Zhuang Xing, Pat DeLaquil and Eric Larson, "Biomass Energy in China and Its Potential", Energy for Sustainable Development, Vol V, no. 4, December 2001, <http://www.ieiglobal.org/ESDVol5No4/biomass.pdf>

<sup>173</sup> Ibid.

See:

**China: Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste, effective from January 1996.**

**CHAPTER I GENERAL PROVISIONS**

**Article 1** This Law is enacted for the purpose of preventing and controlling environmental pollution by solid waste, safeguarding human health and promoting the development of socialist modernization drive.

**Article 2** This Law shall apply to the prevention and control of environmental pollution by solid waste within the territory of the People's Republic of China.

This Law shall not apply to the prevention and control of marine environmental pollution by solid waste or of environmental pollution by radioactive solid waste.

**Article 3** The State shall, in preventing and controlling environmental pollution by solid waste, implement the principles of reducing the discharge of solid waste, fully and rationally utilizing solid waste, and making it hazardless through treatment.

**Article 4** The State encourages and supports clean production and reduced discharge of solid waste.

Full text available at [http://www.zhb.gov.cn/english/law\\_detail.php3?id=7](http://www.zhb.gov.cn/english/law_detail.php3?id=7).

**5. Capture of methane from landfill sites (normally named landfill gas).**

For biogas installations in Germany, the criteria to be considered are the output of the firing installation or the nature and quantity of the substances to be fermented. Typical biogas installations with combustion engines should be examined for approval under emission protection law in the simplified procedure if 1) either the threshold of 1 MW firing heat output (if technologies other than combustion engines are used from 10 MW) is reached for the incineration installation or 2) the associated fermentation installation is an installation for biological processing of waste, with a minimum daily throughput of 10 tonnes. If one of these criteria is met, a site-related preliminary enquiry into the need for an environmental impact assessment should also be carried out, and from 50 tonnes daily fermentation throughput a general preliminary enquiry into the EIA requirement. An authorization procedure with public participation and EIA obligation under emission protection law is necessary only for large installations with at least 50 MW firing heat output.<sup>174</sup>

See:

European Union: European Union Directive 99/31/EC, OJ L 182, 16.7.1999, p. 1-19, Corrigendum OJ L 282, 5.11.1999, p. 16.

The overall objective of the Directive is to prevent or reduce as far as possible negative effects on

<sup>174</sup> [http://europa.eu.int/comm/energy/res/legislation/country\\_profiles/2004\\_0547\\_sec\\_country\\_profiles\\_en.pdf](http://europa.eu.int/comm/energy/res/legislation/country_profiles/2004_0547_sec_country_profiles_en.pdf)

human health or the environment from landfills. The Directive provides as one of its main objectives that Member States draw up strategies to reduce the amount of biodegradable waste going to landfills; it also sets precise targets for the reduction of the amount of biodegradable municipal waste going to landfills. To achieve these targets Member States will have to increase in particular the recycling, the composting of biodegradable waste, the production of biogas and other forms of recovery. ([http://europa.eu.int/eur-lex/en/consleg/pdf/1999/en\\_1999L0031\\_do\\_001.pdf](http://europa.eu.int/eur-lex/en/consleg/pdf/1999/en_1999L0031_do_001.pdf)).

#### **D. What are the impacts on health related to biomass energy use and what legislation has been used to counter these impacts?**

Biomass that is directly combusted in an inefficient cook stove produces pollutants, leading to severe health and environmental consequences. Legislation that focuses on setting standards for emission reduction is important to mitigating the negative impacts. Over the past 20 years, some 90% of improved cook stoves were disseminated in China. Other successful dissemination programs took place in India, Kenya, Tanzania and Uganda. But even the best biomass stoves available today do not greatly reduce the health-damaging effect of biomass combustion.<sup>175</sup> Poor people in the developing world are constantly exposed to indoor particulate and carbon monoxide concentrations many times higher than World Health Organization standards. Traditional stoves using dung and charcoal emit large amounts of carbon monoxide and other noxious gases. Women and children suffer most, because they are exposed for the longest periods of time. Acute respiratory illness affects as much as 6% of the world population. The World Health Organization estimates that 2.5 million women and young children in developing countries die prematurely each year from breathing the fumes from indoor biomass stoves.<sup>176</sup>

Many OECD countries have set standards for pollutant emissions from wood stoves. Since 1994, British Columbia has prohibited the sale of wood stoves that do not meet EPA standards. Nova Scotia's legislature is reviewing a similar regulation. Other provinces and territories are considering following suit, so that only high efficiency, low emission stoves will be available for sale. High-efficiency wood-burning appliances are certified by the Environmental Protection Agency to meet stringent smoke emission limits.

See: **Canada:** Burn-It-Smart legislation sets standards for emissions from wood stoves. [http://www.burnitsmart.org/english/faq/campaign\\_answer.html](http://www.burnitsmart.org/english/faq/campaign_answer.html)

**Austria:** A first law on the efficiency of woodstoves in Austria was implemented in Styrian State in 1992. Today, all Austrian states have the same legislation as agreed in a contract in 2001 between the states and the Austrian Federal Government. The Federal Institute of Agricultural Engineering provides for the installation of certified furnaces that comply with strict emission limits for rated load and part load in newly constructed plants. These requirements were discussed with the producer and have not stunted but rather have stimulated the development of efficient woodstoves.

See the Austrian legislation Feuerungsanlagengesetz, LGBl. Nr. 73/2001 at <http://www.ris.bka.gv.at/lr-steiermark/> (the text is only available in German).

<sup>175</sup> World Energy Assessment: Energy and the Challenge of Sustainability, UNDP, UNDESA and World Energy Council, 2002.

<sup>176</sup> <http://lnweb18.worldbank.org/sar/sa.nsf/0/95ee1c18873abcef852569d0004f83c2?OpenDocument>.

See also:

### **New Zealand: Resource Management Act 1991**

National Environmental Standards relating to wood stoves are regulated under the Resource Management Regulations 2004, pursuant to section 43 of the Resource Management Act 1991:

Discharge from wood stoves installed on certain properties after 1 September 2005 prohibited

- (1) The discharge of particles to air from a wood stove installed after 1 September 2005 in a building on a property with an allotment size of less than 2 hectares is prohibited.
- (2) Subclause (1) does not apply if the discharge from the wood stove complies with—
  - (a) the design standard in regulation 23; and
  - (b) the thermal efficiency standard in regulation 24.

Design standard

- (1) The design standard for a wood stove is a discharge of less than 1.5 gram of particles for each kilogram of dry wood burnt.
- (2) The discharge must be measured in accordance with the method specified in Australian/New Zealand Standard AS/NZS 4013:1999, Domestic solid fuel burning appliances—Method for determination of flue gas emissions.

Thermal efficiency standard

- (1) The thermal efficiency standard for a wood stove—
  - (a) is the ratio of useable heat energy output to energy input (thermal efficiency); and
  - (b) must be not less than 65%.
- (2) The thermal efficiency must be calculated in accordance with the method specified in Australian/New Zealand Standard AS/NZS 4012:1999, Domestic solid fuel burning appliances—Method for determination of power output and efficiency.

Text available at <http://gpacts.knowledge-basket.co.nz/regs/regs/text/2004/2004309.txt>.



## E. What are the environmental impacts of liquid biofuels and legislative support for transport biofuels?

### 1. The negative environmental impacts of biofuels

Ethanol-blended gasoline produces evaporative hydrocarbons. Impacts of both ethanol and biodiesel on oxides of nitrogen are generally minor and depend on climatic and technical conditions. Biofuels also can have impacts on toxic air emissions. While emissions of most toxic air pollutants, such as benzene, 1,3-butadiene, toluene and xylene, decrease when ethanol is added to gasoline, emissions of acetaldehyde, formaldehyde and peroxyacetyl nitrate increase. Formaldehyde and acetaldehyde are by-products of incomplete combustion. Since these are currently uncontrolled emissions, in the future they can be much lower if appropriate emissions controls are applied.<sup>177</sup>

The impacts of biofuels on soils and habitats from growing bioenergy crops, on removing crop and forest residues and using these to produce biofuels, on water quality from bioenergy crop production and biofuels use, and on disposing of various solid wastes are analogous to the impacts examined in section two. The net effect of these factors varies and depends on how the fuels are produced and used, and on the systems and methods applied. In the extreme, such as if a rainforest is replaced by bioenergy crop plantations, the impacts could be strongly negative. In many cases, however, growing bioenergy crops on vacant land, producing biofuels and using these fuels in vehicles provide net environmental benefits.

### 2. Legislative support for vehicle biofuels

Many governments explicitly recognize the environmental advantages of vehicle biofuels as compared with fossil fuels and seek to expand their production and use. Biofuels can reduce many of the vehicle pollutant emissions that exacerbate air quality problems, particularly in urban areas. Biofuels generally produce lower tailpipe emissions of carbon monoxide, hydrocarbons, sulphur dioxide and particulate matter than gasoline or conventional diesel fuel, and blending biofuels can help lower these emissions.

See for example:

**Italy:** Financial Law of 2001 supports biofuels production through an excise tax exemption.  
[http://europa.eu.int/comm/energy/res/legislation/country\\_profiles/2004\\_0547\\_sec\\_country\\_profiles\\_en.pdf](http://europa.eu.int/comm/energy/res/legislation/country_profiles/2004_0547_sec_country_profiles_en.pdf)

**Spain:** Law 53 of 30 Dec. 2002 on Measure of a Fiscal, Administrative and Social Order Nature sets a hydrocarbon tax level of zero percent for biofuels until 2012.  
[http://europa.eu.int/comm/energy/res/legislation/country\\_profiles/2004\\_0547\\_sec\\_country\\_profiles\\_en.pdf](http://europa.eu.int/comm/energy/res/legislation/country_profiles/2004_0547_sec_country_profiles_en.pdf)

<sup>177</sup> Biofuels for Transport: An International Perspective, International Energy Agency, 2004, <http://www.iea.org>.

**United States: Internal Revenue Code of 1986, 26 U.S.C.S. § 40, 40A**

The Alcohol Fuels Credit in the United States encourages the production of gasohol and ethanol through a credit to taxpayers for alcohol or biodiesel used as fuel.

I.R.C. §40 Alcohol used as fuel 26 USCS§ 40 (2004)

I.R.C. §40A Biodiesel used as fuel 26 USCS§ 40A (2004)

- (b) (1)(A) In general. The biodiesel mixture credit of any taxpayer for any taxable year is 50 cents for each gallon of biodiesel used by the taxpayer in the production of a qualified biodiesel mixture.
- (3) Credit for agri-biodiesel. In the case of any biodiesel that is agri-biodiesel, paragraphs (1)(A) and (2)(A) shall be applied by substituting "\$ 1.00" for "50 cents".
- (4) Certification for biodiesel. No credit shall be allowed under this section unless the taxpayer obtains a certification (in such form and manner as prescribed by the Secretary) from the producer or importer of the biodiesel, which identifies the product produced, and the percentage of biodiesel and agri-biodiesel in the product.
- (d) Definitions and special rules. For purposes of this section-
  - (1) Biodiesel. The term "biodiesel" means the monoalkyl esters of long chain fatty acids derived from plant or animal matter which meet-
    - (A) The registration requirements for fuels and fuel additives established by the Environmental Protection Agency under section 211 of the Clean Air Act (42 U.S.C. 7545), and
    - (B) The requirements of the American Society of Testing and Materials D6751.
  - (2) Agri-biodiesel. The term "agri-biodiesel" means biodiesel derived solely from virgin oils, including esters derived from virgin vegetable oils from corn, soybeans, sunflower seeds, cottonseeds, canola, crambe, rapeseeds, safflowers, flaxseeds, rice bran, and mustard seeds, and from animal fats.

In many non-OECD countries, emissions control standards are less strict, and biofuels are likely to have a larger impact on emissions. In many countries, however, new vehicles are increasingly being required to meet basic emissions standards. Worldwide, older vehicles with little or poor quality emissions control equipment can certainly benefit from the use of biofuels.

**Brazil:** The Brazilian Pro-Alcohol program, launched in the 1970s, is a unique example of a major biofuels program. It is the largest program of commercial biomass utilization in the world. The program demonstrates the technical feasibility of large-scale production of ethanol as a transport fuel, and its use in high-level blends as well as in dedicated ethanol vehicles. Sugar cane plants in Brazil make excellent use of biomass as process energy. Emission reductions from sugar cane-derived fuels are greater than from ethanol from grains because nearly all conversion plant process energy is provided by the remains of the crushed cane after the sugar has been extracted, i.e. the

bagasse. After the second oil crisis, steps were taken to use hydrated ethanol. The Brazilian car industry agreed to implement the technical changes necessary for vehicles to safely operate on the neat fuel. The investment required for this phase of the program was funded through soft loans by the government. Tax reduction made the ethanol option highly attractive to consumers.

When Pro-Alcohol was established, several negative environmental impacts were expected: the exacerbation of historical labor problems, water contamination by the stillage, air pollution from traditional burning of field residues and competition with other agricultural products. Many of these problems have been overcome with technological advances. The main remaining problem is the burning of residues that pollute the air with ashes. Federal law requires this practice to end in the near future). Today, ethanol is sold competitively in Brazil because the sugar cane industry has been able to increase productivity over the past three decades.

On October 30, 2002, Brazil launched the Probiodiesel Program, with Portaria MCT Number 702, Directive #702 of the Ministry of Science and Technology. The program aims to develop technology for the production, industrialisation, and use of biodiesel. According to the legislation, Brazil wants to reduce its dependence on diesel imports. President Lula's administration views biodiesel as a program for social inclusion and job creation, with hopes that it will generate up to 200,000 jobs. See <http://www.udop.com.br/> (law in Portuguese but with links in English)

#### Other countries with biofuels programs include:

**Paraguay:** A group of legislators in Paraguay has filed a draft bill for discussion in the Congress on supporting the purchase of renewable bio-fuels. The draft bill promises stable taxes for companies producing bio-fuels for at least 15 years. Bio-fuels will be increasingly needed as the government intends that all fuels to be sold in the country contain as minimum as 20% of any bio-fuel and as maximum as 80% of the same product. <http://www.ultimahora.com/template.asp?notic=85647> (in Spanish)

**India:** See Ministry of Petroleum and Natural Gas Resolution, New Delhi, 3 September, 2002, No. P-45018/28/2000-C. C., effective from January 2003, that decrees that 5% ethanol-doped-petrol will be supplied in the following nine States and four contiguous Union Territories: States & Union Territories 1. Andhra Pradesh 1. Damman and Diu 2. Goa 2. Dadra and Nagar Haveli 3. Gujrat 3. Chandigarh 4. Haryana 4. Pondicherry 5. Karnataka 6. Maharashtra 7. Punjab 8. Tamilnadu 9. Uttar Pradesh.

**Colombia:** Colombia's congress has approved a bill that permits mixing a 10% ethanol mixture in gasoline beginning on 25 September 2005 and another that promotes the production, consumption and commercialization of biofuels. The bill stipulates a 10-year grace period from paying income taxes on crops and a tax exemption on biodiesel. Development of its biofuels program is expected to generate 150,000 new jobs.

### III. CONCLUSION

Biomass has tremendous potential in developing countries. It is plentiful in supply and its use maximizes local labor minimizes the need for imported equipment. If environmental safeguards are observed, it can provide a significant energy resource to assist in development efforts. This chapter describes some of the legislation that has been used both to promote and safeguard the use of biomass as an energy resource.

## CHAPTER E. GEOTHERMAL ENERGY

Adrian J Bradbrook\*

### I. THE NATURE OF THE RESOURCE

The potential of geothermal energy for satisfying the world's growing energy requirements is enormous. In the United States, for example, recoverable reserves of heat energy in the earth in the 90°C to 150°C range has been estimated at the equivalent of 900 billion barrels of oil.<sup>178</sup> On a worldwide basis, scientists have calculated that if means could be found to reduce the temperature of the earth's core by 0.6°C, sufficient energy could be generated to power all existing power plants for 20 million years.<sup>179</sup>

Scientifically, there are three fundamentally different types of geothermal energy:

1. In areas of geological instability and volcanic activity, such as the Philippines and New Zealand, there are volcanic or magmatic reserves and vapor-dominated systems. These resources rely on natural systems where water is heated and comes to the surface as steam. This steam is used to generate electricity through the use of conventional turbines.
2. In many areas of the world, such as Australia, substantial reserves of hot groundwater exist, which can be used for heating purposes, although not for the generation of electricity as no steam is generated.
3. Recent research has shown the widespread existence of hot dry rocks (HDR). This resource can be exploited by the injection into the earth through drilled holes of cold water that becomes superheated on contact with underground heated rock and is discharged at the surface in the form of steam. HDR technology is still at the experimental stage, but is regarded as very promising. Various exploratory work has already been undertaken around the world.<sup>180</sup>

Despite the fundamental differences between these different types of geothermal resources, it appears from a legislative standpoint that they can be treated together. This is the experience of countries that have legislated in this field, which include 12 States of the United States, Queensland (Australia), British Columbia (Canada), New Zealand, Chile, Iceland, Vanuatu and the Philippines.

In general terms, this legislation seeks to establish a legal management regime in respect of the resource, much of which appears to be a modified version of legislation established many decades before to regulate and promote the exploration and production of petroleum and natural gas. The fact that the oil and gas legislation has been used as a close model for geothermal legislation is recognition of the fact that the processes of exploration and production of geothermal energy closely resemble that in operation in the oil and gas industry. The legislation already in effect in some

\* See bio in Transport Section.

<sup>178</sup> S D Naumann, "Form Over Function: The Law of Hot Water" (1983) 4 J Energy L and Policy 205 at 209.

<sup>179</sup> G Vranesh and J D Musick, "Geothermal Resources: Water and Other Conflicts Encountered by the Developer" (1977) 13 Land and Water L Rev 109 at 115.

<sup>180</sup> In Australia, the New South Wales state government has awarded Pacific Power the tender to explore for HDR in the Hunter Valley. A renewable energy company, Geodynamics Limited, which plans to produce power by HDR has recently listed on the Australian Stock Exchange: see <[www.aie.org.au/pubs/hotdry.htm](http://www.aie.org.au/pubs/hotdry.htm)>

countries also controls particular environmental problems associated with the geothermal energy industry; in some cases these environmental controls are contained in the country's environmental laws of general application, and in other cases the environmental controls are contained in the specific geothermal legislation (and sometimes a mixture of the two).

**A. Can the allocation and management of geothermal resources be effectively conducted by amendments to legislation controlling other natural resources or is new legislation specifically controlling geothermal resources required?**

The first issue confronting legislative drafters is whether completely new legislation is required for geothermal energy or whether the existing mining or oil and gas legislation can be amended to achieve the same result.

If the amendment approach is adopted, geothermal water or steam could be deemed by legislation to be a "mineral", "gas" or "groundwater" so as to attract the operation of the legislation regulating minerals, oil and gas or groundwater (respectively). Precedents exist for all these alternative approaches. In the United States, for example, some States declare the resource to be "water"<sup>181</sup>, some declare it to be a "mineral"<sup>182</sup>, while the United States Court of Appeals, Ninth Circuit, held in *Reich v Commissioner of Internal Revenue*<sup>183</sup> that the resource is "gas" for the purpose of securing entitlement to the depletion allowance in the US Internal Revenue Code.<sup>184</sup> This approach is fundamentally appealing, as it would only require a simple amendment to the statutory definition of "mineral", "gas" or "groundwater" for geothermal resources to be included within the existing legislation. This approach may be appropriate in jurisdictions where only one of the different types of geothermal resources identified earlier is known to exist. Thus, for example, there is sufficient in common between the HDR resource and minerals generally possibly to justify a legislative declaration that the minerals legislation is deemed to include the HDR resource. Similarly, the obvious similarities between hot groundwater and groundwater reserves used for irrigation purposes may lead to a legislative declaration including this geothermal resource within the existing groundwater statutory regime.

Even in these situations, however, the notion of adapting existing legislation to include geothermal resources can be attacked, as on close analysis the similarities between geothermal resources and minerals, gas and groundwater break down. Geothermal resources are fundamentally different from groundwater as it is the heat energy, rather than the liquid content, which constitutes the resource. Fundamental differences also exist between geothermal resources, on the one hand, and minerals, oil and gas, on the other hand, as the latter must be burned or processed in order to produce heat energy, while the former is heat energy and requires no such processing. An additional factor is that minerals, oil and gas can be utilized directly, while the geothermal resource can only be exploited indirectly by means of steam or water that conveys the heat energy to the land surface.<sup>185</sup>

Thus, even in jurisdictions where only one of the various types of geothermal resources is known to exist, it is submitted that the preferred approach is to enact legislation specifically designed

<sup>181</sup> See eg. Wyoming: Wyo. Stat. s 41-121(b); Nevada Rev Stat s 534A.040.

<sup>182</sup> See eg. Hawaii Rev Stat. s 182-1(1); Texas Rev Civ Stat Ann, art 1435a, s 4(2).

<sup>183</sup> (1972) 454 F 2d 1157. Cf US v Union Oil Co (1971) 549 F 2d 1271.

<sup>184</sup> See P McDevitt and D Wells, "Energy Market Impacts of the Legal Definition of Geothermal Energy in the Western United States" (1982) 22 Nat Res J 391 at 392ff.

<sup>185</sup> J W Aidlin, "Representing the Geothermal Resources Client" (1974) 19 Rocky Mt M L Inst 27 at 30-31.

for geothermal energy rather than to enact amendments to existing legislation designed for other purposes. This conclusion applies a fortiori where two or more different types of geothermal resources are known to exist. The only way of adapting existing legislation in this situation would involve either grossly misclassifying one or more types of resource (for example, to declare hot groundwater to be a “mineral” or the HDR resource to be “groundwater”) so as to ensure that all types of geothermal resource fall within the same legislation or to classify the various types of resources differently (for example, to treat the HDR resource as a mineral and hot groundwater as groundwater). Neither of these approaches would appear to be desirable on any analysis.

The conclusion that geothermal resources require separate legislation accords with the general experience in jurisdictions where the resource has been significantly exploited in the past.

For example, the Ugandan government has made geothermal energy a priority by adopting a new strategic plan for power restructuring and privatization and passing the Electricity Act in October, 1999. The goals of the new policy are to make the energy sector independent and viable without government subsidy, to improve efficiency and performance, to attract private investment and entrepreneurship, to meet growing demands and to explore exportation opportunities. Uganda has created incentives to encourage geothermal development that include generous capital recovery terms, annual depreciation allowances, Duty and VAT exemptions on capital goods, negotiable terms for strategic investments, and free repatriation of capital, interest and profits.<sup>186</sup>

## II. THE FORMAT OF THE LEGISLATION

Although, as discussed above, certain geothermal resources share much in common with minerals and/or groundwater and could be regulated by a statutory regime similar to that established for either of these two types of natural resources, it is submitted that the preferred approach is to copy the format of the legislation established for petroleum exploration and production.

Difficulties arise in the context of production because of different environmental concerns affecting the development of hot groundwater as opposed to the HDR or geopressed types of geothermal resources. One method of tackling this problem would be to have one part of the new legislation devoted specifically to the production of the hot groundwater resource and a separate Part dealing with the production of all other types of geothermal resources. While this would be effective, it would be a cumbersome procedure and would significantly lengthen the statute. It is submitted that the preferred approach is to define hot groundwater as a low-temperature geothermal resource and to apply separate provisions as to this type of resource where required by the nature of the resource in the appropriate Part of the statute imposing environmental safeguards.

The new provisions regulating the exploration and production of geothermal resources could be included in two separate Parts of the Act and would form the bulk of the legislation. The statute also requires a Part relating to environmental safeguards. To be consistent with normal drafting techniques, any new geothermal legislation would also need a preliminary Part containing an interpretation section and provisions concerning the ownership of the resource, and a final Part dealing with miscellaneous matters such as the creation of offences and penalties, and the establishment of regulation-making powers.

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<sup>186</sup> UNEP communication

**Thus, the suggested format of the legislation is as follows:**

Part I:	General
Division 1:	Interpretation
Division 2:	Ownership of Resources
Part II:	Exploration Permits
Part III:	Production Leases
Part IV:	Environmental Protection
Part V:	Miscellaneous

## **A. General**

### **1. Division One: Interpretation**

The legislation must define at the outset the types of resource intended to be included within its scope. The most appropriate method of achieving this is to include an exhaustive definition of “geothermal resources” within the interpretation section. In order to include the HDR resource, the definition must be stated to include water introduced underground (that is, injected water) as well as water occurring naturally underground. In addition, the definition must be stated to exclude resources included within the petroleum and minerals legislation.

As explained earlier, since it is necessary for the hot groundwater resource to be subject to some different provisions in the Part of the Act relating to environmental safeguards, it is also necessary to include a definition of “low-temperature geothermal resources” and to ensure that hot groundwater is excluded from the definition of “geothermal resources”. The definition of “low-temperature geothermal resources” could be defined so as to include both a maximum and minimum temperature. The appropriate maximum temperature is 100°C, as beyond that point steam will be generated. The minimum temperature should be designed to ensure that normal groundwater reserves used for irrigation purposes are not caught by the legislation. The minimum would ideally be the lowest figure at which the heated water is commercially exploitable. Scientific evidence suggests that this figure is in the range of 35°C to 40°C.

See:

Alaska, USA, Drilling Regulations (AS 41.06.060)  
[www.touchngo.com/lglcntr/akstats/Statutes/title 41.html](http://www.touchngo.com/lglcntr/akstats/Statutes/title 41.html);

British Columbia, Canada (Geothermal Resources Act 1996, c 171, § 1)  
[www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html);

United States (30 USC § 1001(c))  
<http://ipl.unm.edu/cwl/fedbook/geosteam.html>;

Philippines (Presidential Decree No. 1442 (1978), § 1)  
[www.geocities.com/afdb/enerlaw.html](http://www.geocities.com/afdb/enerlaw.html);

Vanuatu (Geothermal Energy Act, c 197 (1988), § 1)  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation).

Based on the above, the author suggests legislation in which the following definitions might be used:

**“Geothermal resources” means substances derived or derivable from the earth that are produced by natural phenomena, and include:**

- (a) all steam, water and water vapor or mixture thereof, that has been produced naturally or artificially by the injection of fluids to the source of energy; and
- (b) all minerals naturally occurring in or derived or derivable from any steam, water or water vapor or mixture thereof, but does not include:
- (c) petroleum, natural gas or helium; or
- (d) water which constitutes low-temperature geothermal resources; or
- (e) minerals which are extracted from the earth by the use directly or indirectly of geothermal resources”.

“Low-temperature geothermal resources’ means water derived from the earth and produced naturally within the earth which has a temperature which does not exceed 100 degrees Celsius at the point at which it reaches the earth’s surface and which is less than 40 degrees Celsius at the point at which it reaches the earth’s surface”.

## 2. Division 2: Ownership of Resource

The issue of ownership of the resource is a major policy issue that each legislature must address.<sup>187</sup> This is not an issue where geothermal resources are developed on public land, as on any legal analysis the ownership rights will vest in the State. However, the issue will arise in respect of private lands. If the ownership issue is not resolved by legislation, claims to ownership may be lodged by both the surface landowner and by the State.

Except in the United States, other legislatures have vested ownership rights of geothermal resources in the State.

Thus, in British Columbia (Canada), the Geothermal Resources Act 1996, c 171, § 2 states: “The right, title and interest in all geothermal resources in British Columbia are vested in and reserved to the government”. ([www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.htm](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.htm))

<sup>187</sup> See A J Bradbrook, “The Ownership of Geothermal Resources” [1987] Australian Mining and Petroleum Law Association Yearbook 353.



See also: **Chile:** Law on Geothermal Energy Concessions, Law No 19.657 (2000), Art. 4  
[www.cne.cl/fuentes\\_energeticas/f\\_renovables.html](http://www.cne.cl/fuentes_energeticas/f_renovables.html)

Queensland, Australia: Geothermal Exploration Act 2004, § 11  
[www.legislation.qld.gov.au](http://www.legislation.qld.gov.au)

Vanuatu: Geothermal Energy Act, c 197 (1988), § 2  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation)

## B. Exploration permits <sup>188</sup>

Consistent with existing legislation, this Part of the legislation could contain provisions relating to the making of applications for exploration permits, the power to refuse or grant applications, the area for which a permit may be granted, the term of the permit, the permit fee, the duties of permit holders, the restrictions on drilling operations, and rules relating to the cancellation of permits. From a drafting standpoint, many of these issues present no difficulties. However, the following points should be noted:

### 1. The area for which the permit may be granted

The size of the block for which individual permits are issued must be specified. This could be left to the relevant Minister, in which case no specifying provision would be needed in the legislation. Alternatively, the maximum and minimum size of the block could be prescribed. See:

In **Alaska**, the minimum size is 40 acres and the maximum size is 2,560 acres (Alaska Stats. Ann., § 38.05.181(e));  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation);

In **California**, the minimum and maximum is 640 acres and 5,760 acres (Public Resources Code, § 6922), [www.leginfo.ca.gov](http://www.leginfo.ca.gov);

In **Chile** and **Vanuatu**, the maximum is 100,000 hectares and 100 km<sup>2</sup> (respectively), but no minimum is specified (Law on Geothermal Energy Concessions, Law No. 19.657 (2000), Art. 7 (Chile) and Geothermal Energy Act, c 197 (1988), § 11(4) (Vanuatu)).  
[www.cne.cl/fuentes\\_energeticas/f\\_renovables.html](http://www.cne.cl/fuentes_energeticas/f_renovables.html) (Chile)  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation) (Vanuatu).

A compromise form of legislation suggested by the author is as follows:

“The area in respect of which an exploration permit is granted shall not be less than X hectares nor shall it exceed Y hectares, but if the Minister is satisfied that because of the unusual nature of the method of exploration to be undertaken or the kind of land applied for a greater area is necessary, the Minister may in his absolute discretion grant the permit in respect of a larger area than Y hectares”.

<sup>188</sup> Sometimes referred to as “exploration leases”, “prospecting licenses”, “prospecting permits”, “exploration permit”, “exploration concessions” or “service contracts”.

## 2. Term of the permit

It is important for the term of the permit to be specified in a separate section of the legislation. The length of the term of the permit is a matter of judgment for the legislature. The length specified in existing geothermal statutes ranges from two years in Alaska (Alaska Stats Ann § 38.05.181) to two years plus a possible extension of two years in California (California: Public Resources Code, § 6910(b)).

See [www.touchngo.com/lglcntr/akstats/Statutes/title41.html](http://www.touchngo.com/lglcntr/akstats/Statutes/title41.html) for Alaska statutes and [www.leginfo.ca.gov](http://www.leginfo.ca.gov) for California code.

In **Queensland, Australia**, § 33 of the Geothermal Exploration Act 2004 gives the relevant Minister the power to grant a 1, 2 or 3 year term. [www.legislation.qld.gov.au](http://www.legislation.qld.gov.au).

## 3. Duties of permit holder

As in petroleum exploration, the government has an interest in obtaining geological, surveying and other scientific and technical information that may be learned in the course of geothermal exploration. The government is also concerned to ensure that the permit holder conducts exploration with due diligence. These valid concerns can be appropriately be satisfied by a separate section of the legislation making certain requirements of the permit holder.

See:

Geothermal Exploration Act 2004 (Queensland, Australia), §§ 40-52  
[www.legislation.qld.gov.au](http://www.legislation.qld.gov.au);

Geothermal Energy Act, c 197 (1988) (Vanuatu), §§ 15-18  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation).

See also:

### **Geothermal Resources Act 1996, c 171 (British Columbia, Canada), §§ 7-8**

"(1) The holder of a permit shall, subject to this Act –

- (a) within three months from the date of the issue of such permit, employ and arrange for a geologist to commence a reconnaissance, aerial, geological or geophysical survey within the area covered by the permit;
- (b) furnish to the Minister within thirty days after the end of each quarter ending the last day of March June September and December of each year a written report in the prescribed form of operations conducted during each quarter and, within a reasonable time after the end of such quarter, geological maps of the portion of the area which has been so surveyed;
- (c) during the currency of the permit carry out survey operations within the area covered by the permit with due diligence and to the satisfaction of the Minister;

- (d) keep an adequate record of all operations conducted, collect geological specimens of outcrops, fossils, rocks and materials encountered in drilling, take all reasonable precautions to ensure that all such records and specimens are clearly and permanently labeled and stored in such a way as to prevent deterioration or loss thereof, and at all reasonable times allow the Minister or any person authorized by the Minister to inspect and take copies of any such records and to examine any such specimens and take representative samples thereof.
- (2) The Minister may, from time to time during the currency of a permit, by notice in writing direct the holder thereof to conduct such operations or further operations as are specified in the notice in connection with or as part of the survey operations to be conducted”.

Source: [www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html).

Alternatively, the duties of the permit holder can be specified in the geothermal lease. In this case, the duties do not need to be specified in the legislation. See:

Geothermal Exploration Act 2004, § 35 (Queensland, Australia) [www.legislation.qld.gov.au](http://www.legislation.qld.gov.au).

### C. Production leases<sup>189</sup>

Based on existing geothermal legislation, this part of the legislation could contain provisions relating to the following matters:

#### 1. The size of the leased area

This issue is the parallel issue to the size of the area over which an exploration permit may be granted. The maximum and minimum sizes of the leased area specified in the Alaskan and Californian legislation are the same as those specified in respect of exploration permits by their statutes but add the statement that a person may not own, or hold an interest in, geothermal leases covering more than 51,200 acres and 25,600 acres, respectively.

The Geothermal Steam Act 1970 (US), which applies in respect of federal lands in the United States, imposes a maximum limitation of 10,240 acres. (<http://ipl.unm.edu/cwl/fedbook/geosteam.html>).

In Chile, the maximum area is 20,000 hectares (Law on Geothermal Energy Concessions, Law No 19.657 (2000), Art. 7. ([www.cne.cl/fuentes\\_energeticas/f\\_renovables.html](http://www.cne.cl/fuentes_energeticas/f_renovables.html))).

It is a policy decision for the legislature whether to impose a similar limitation or whether to leave the size of individual leased areas to the discretion of the Minister. If it is thought desirable to specify maximum and/or minimum sizes, the form of legislation referred to in the context of exploration permits could be adapted for use in Part III of the Act.

<sup>189</sup> Sometimes referred to as “production licenses” or “exploitation concessions”.

## 2. The rights conferred by a lease

The Act could specify the nature of the mining rights and the rights to the use of the land surface granted by the lease. A useful precedent is:

### **Victoria, Australia: Petroleum Act 1998, § 46**

***“Subject to this Act, a lease confers upon the lessee the following rights –***

- (a) the exclusive right to drill for, mine, extract, recover, remove and dispose of all geothermal resources in or under the land demised and to inject water into a natural reservoir in or under the land demised and to recover it therefrom, with the right to construct maintain and operate on the land demised all works building plant waterways roads pipelines reservoirs tanks pumping stations and other structures necessary to enable the lessee to exercise that exclusive right and that are or are of a class of works buildings plant waterways roads pipelines reservoirs tanks pumping stations and other structures the construction and operation of which has the written approval of the Ministry;
- (b) the right to use so much of the land surface as is reasonably necessary to carry out the rights contained in paragraph (a).”

Source: [www.austlii.edu.au/au/legis/vic/consol\\_act/pa1998137/](http://www.austlii.edu.au/au/legis/vic/consol_act/pa1998137/).

## 3. The statutory covenants and conditions of the lease

The relevant Minister could be authorized to impose such covenants and conditions into a production lease as appear to him to be appropriate.

Vanuatu: Geothermal Energy Act, c 197 (1988), § 23 [www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation).

In addition to this general discretionary power, consistent with production leases of other types of natural resources, the geothermal legislation could specify a number of basic covenants and conditions that would be common to all geothermal leases. This, based on existing precedents, the legislation, as suggested by the author, could read:

***“A lease shall contain the following covenants and conditions in addition to any other covenants and conditions which are prescribed by regulations, namely –***

- (a) A covenant by the lessee to pay royalty upon geothermal resources produced or obtained from the land at the rate of and in accordance with the scale prescribed by the regulations;
- (b) in the case of a lease authorizing the injection of water into and its recovery from a natural reservoir – a covenant by the lessee to do all such acts and things as are prescribed or as the Minister may from time to time direct in writing to be done in relation to that injection or recovery;

- (c) A covenant by the lessee to pay rent in the amount in the manner and at the times provided in this Act;
- (d) A covenant by the lessee to use the land continuously and bona fide exclusively for the purpose for which it is demised and in accordance with this Act;
- (e) A covenant by the lessee not to assign or let or part with the possession of the land or any part thereof without the previous consent in writing of the Minister;
- (f) A covenant by the lessee to carry on all his operations in a good and workmanlike manner in accordance with recognized and approved methods and practice to the satisfaction of the Minister and to take all reasonable precautions to prevent waste of geothermal resources developed in the leased land;
- (g) A covenant by the lessee to furnish to the Minister such reports as may be prescribed containing such particulars as may be prescribed relating to development works and structures in connection with the production of geothermal resources;
- (h) Such other covenants and conditions as the Minister may think fit and specify".

The covenant to use the land continuously and in accordance with the Act mirrors a statutory term commonly included in petroleum production and mineral leases. Essentially it requires the lessee to exploit the leased land in a diligent manner and allows the lease to be terminated by forfeiture if the leased area is not worked expeditiously. Such a term is traditionally justified both on the public policy ground that it is in the public interest that the natural resources should be exploited efficiently, effectively and without unnecessary delay, and on the ground that in light of the competition for mineral or petroleum leases, if a lessee does not work the leased area expeditiously another lessee should be given the opportunity to do so.

Covenant (h), vesting a wide discretionary power in the Minister, may seem to be unnecessarily broad. However, such a clause is designed to cover unforeseen eventualities and/or special problems and issues that may arise concerning the exploitation of particular geothermal fields. An illustration of this might be the need for special measures concerning the support of buildings where geothermal development occurs close to urban or suburban areas. As will be shown later, a broadly drafted clause of this nature would also be useful in the environmental context.

#### **4. Drilling operations.**

Existing geothermal statutes contain a number of provisions relating to the drilling of wells.

See: Public Resources Code, §§ 3724-3726 [www.leginfo.ca.gov](http://www.leginfo.ca.gov).

One common requirement is to restrict the situation of the drill and to require that drilling does not take place too close to the outer boundaries of the leased area. This could be achieved by stating in the legislation that drilling shall not commence within a specified number of meters of the outer boundaries of the land demised:

**California** Public Resources Code, § 3757 [www.leginfo.ca.gov](http://www.leginfo.ca.gov).

Alternatively, the exact distance could be left in the discretion of the relevant government authority.

Consideration could also be given to the inclusion of a section requiring the lessee to drill at least one well within a specified period and to drill further wells within a reasonable period of time. Such a section has the same public policy justification as the covenant to use the land continuously and in accordance with the Act. The following is a precedent:

- "(1) Within six months after the date of execution of a lease or such further time as the Minister may allow, the lessee shall proceed with reasonable diligence to install (if not already installed) on the land demised drilling equipment approved in writing by the Minister or by a person authorized by the Minister in that behalf, and shall commence drilling at least one well for the purpose of determining the presence or absence of geothermal resources.
- (2) A lessee shall during the period referred to in sub-section (1) and thereafter continue with reasonable diligence drilling operations commenced in accordance with sub-section (1) to a point where the well is proved either successful or unsuccessful to the satisfaction of the Minister.
- (3) A lessee shall, unless the Minister by notice in writing served on a lessee either personally or by post directs him to cease drilling operations, after a well referred to in sub-sections (1) and (2) has been proved successful or unsuccessful, continue drilling operations by drilling further wells to a point where each well is proved either successful or unsuccessful to the satisfaction of the Minister".

Source: British Columbia, Canada: Geothermal resources Act 1996, c 171, § 7, [www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html),

California: Public Resources Code, 3724, [www.leginfo.ca.gov](http://www.leginfo.ca.gov).

Finally, the legislation could require that a drilling log and core record be made.

#### **California Public Resources Code §§ 3730-3732:**

3730. The owner or operator of any well shall keep, or cause to be kept, a careful and accurate log, core record, and history of the drilling of the well.

3731. The log shall show the character and depth of the formation passed through or encountered in the drilling of the well, the amount, size and weight of casing used, and particularly the location, depth and temperature of water bearing strata, together with the temperature, chemical composition, and other chemical and physical characteristics of fluid encountered from time to time, so far as ascertained.

3731. The core record shall show the depth, character, and fluid content of the cores obtained, so far as determined."

Source: [www.leginfo.ca.gov](http://www.leginfo.ca.gov).

## 5. Access and inspection.

The majority of existing geothermal statutes contain a provision entitling the Minister or governmental official responsible for the operation of the legislation to enter geothermal fields at any time and to inspect the workings, plant and records. Such a right would appear to be essential to ensure that the terms of the legislation are complied with.

See:

**The British Columbia, Canada, legislation (Geothermal Resources Act 1996, c 171, § 14 states:**

- “(1) At any reasonable time, persons authorized in writing by the division head have the right, with respect to a geothermal resource,
- (a) to enter on and inspect any well or place at which geothermal resources are handled, processed or treated, and any place used or occupied for those purposes,
  - (b) to inspect all equipment, plant and records relating to the resource, and
  - (c) to take samples or particulars or carry out tests or examinations.
- (2) If records required by the regulations to be kept are kept at a place other than a place referred to in subsection (1)(a), persons employed in the division and authorized in writing by the division head have the right, during normal business hours and after giving reasonable notice to the persons affected, to inspect the records, and for that purpose to enter the place where the records are kept.
- (3) Persons authorized by the division head to exercise any of the powers in subsection (1) or (2) must produce on demand their authorization signed by the division head and their identification card signed by the Minister.”

Source: [www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html)

See also: Chile: Law on Geothermal Energy Concessions, Law No 19.657 (2000), Art. 26 [www.cne.cl/fuentes\\_energeticas/f\\_renovables.html](http://www.cne.cl/fuentes_energeticas/f_renovables.html).

## 6. Assignment of leases

Under the normal law of leases in most countries, unless there is an express term in a lease to the contrary, a lessee may assign the premises without the consent of the lessor. Where there is an express term requiring the lessee to obtain the consent of the lessor to an assignment, in most jurisdictions statutory law requires that the consent shall not be unreasonably withheld. These rules will apply in the present context unless contrary statutory provision is made in the geothermal legislation. It may be thought appropriate to add such a contrary provision in light of the desirability of harnessing the resource in the public interest. In this regard, the interests of the State cannot realistically be equated with those of a private landlord.

The author suggests that the following precedent could be used:

- "(1) No lease or any land demised thereby or any interest in such lease or land shall be directly or indirectly assigned, transferred, sub-let, or be made the subject of any trust, except with the consent of the Minister first had and obtained, and any such dealing with such lease, or land made without such consent shall be void.
- (2) The Minister may require to be furnished to him such information concerning any proposed transfer, assignment, or sub-letting, as he considers necessary or advisable.
- (3) The Minister shall not be bound to consent to any such assignment, transfer or sub-letting.
- (4) If any lease or any land demised thereby is assigned, transferred or sub-let, or made the subject of a trust, except with the consent of the Minister first had and obtained, the lease shall be forfeited to the State."

In **Chile**, there is a statutory right to assign production leases.

Article 24 of the Law on Geothermal Energy Concessions, Law No 19.657 (2000)

"Geothermal energy concessions may be assigned to third parties, in whole or in part. Such transfer shall be made through public deed. Upon execution of such public deed of assignment, the new holder of a concession shall surrogate the previous holder thereof, solely by operation of law, in the liabilities and rights under the concession." [www.cne.cl/fuentes\\_energeticas/f\\_renovables.html](http://www.cne.cl/fuentes_energeticas/f_renovables.html).

In contrast, in **Vanuatu** the Geothermal Energy (Prospecting Licenses) Regulations, c 197 (1988), reg. 5 provides that:

"a license is not transferable except with the consent in writing of the Minister, who shall only grant such consent if he is satisfied as to the status of the new licensees as he would be for the grant of a new license." [www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation).

## 7. Termination of leases

Termination of leases may occur by forfeiture or by surrender. A separate provision in the legislation would be required for each eventuality.

### a. Forfeiture

The legislature will presumably wish to retain discretion to exercise a right of forfeiture of a production lease wherever the lessee fails to comply with the terms of the lease or breaches the requirements of the Act. A suitable precedent would read:

"If the lessee fails to comply with the provisions of this Act or makes default in the performance or observance of any of the covenants and conditions of the lease, the lease shall for any such failure or default be voidable at the will of the Minister".

**British Columbia, Canada:** Geothermal Resources Act 1996, c 171, §§ 10-11  
[www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html)



## b. Surrender

Statutes relating to the exploitation of natural resources commonly include a provision entitling the production lessee to surrender the lease prior to its expiration through the effluxion of time. In order to avoid doubt, the legislation usually states that surrender does not affect any existing liability or obligation that arose during the term of the lease. The legislation also usually requires the lessee to make suitable provision for the conservation and protection of the property either prior to or after the surrender: See:

Geothermal Exploration Act 2004, §§ 65-66 (**Queensland, Australia**) [www.legislation.qld.gov.au](http://www.legislation.qld.gov.au);

Geothermal Energy Act, c 197 (1988), § 25 (**Vanuatu**)  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation).

The author suggests that a suitable precedent could read:

- (1) The lessee may with the written consent of the Minister surrender and terminate the lease upon the payment of all rents royalties and other obligations due and payable to the State.
- (2) The surrender of a lease shall not release the lessee from any liability that arose during the term of the lease or on the surrender thereof, or from liability to comply with all the obligations under this Act.
- (3) On the surrender of a lease the lessee shall immediately take all necessary steps to make the geothermal work to which the lease relates secure and safe in accordance with the regulations.

## 8. Unitization agreements and orders

A commonly found provision in existing geothermal legislation is one or more requirements relating to unitization agreements and orders:

See:

**British Columbia, Canada:** Geothermal Resources Act 1996, c 171, §§ 18-19  
[www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html);

**USA:** Geothermal Steam Act 1970, 30 USC, § 1017  
<http://ipl.unm.edu/cwl/fedbook/geosteam.html>.

Such agreements and orders require the production field to be treated as one field for the purposes of production. Unitization enables the production by each lessee to be controlled by a certain formula. The advantages of unitization are fourfold: it may prevent damage to the reservoir; it prevents unnecessary capital expenditures for drilling, casing and the completion of wells; it promotes conservation of the resource; and it entitles each developer to a fair share of production.<sup>190</sup>

<sup>190</sup> For a discussion of unitization, see G J Kitchen, "Geothermal Leasing Practices" (1977) 13 Land and Water L Rev 25 at 56.

The author suggests that a suitable precedent could read:

- “(1) On receipt of an application for a unitization order from a lessee or group of lessees who hold locations that comprise at least 2/3 of the area proposed to be operated under the unitization agreement, and who have agreed in writing to a proposed unitized operation, the Minister may invite interested persons to make, within a time he specifies, submissions representing the advisability of or necessity for a unitization agreement.
- (2) After reviewing the submissions or on expiration of the time specified by him under subsection (1), the Minister may reject the application or make a unitization order requiring that the plan of unitized operations proposed by the applicant be applicable to the whole of the proposed unitized area, or to any area situated in the same field that he determines, and the order is binding on all owners of interests in the area ordered by the Minister to be subject to the plan of unitized operations.
- (3) Whenever the Minister determines that a geothermal resource area should be cooperatively operated as a unit to avoid waste, and the persons owning tracts or interests in such area refuse to enter into a unitization agreement pursuant to subsection (1) of this section, the Minister may issue an order that such area shall be operated as a unit.
- (4) A unitization order shall provide an equitable sharing of proceeds and liabilities from the geothermal resource area among the several lessees.”

## 9. Compensation to private landowners

Considerable, but unavoidable, inconvenience and financial loss will inevitably occur to the surface landowner wherever geothermal exploration and production takes place on his land. The loss may range from crop loss or damage, and/or damage to the surface and deprivation of possession over certain parts of the land. Existing geothermal statutes entitle the surface owner to full compensation for all losses, subject to the qualification that no compensation is payable in respect of geothermal energy beneath the land. See:

Geothermal Exploration Act, §§ 100-101 (Queensland, Australia)  
[www.legislation.qld.gov.au](http://www.legislation.qld.gov.au);

Geothermal Energy Act, c 197 (1988), § 33 (Vanuatu)  
[www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation).

The author suggests as an illustrative example:

- “(1) Every person who –
- (a) Has any estate or interest in any land injuriously affected by the exercise of any powers conferred by this Act or conferred by any exploration license or production lease granted under this Act; or
  - (b) Suffers any damage from the exercise of any powers so conferred – shall be entitled to full compensation for all such loss, injury and damage suffered by him.
- (2) The compensation to be made under this section shall be compensation for –
- (a) deprivation of the possession of the surface or of any part of the surface;
  - (b) damage to the surface or any part thereof, and to any improvements thereon, which may arise from the carrying on operations by the Minister or the lessee thereon or there under;
  - (c) severance of the land from other land of the owner or occupier;
  - (d) surface rights of way; and
  - (e) all consequential damages: Provided that in determining the amount of compensation no allowance shall be made for any geothermal resources known or supposed to be in or under the land.”

#### **D. Environmental Protection**

Six environmental problems associated with the development and exploitation of geothermal resources exist: blowouts; atmospheric pollution; land subsidence; water pollution; noise; and well abandonment.

The first issue is the relationship between the general environmental legislation, which most countries now possess, and the specific environmental provisions to be included within the geothermal statute. Should the geothermal statute contain all the legislative measures necessary to control the various environmental problems associated with geothermal energy, or should the statute merely contain provisions relating to environmental problems that are not encompassed within the general environmental legislation? Existing geothermal legislation adopts the latter approach.

The second issue is that the different types of geothermal resources do not all share the same environmental problems. All types of geothermal resources may cause problems of land subsidence, water pollution and well abandonment. The other problems of noise, air pollution and blowouts may be caused by the HDR resource and geopressed systems, but not the hot groundwater resource. The problem could be resolved if the distinction between a “geothermal resource” and a “low-temperature geothermal resource” referred to above is accepted and added into the definition section of the Act. If this legislative framework is adopted, the various environmental provisions

relating to blowouts, atmospheric pollution and noise can be stated in a separate subsection of the relevant sections to be inapplicable to low-temperature geothermal resources, while the provisions relating to land subsidence, water pollution and well would be applicable to both geothermal resources and low-temperature geothermal resources.

Any comprehensive environmental legislation is likely to include measures designed to safeguard against atmospheric pollution, water pollution and noise. Unless otherwise stated in the legislation, these measures would automatically apply to geothermal operations. For this reason, assuming the existence of comprehensive environmental legislation, no specific provision relating to any of these matters would appear to be required in any new geothermal legislation. The problems of blowouts, land subsidence and well abandonment are unlikely to be encompassed by the general environmental legislation. Specific provisions dealing with each of these matters could be inserted in the geothermal statute:

### 1. Blowouts

A common approach is to impose a general duty of care on the geothermal operator. See for example:

#### **California Public Resources Code, § 3739**

"Any person engaged in operating any wells wherein high pressure are known to exist, and any person drilling for geothermal resources in any district where the pressures are unknown shall equip the well with casings of sufficient strength, and with such other safety devices as may be necessary, and shall use every reasonable effort and endeavor effectually to prevent blowouts, explosions, and fires."

Source: [www.leginfo.ca.gov](http://www.leginfo.ca.gov).

### 2. Land subsidence

This problem can be dealt with administratively by the Minister if the geothermal statute gives the Minister the power to issue the lease subject to such conditions and covenants as he thinks fit, as referred to earlier.

### 3. Well abandonment

A good example of legislation dealing with well abandonment is the following:

**The Groundwater Act 1969, in Victoria, Australia § 40 states:**

- "(1) No occupier of a bore which has been used for the extraction of groundwater or for the disposal of any matter or which was constructed deepened enlarged or altered under a permit shall abandon such bore without the consent of the Minister.
- (2) An occupier may apply in an approved form to the Minister for his consent to abandonment of a bore.
- (3) The Minister may refuse to grant his consent until such abandonment program as may be specified by him has been carried out to his satisfaction.
- (4) If an occupier fails to comply with sub-section (1) the Minister may in writing direct him to carry out a specified abandonment program."

If the provision is breached, the Minister may order the work to be carried out and recover the cost as a civil debt.

Source: [www.austlii.edu.au/au/legis/vic/consol\\_act/pa1998137/](http://www.austlii.edu.au/au/legis/vic/consol_act/pa1998137/).

See also: **California:** Public Resources Code, §§ 3746-3750 [www.leginfo.ca.gov](http://www.leginfo.ca.gov)

### E. Miscellaneous

This part could contain the offences and penalties for breach of the legislation, as decided upon by the local legislature. This Part can also contain any regulations made under the legislation.

For offences and penalties, See: Chile: Law on Geothermal Energy Concessions, Law No 19.657 (2000), Arts. 43-44, [www.cne.cl/fuentes\\_energeticas/f\\_renovables.html](http://www.cne.cl/fuentes_energeticas/f_renovables.html);

Vanuatu: Geothermal Energy Act, c 197 (1988), Part XII [www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu\\_legislation](http://www.Vanuatu.usp.ac.fj/paclawmat/Vanuatu_legislation);

**British Columbia, Canada:** Geothermal Resources Act 1996, c 171, § 22 [www.qp.gov.bc.ca/statreg/stat/G/96171\\_01.html](http://www.qp.gov.bc.ca/statreg/stat/G/96171_01.html).

## III. CONCLUSION

Geothermal energy has many useful applications and is now being used to a considerable extent around the world. The chapter seeks to give the drafter of geothermal legislation guidance on the issues presented with this energy medium, from drilling, leasing and property rights provision through environmental protection and abandonment of geothermal properties.

## SECTION FIVE

# RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

Ibibia Lucky Worika\*

### I. INTRODUCTION

Many parts of the developing world are energy-resource rich. Even at that, energy prices are often too high with poor delivery even in the few cases where it is accessible, thus making it an important impediment to sustainable development. Apart from exhaustibility, the extraction, transportation and use of fossil fuels have deleterious impact on man and the environment, thus raising questions on their long-term sustainability.<sup>191</sup>

Nevertheless, energy production, transmission and consumption are fundamental ingredients to the development process. If developing countries are to transform from predominantly rural to industrial economies, however, they must necessarily choose a more sustainable energy path,<sup>192</sup> one that is environmentally benign in the short, medium and long run with a capacity for renewal.

The challenge is to provide energy services to large populations in rural areas and to reduce greenhouse gas emissions and other pollutants, without impeding development. This paper focuses on the legislative and regulatory aspects of energy efficiency and renewable energy for rural electrification. Rural electrification is especially significant in developing regions of the world where about two billion people lack access to modern energy services.<sup>193</sup>

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The views expressed in this paper are personal to the author and should not be attributed as the official views or positions of the organization with which he is affiliated. This paper is an adaptation of an earlier paper titled "Comparative Law Evaluations of Sustainable Energy: The African Perspective" delivered by author at a colloquium in Shanghai on "The Law of Energy for Sustainable Development" in November, 2003.

<sup>191</sup> Regarding the environmental impacts of energy production and consumption see "A Second Asia –Pacific Expert Meeting on Promoting Sustainable Consumption and Production: A Background Paper", Seoul, Republic of Korea, 6th – 7th November 2003. Organized by the Government of Korea, UN Department of Economic and Social Affairs (UNDESA), United Nations Environment Programme (UNEP), United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), <http://www.un.org/esa/sustdev/sdissues/consumption/Marrakech/KoreaBP%20final.pdf>

<sup>192</sup> On the linkages between energy, poverty and economic growth, see Dominique Lallement, "Delivering Sustainable Energy Services for Poverty Reduction and Economic Growth", [http://www.worldbank.org/html/fpd/esmap/pdfs/wec\\_dl.pdf](http://www.worldbank.org/html/fpd/esmap/pdfs/wec_dl.pdf) (October 25, 2001).

<sup>193</sup> E. Martinot and K. Reiche, "Regulatory Approaches to Rural Electrification and Renewable Energy: Case Studies from Six Developing Countries", A Working Paper, June 2000, p. 1 quoting the World Bank see [http://www.martinot.info/Martinot\\_Reiche\\_WB.pdf](http://www.martinot.info/Martinot_Reiche_WB.pdf). See also "Renewable Power Policy/Regulatory Approaches Worldwide: An Overview." Available at [http://www.worldenergy.org/wec-geis/global/downloads/accelerating/p3a\\_p.pdf](http://www.worldenergy.org/wec-geis/global/downloads/accelerating/p3a_p.pdf).

To be sure, rural electrification per se cannot ensure economic development. It is a necessary but insufficient condition. Rural electrification works best when overall conditions are right for rural income growth and when it is complemented by social and economic infrastructure development – such as rural water supplies, regional and feeder roads, health programs, and primary, secondary and college or technical education.<sup>194</sup> But, no doubt, rural electrification is a sine qua non for rural economic development as it catalyses these complimentary programs.

This Section sets out the legislative and regulatory options for promoting energy efficiency and renewable energy for rural development

## **A. Brief Overview of Rural Applications of Efficiency and Renewable Energy**

Some who currently lack access to modern electricity in developing countries will be served by central grid connections, connecting villages and remote areas to a national grid often owned and operated by a public utility. This tendency to incrementally extend grid to remote communities, however, increases costs particularly for those areas that are farther from the national grid. Predictably, remote areas with very small populations may remain unconnected.

Due to a lack of access to modern electricity, rural populations resort to burning large quantities of wood to satisfy their everyday energy needs. For example, much of the cooking in developing countries is done on wood or coal burning stoves. Use of wood requires women and children to spend much of their time and energy collecting firewood. Using either wood or coal for cooking in enclosed buildings exposes occupants, particularly women and children, to very concentrated health-damaging emissions and contributes considerably to carbon dioxide and other pollutant emissions. Wood burning also causes other severe harm to the environment, including rapid deforestation, followed by irreversible biodiversity loss.

Rural off-grid electrification can provide a viable alternative to grid electrification as the cost of off-grid technologies continues to decline. Costs will decline because of proven and improved technologies, and increased demand and production. There are examples of both public and private-sector-led markets for off-grid electrification in rural areas of developing countries. These decentralized off-grid generation technologies have been demonstrated, for example in small-scale hydropower, photovoltaic, wind, and geothermal and small-scale bio power using producer gas electrification projects. There are demonstrated experiences, for instance, in China, India, Kenya and Nigeria.<sup>195</sup>

**Other alternatives to wood burning for cooking, for example, include:**

- Fuel-efficient stoves that reduce wood and coal consumption and polluting emissions.
- Hybrid fuels that incorporate biomass waste and reduce the harmful effects of coal burning.
- Biogas units that yield gas from waste agricultural materials and improve sanitation while

<sup>194</sup> J. Goldemberg, *WORLD ENERGY ASSESSMENT (2000)*, Chapter 10 “Rural Energy in Developing Countries,” available at <http://stone.undp.org/undpweb/seed/wea/pdfs/chapter10.pdf> (LEAD AUTHORS: A. K. N. Reddy, Kirk R. Smith and R. Williams)

<sup>195</sup> For case studies around the world on micro financing of rural energy enterprise employing renewable energy resources and technologies, see E+Co, an independent company that began as a Ford Foundation Program. [http://www.energy-house.com/casestudy\\_world.htm](http://www.energy-house.com/casestudy_world.htm).

providing fuel for cooking and lighting.

- Use of Improved building materials and passive solar construction that reduce heating needs.
- Micro-hydropower and other renewable energy generators that provide clean electricity to rural off-grid communities.

Kenya's Rural Electrification Programme involves a government plan to invest \$13 million (US) annually to increase access to electricity in rural areas by modern forms of energy.<sup>196</sup> Kenya has an outstanding cooking stove program, having adapted a Thai bucket ceramic-lined charcoal-burning stove that saves between 20% and 50% of the fuel otherwise used and now costs only \$1-3. There are now about 900,000 of these "jiko" stoves in Kenya, reaching about 60% of urban households and 20% of rural homes. About 200 local firms produce the stoves. The Kenya program has been adopted in Tanzania, Uganda and Rwanda. China established a National Improved Stove Program in 1992, which has provided over half of China's rural households with improved stoves. China also started to manufacture, install and service the stoves. Some 160 million cooking stoves were upgraded between 1982 and 1998 at a cost of \$158 million in government support. The unit cost per stove was \$9. Inexpensive efficient stoves are available and in use in many places around the world now, which both reduce the amount of fuel needed and pollutant emissions.

## II. POLICY GOALS FOR EFFICIENCY AND RENEWABLE ENERGY DECISION-MAKING

What policy goals can guide rural applications of efficiency and renewable energy decision-making in developing countries?

Sustainable development in developing countries can hardly be achieved without rural applications of efficiency and renewable energy, thus underscoring the necessity for a dynamic and efficient legislative and regulatory system. All such regulatory systems must require a number of tasks to be performed: as an exercise of policy-making. The goals of rural applications of efficiency and renewable energy regime must be established; those goals must then be translated into the principles and rules that control behavior of the principal actors; and there must be procedures for explicating and enforcing the principles and rules and for the adjudication of disputes arising from them.<sup>197</sup>

While there is no single logarithm for determining universally applicable policy goals that can guide rural applications of efficiency and renewable energy decision-making, the policy goals, however they are couched, can amongst others stress the need to:

- Promote rural applications of efficiency and renewable energy in all its ramifications;
- Maintain fair, just and reasonable rates for rural electricity consumption;
- Ensure uninterrupted electricity to rural areas;
- Promote rural energy efficiency;

<sup>196</sup> UNEP communication

<sup>197</sup> See A. Ogus, *Regulation: Legal Form and Economic Theory* (Oxford: Oxford University Press, 1994), p. 99. See <http://www.hartpublishingusa.com/bookdetails.asp?id=760&bnd=1>



- Promote technological innovations and transfer of renewable energy technologies to rural communities (and to the people who would directly benefit from their use);
- Facilitate and encourage effective competition, education, training and public participation;
- Improve people's lives and livelihoods;
- Meet goals of sustainable development, including obligations and norms per multilateral environmental agreements such as those for greenhouse gas emissions reductions.

## A. India Policy Goals

In India, the policy goals have been stated to be:

- Providing reliable energy supply through a diverse and sustainable fuel mix that addresses security concerns;
- Speedy commercial exploitation of renewable power potential;
- Eradication and removal of energy poverty across the country;
- Ensuring availability and affordability of energy supply, including safety aspects related to it;
- Electrification of all households in remote villages by 2012;
- Electrification of around 18,000 remote villages through renewables by 2007 (those that are not likely to be connected to the grid by 2012);
- 10 per cent power capacity addition through renewables by 2012;
- 3 million family-type biogas plants and 7 million solar lighting systems by 2012.<sup>198</sup>

Other parts of India's evolving energy strategy include a Rural Electrification Action Plan that calls for 62,000 villages to be electrified by 2007 and 18,000 remote villages to be electrified using renewable energy sources by 2012.

## B. China Policy Goals

China's policies on energy efficiency and renewable energy development fall into three categories. Its central government establishes the first two levels of policy. Local governments, including provincial, municipal, and county governments, establish the third level of policy with overall direction from the central government.

The first-level policies provide general direction and guidance, and include speeches of state leaders about development of renewable energy and the Chinese government's standpoint on the global environment. The second-level policies specify goals/objectives and development plans, focusing on rural electrification, renewable energy-based generation technologies and improved

<sup>198</sup> M. Konnappan, "New Energy for Development" <http://www.ourplanet.com/imgversn/143/kannappan.html>. See also The Energy and Resources Institute, "Need for Rural Energy Policy in India" <http://www.teriin.org/discussion/renew/rural.htm> p. 1 of 1.

<sup>199</sup> National Renewable Energy Laboratory (NREL), "Renewable Energy Policy in China: An Overview" [http://www.nrel.gov/international/china/pdfs/35786\\_policy.pdf](http://www.nrel.gov/international/china/pdfs/35786_policy.pdf)

fuel wood facilities. These policies attempt to standardize the directions, focal points, and objectives of renewable energy development from different standpoints. Third-level policies consist of practical and specific incentives and managerial guidelines. These prescribe specific supporting measures for developing and using renewable energy.<sup>199</sup>

In October 2001, the China State Economic and Trade Commission (SETC) proposed its Tenth Five-Year Plan for Sustainable Development, including the Tenth Five-Year Plan for New and Renewable Energy Commercialization Development. For the period ending 2005, program goals include meeting electricity production targets, providing remote power, increasing annual solar water heating, providing and increasing solar electricity generation and transmission, wind power, geothermal energy as well as bio-energy amongst others.<sup>200</sup>

China regards the development of renewable energy as an important means to reduce the power sector's heavy reliance on coal, replacement of which is essential to reducing greenhouse gas (GHG) emissions, other pollutants and debilitating smog. Reducing local environmental damage is important as annual health and agricultural losses associated with coal-related air pollution in China are estimated to be as high as 6 percent of GDP. Renewable energy also is a critical component of China's long-term energy strategy for rural development. In 1995, China voiced new commitment to renewable energy, as outlined in the New and Renewable Energy Development Program, 1996-2010, developed by the State Planning Commission (SPC), the State Science and Technology Commission (SSTC), and the State Economic and Trade Commission (SETC). This program aims at improving the efficiency of renewable energy technology applications, lowering production costs and enlarging the contribution of renewable energy to overall energy supply.<sup>201</sup> China recently enacted a new Renewable Energy Law<sup>202</sup> designed to accelerate development of renewables in that country that reads in part:

## **The Renewable Energy Law - The People's Republic of China**

### **Chapter 4 Promotion and Application.**

Article 18—The Government encourages and supports the development and utilization of renewable energy in rural areas.

Energy authorities of local people's governments above the county level shall, on the basis of local economic and social development, ecological protection and health need, etc., prepare renewable energy development plan for the rural area and promote biomass energy like the marsh gas, etc. conversion, household solar energy, small-scale wind energy and small-scale hydraulic energy, etc.

People's government above the county level shall provide financial support for the renewable energy utilization projects in the rural areas.

Source: [http://www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

<sup>200</sup> See generally "Renewable Energy Policy in China: Overview" <http://www.nrel.gov/docs/fy04osti/35786.pdf> pp. 1-2.

<sup>201</sup> <http://www.worldbank.org.cn/English/content/702q1225506.shtml>

<sup>202</sup> [www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

## C. Nigeria Policy Goals

Unlike China, in Nigeria, there is no national policy dedicated specifically to energy efficiency and renewable energy or its applications to rural areas. There are, however, other policy instruments on the environment and energy that may be relevant to supporting such applications. The Nigerian National Policy on the Environment<sup>203</sup> provides that the goal of the National Policy on the Environment is to achieve sustainable development in Nigeria, and in particular to:

- Secure a quality of environment adequate for good health and well being;
- Conserve and use the environment and natural resources for the benefit of present and future generations;<sup>204</sup>

Strategies to achieve this objective include:

- Implementing a detailed Environmental Impact Assessment (EIA) on all planned energy projects backed by a detailed baseline ecological data against which subsequent environmental changes and/or impacts can be measured;
- Developing a rational National Energy Utilization Master-Plan<sup>205</sup> that balances the need for conservation with the utilization of premium energy resources for premium socio-economic needs;
- Encouraging the use of energy forms that are environmentally safe and sustainable, particularly solar energy;
- Promoting and encouraging research for the development and use of various locally available energy sources especially non-conventional resources such as geothermal, solar, wind and other complex forms of hydrocarbons other than oil and coal.<sup>206</sup>

One of the most important objectives of the National Electric Power Policy adopted by the Electric Power Sector Reform Implementation Committee and approved by the National Council on Privatization is to ensure that Nigeria has an electricity supply industry that can meet the needs of its citizens in the 21st Century.<sup>207</sup> On rural electrification, the primary policy objective is to expand access as rapidly as can be afforded in a cost-effective manner. The rural electrification policy includes a full menu of options – grid and off-grid, mini-grid, non thermal and renewables, while ensuring close co-ordination of rural electrification expansion with economic development objectives and encouraging states, local communities as well as the private sector to develop and contribute financially to rural electrification.<sup>208</sup>

<sup>203</sup> Federal Environmental Protection Agency (FEPA) Revised Edition 1999.

<sup>204</sup> Emphasis supplied.

<sup>205</sup> Emphasis supplied to underscore the irony that there is no such National Energy Utilization Master-Plan.

<sup>206</sup> Federal Environmental Protection Agency (FEPA) Revised Edition 1999.

<sup>207</sup> See Bureau of Public Enterprises (BPE), Federal Republic of Nigeria National Electric Power Policy, <http://www.bpeng.org/10/adddoctool.asp?DocID=216&MenuID=43#> (Sector Policy – Electric Power Policy).

<sup>208</sup> Ibid at pp. 38-39.

## D. Ghana Policy Goals

In Ghana, the evolution of national energy policies can be traced to the enactment of the Provisional National Defense Council (PNDC) Law 62 in 1983, which provided the statutory foundations for the establishment and operations of a board known as the National Energy Board (NEB) that was responsible for formulating recommendations on energy policy and submit it to the PNDC.<sup>209</sup> The current policy document guiding the development of the energy sector is the Energy Sector Development Programme (ESDP). According to Part II of the ESDP document, Ghana energy sector policies are shaped by the following needs amongst others:<sup>210</sup>

- To plan for the sustained provision and security of energy supplies;
- To increase the reach of energy resources to all sections of the country to facilitate their socio-economic improvements, especially the majority rural people;
- To enhance private sector investment in the development of the energy sector.

Within the framework of meeting the country's energy requirements for sustained growth and development, the energy sector's goals include:<sup>211</sup>

- To restore improved productivity and efficiency in the procurement, transformation, distribution and use of all energy resources;
- To reduce the country's vulnerability to short-term disruptions in the energy resources and supply bases;
- To consolidate and further accelerate the development and use of the country's indigenous energy sources, especially wood fuels, hydropower, petroleum and solar energy.

Amongst the action programs developed by the Ministry of Mines and Energy for the energy sector for the short, medium and long-terms are: The Renewable Energy Development Programme (REDP); The Power (Electricity) sub-sector; and The Energy Efficiency & Conservation Programme.<sup>212</sup>

The implementation strategy for all renewable energy projects is on a demand-driven basis within the following criteria: sustainability, payment for service and cost recovery, full involvement of potential users, environmental considerations and the basic needs of the community or users. Also considering that most of the renewable energy technologies are still at their infancy, the Ministry of Mines and Energy proposed to subsidize the sector for interested investors in order to encourage accelerated penetration of renewable energy technologies in the market.<sup>213</sup>

<sup>209</sup> Ghana Provisional National Defense Council Law (PNDC) Law 62 of 1983. See J. P. Painuly and J. V. Fenhann, *Implementation of Renewable Energy Technologies – Opportunities and Barriers: Ghana Country Study* (Denmark: UNEP Collaborating Centre on Energy and Environment, 2001), p. 22. URL: <http://uneprisoe.org/RETs/SummaryCountryStudies.pdf> at p. 22.

<sup>210</sup> *Ibid* at p. 25.

<sup>211</sup> *Ibid* at p. 26.

<sup>212</sup> *Ibid*.

<sup>213</sup> "Renewable Energy Policy Instruments and Measures in Ghana", *supra* note 20 at pp. 28-29.

<sup>214</sup> *Ibid* at p. 30.

There also is a power sector development program (PSDP), which strategy and action plan are aimed at achieving the following objectives amongst others:<sup>214</sup>

- Extension of reach of electricity to all parts of the country, especially to the rural areas, under a National Electrification Scheme (NES) by the year 2020;
- Assuring future supply of power by developing new hydro resources as well as complementing the predominantly hydropower generation capacity with other energy sources such as thermal generation.<sup>215</sup>

### III. LEGISLATIVE AND REGULATORY FRAMEWORK FOR RURAL APPLICATIONS OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

What legislative measures can best advance rural applications of energy efficiency and renewable energy in developing countries?

In most jurisdictions, a principal law of the power sector usually establishes an electricity regulatory board or other regulatory agencies with powers to process and recommend applications for licenses, set, review and adjust transmission and distribution tariffs, enforce environmental and safety regulations, investigate complaints, ensure there is competition and approve power purchase contracts and transmission and distribution contracts. The provisions are usually broad and permissive, with the enactment of subsidiary legislation or regulations to deal with specific aspects of electricity regulation. Since the bulk of regulatory matters are usually addressed through subsidiary legislation or regulations in order to maintain a fair degree of flexibility in dealing with ever-changing and fluid power sector needs, an opportunity exist for regulating off-grid electrification in rural areas not easily accessible by the grid network. Additionally, other statutes may complement the electric power legislation in the regulation of the power sub-sector by paying specific attention to rural applications of efficiency and renewable energy.

Regulations and energy policies have a direct impact on the success of energy markets generally, market participants and stakeholders, as well as products and services. However, the exact nature and scope of this impact will depend on the effectiveness of the implementing agencies or institutions. Regulatory institutions can either promote or defeat the goals of regulatory policy captured in legislation or regulations. Every regulatory institution needs at least to have:

- A clearly defined organizational structure;
- A hierarchical relationship within its structure;
- Sufficient qualified staffing and financing;
- Strategic policy goals;
- Internal and external reporting requirements;
- Licensing provisions; and
- Consultation, hearing and expeditious approval processes.

<sup>215</sup> The implementing legislation and regulations will be examined in the next subsection dealing with regulations.

The legislative and regulatory provisions for promotion and regulation of energy efficiency and renewable energy are addressed below for India, China, Nigeria, Ghana and Kenya as typical of countries in transition and developing countries. In some cases the laws of other countries are discussed, including some comparisons to the laws of developed countries.

## A. India

In India, the Electricity Act 2003 seeks to create a liberal framework of development for the power sector by distancing the Government from regulation, while promoting efficient and environmentally benign policies.<sup>216</sup> Despite this fact and the establishment of the unique India Renewable Development Agency (IREDA) under the administrative control of the Ministry of Non-conventional Energy (MNE)<sup>217</sup> and, apart from environmental laws, there is no countrywide renewable energy specific legislation applicable to rural areas in India.<sup>218</sup> It is, however, noteworthy that section 4 of the Electricity Act 2003 makes it imperative on the Central Government after consultation with the State Governments to "...prepare and notify a national policy, permitting stand-alone systems (including those based on renewable sources of energy and non-conventional sources of energy) for rural areas.<sup>219</sup>" Section 5 then obliges the Government to also "...formulate a national policy for rural electrification and for bulk purchase of power and management of local distribution in rural areas through Panchayat Institutions, users' associations, co-operative societies, non-Governmental organizations or franchisees."<sup>220</sup>

With respect to energy efficiency, an energy conservation law was enacted in 2001 that addresses the use and conservation of energy in an attempt to reduce the amount of new generating capacity needed. This law created a Bureau of Energy Efficiency that has the power to make regulations concerning energy efficiency and conservation.<sup>221</sup> The Energy Conservation Act 2001 extends to the whole of India except the states of Jammu and Kashmir.<sup>222</sup> One of the distinctive features of this Act is the incorporation and establishment of a Bureau of Energy Efficiency (BEE) in Chapter II, which functions amongst others are to formulate and facilitate implementation of pilot projects and demonstration projects for promotion of efficient use of energy and its conservation; promote use of energy efficient processes, equipment, devices and systems. It is also to give financial assistance to institutions for promoting efficient use of energy and its conservation.<sup>223</sup>

India's current regulatory framework for efficiency and renewable energy applications of rural electrification oscillates somewhere between the Electricity Act of 2003 and the Energy Conservation

<sup>216</sup> The Electricity Act 2003 (No. 36 of 2003), See [http://powermin.nic.in/The%20Electricity%20Act\\_2003.pdf](http://powermin.nic.in/The%20Electricity%20Act_2003.pdf) or <http://powermin.nic.in/>. A review of India's old electricity laws beginning with the Indian Electricity Act of 1910, the Electricity (Supply) Act of 1948 and, Electricity Regulatory Commission Act 1998 (all now superseded by the 2003 Act) indicates that these pieces of legislations were not actually directed at efficiency and renewable energy applications for rural electrification. See Central Electricity Regulatory Commission at <http://www.cercind.org/ext.htm>

<sup>217</sup> IREDA is the world's only cabinet-level renewable energy agency

<sup>218</sup> For Environmental law resources including specific legislation on the Indian Environment see <http://www.sanctuaryasia.com/resources/environlaw/index.php>. See also <http://envfor.nic.in/legis/legis.html>

<sup>219</sup> [http://powermin.nic.in/acts\\_notification/pdf/The%20Electricity%20Act\\_2003.pdf](http://powermin.nic.in/acts_notification/pdf/The%20Electricity%20Act_2003.pdf)

<sup>220</sup> Ibid.

<sup>221</sup> Department of Energy, U.S., "An Energy Overview of India" [http://www.fe.doe.gov/international/South\\_and\\_Southwest\\_Asia/indiover.html](http://www.fe.doe.gov/international/South_and_Southwest_Asia/indiover.html) p. 6 of 37

<sup>222</sup> See Chapter 1, Article 1(3) URL: [http://powermin.nic.in/acts\\_notification/pdf/ecact2001.pdf](http://powermin.nic.in/acts_notification/pdf/ecact2001.pdf). Chapter 1, Article 2 of the Energy Conservation Act 2001 defines "energy" as "any form of energy derived from fossil fuels, nuclear substance or materials, hydro-electricity and includes electrical energy or electricity generated from renewable sources of energy, or biomass connected to the grid."

<sup>223</sup> Energy Conservation Act 2001, Chapter IV, Article 13(j), (k) and (m).

Act of 2001. However, the absence of legislation for the mandatory purchase of renewable power, absence of a green power market, and financially weak utilities are some of the barriers the State Electricity Regulatory Commissions are facing in promoting renewable power.<sup>224</sup> India is direly in need of a renewable energy electricity law that will set the stage for rural applications of renewable energy.

In India, the Ministry of Non-Conventional Energy Sources (MNES) is the administrative ministry for policies and programs in the area of renewable energy. The Ministry is organized into several divisions dealing with a set of technologies and applications. The extension programs of the Ministry are largely implemented through State "Nodal" Agencies. These agencies in turn mobilize participation of local institutions, non-governmental organizations (NGOs) and village-level organizations for implementation of programs. R&D programs also are sponsored by the Ministry, mainly in educational institutions, national laboratories and to some extent, in industries, in the public and private sectors.<sup>225</sup>

MNES has set up a Solar Energy Centre with state-of-the-art facilities for testing solar thermal and solar photovoltaic materials, devices and systems. The centre provides test facilities for certification as well as developmental purposes. It also prepares product specifications and draft national standards.<sup>226</sup> In India, there has been a long-standing program of financial incentives for solar photovoltaic electricity, which has resulted in 50,000 solar home systems and 30,000 solar streetlights.<sup>227</sup>

Another institution, the Centre for Wind Energy Technology, has been created to provide technical support to the Ministry in the implementation of wind energy programs.<sup>228</sup> Besides, a National Institute of Renewable Energy is being set up at Jalandar in Punjab to cater to research and human resources needs of the renewable energy arena.<sup>229</sup>

The India Renewable Energy Development Agency (IREDA) promotes, develops and extends financial assistance for renewable energy and energy efficiency/conservation projects.<sup>230</sup> Established in 1987 as a Public Sector Enterprise, under the administrative control of Ministry of Non-Conventional Energy Sources (MNES), IREDA has been spearheading the mission to ensure "Energy for All". In the past fifteen years IREDA has evolved into a unique development and financial institution in the renewable energy sector, reaching out to the individual user and providing micro-credit through financial intermediaries.<sup>231</sup>

It can be said that India considers new and renewable energy development and deployment to be of great importance for long-term energy supply security, decentralization of energy supply (particularly for the benefit of the rural population), and environmental benefits and sustainability.

<sup>224</sup> "Renewable energy power: an Indian perspective" Energy Technology News, Issue 6 and 7, January and April 2002 at <http://www.teriin.org/opet/articles/art10.htm>

<sup>225</sup> "Renewable Energy in South Asia" [http://www.worldenergy.org/wec-geis/publications/reports/renewable/country\\_reports/chap\\_2\\_3\\_3.asp](http://www.worldenergy.org/wec-geis/publications/reports/renewable/country_reports/chap_2_3_3.asp)

<sup>226</sup> <http://mnes.nic.in/solarenergy1.html>

<sup>227</sup> See E. Martinot and K. Reiche, *ibid.* See also A. Barnett, "The Diffusion of Energy Technology in Rural Areas of Developing Countries: A Synthesis of Recent Experience" 18(4) *World Development* 539-53 (1990).

<sup>228</sup> <http://www.cwet.tn.nic.in/WRA.html>

<sup>229</sup> [http://www.worldenergy.org/wec-geis/publications/reports/renewable/country\\_reports/chap\\_2\\_3\\_3.asp](http://www.worldenergy.org/wec-geis/publications/reports/renewable/country_reports/chap_2_3_3.asp)

<sup>230</sup> See India Renewable Energy Development Agency (IREDA), Ltd., <http://www.iredaltd.com/>. See also <http://www.eco-web.com/cgi-local/sfc?a=/index/index.html&b=/register/04030.html>

<sup>231</sup> Ministry of Non-conventional Energy Sources Government of India, "India Renewable Energy Development Agency", <http://www.mnes.nic.in/frame.html?publications.html>

In this context, the Indian renewable energy program is a goal-oriented effort to meet the country's energy needs in an environmentally sound way.<sup>232</sup> Even at that, there appears to be an urgent need for promotional and regulatory measures that can widen the role of and demand for renewable energy generation and use, particularly in rural communities. Although a few of the states have begun legislative reforms in the electricity sector – Orissa, Haryana and Andhra Pradesh – more still needs to be done in the form of a country-wide integrated legislative program. Most of existing reforms are aimed at extending existing grid-networks. In addition to the Energy Conservation Law 2001, a Renewable Energy Promotion and Application Law similar to that proposed in China for 2005 can focus attention specifically on rural applications of efficiency and renewable energy. Additionally, an effective co-ordination of the works of existing institutions for an integrated approach can translate policy and regulatory proposals into concrete gains.

## B. China

China's Electricity Law of 1995 went into effect April 1, 1996.<sup>233</sup> Several articles of the law encourage the use of cleaner fuels, such as natural gas and liquefied petroleum gas, and require environmental facilities to be built in tandem with new power generation facilities.<sup>234</sup>

### China: The Electricity Law of 1995

The 1995 Electricity Law also extends support to solar, wind, geothermal and biomass energy for power. Article 5 of the Law provides that:

"The construction, production, supply and utilization of electric power shall protect the environment according to law, adopt new technologies, minimize discharge of poisonous waste, and prevent pollution and other public hazards. The State encourages and supports electricity generation by using renewable and clean energy resources."<sup>235</sup>

Chapter VI deals with the subject of "Rural Electric Power Construction and Agricultural Utilization of Electricity".<sup>236</sup> Article 48 provides that:

"The State advocates the exploitation of rural hydropower resources, the construction of medium size hydropower stations to promote rural electrification. The State encourages and supports rural areas to utilize solar energy, wind energy, geothermal energy, biomass energy, and other energy resources to develop rural electric power sources and to increase the rural power supply."

Full text available at: <http://www.zhb.gov.cn/english/chanel-3/index.php3?chanel=3>

<sup>232</sup> "MNES: Ministry of Non-conventional Energy Sources" <http://www.vigyanprasar.com/comcom/develop67.html> See also "MNES - A Profile" <http://www.indiasolar.com/MNES-PROFILE.html>.

<sup>233</sup> Article 5, Electricity Law of the Peoples' Republic of China (December 28, 1995), see DTPOWER, "Industry Overview" [http://www.dtpower.com/en/jygl/overview\\_law.asp](http://www.dtpower.com/en/jygl/overview_law.asp). See also China SEPA website for the translated English version <http://www.zhb.gov.cn/english/chanel-3/index.php3?chanel=3>.

<sup>234</sup> "China's Electric Power Sector Gets New Law and New Structure" <http://www.pnl.gov/china/bulle2-4.html>. See also China Daily, March 29, 1996 and Asian Energy News, Vol. 5, No. 12, Dec. 1995.

<sup>235</sup> Supra note 35.  
<sup>236</sup> Article 48, *ibid*.



In 2005, China passed a new Renewable Energy Law to go into effect in January 31, 2006, designed to promote and regulate renewable energy, providing inter alia:

### **China: The Renewable Energy Law of 2005**

**Article 4**—The Government lists the development of utilization of renewable energy as the preferential area for energy development and promotes the construction and development of the renewable energy market by establishing total volume for the development of renewable energy and taking corresponding measures.

The Government encourages economic entities of all ownerships to participate in the development and utilization of renewable energy and protects legal rights and interests of the developers and users of renewable energy on the basis of law.

**Article 8**—Energy authorities of the State Council shall, on the basis of the middle and long-term total volume target of renewable energy throughout the country, prepare national renewable energy development and utilization plan, which is to be implemented after being approved by the State Council.

Source: [www.renewableenergyaccess.com/assets/download/China\\_RE\\_Law\\_05.doc](http://www.renewableenergyaccess.com/assets/download/China_RE_Law_05.doc)

Amongst others, the new law would enforce such coercive measures as the prescribed proportion of renewable energy in the total electricity output, so as to expand the market share of renewable energy.<sup>237</sup> The law provides a legal framework for the implementation of incentives aimed at encouraging the development of renewable technologies and provides market opportunities for renewable energy companies so that local governments, energy enterprises and the public can themselves promote and utilize renewable energy.<sup>238</sup>

The overall objective of the law is to meet short-term energy needs while strengthening long-term sustainable development objectives. Amongst others, the law aims to reduce air pollution, safeguard human health and the environment, provide power to off-grid rural areas as well as contribute to mitigating climate change. It will blend the basic principles of the market economy with the political objectives of energy security.<sup>239</sup>

In order to provide electricity remote areas in western China, and promote sustainable development in these areas, the central government of China implemented the Songdiandaoxiang (Providing Electricity to the Towns, hereinafter SDDX) Township Electrification Program in 2002, by means of building solar PV power stations and small hydropower installations. The National Development and Reform Commission (NDRC) oversee SDDX.<sup>240</sup>

<sup>237</sup> "China Drafting Law on Promotion of Renewable Energy" <http://au.news.yahoo.com/040831/3/qk1b.html> p. 1 of 1.

<sup>238</sup> Ibid.

<sup>239</sup> National Renewable Energy Laboratory (NREL), "Renewable Energy Policy in China: Overview" <http://www.nrel.gov/docs/fy04osti/35786.pdf>

<sup>240</sup> [http://www.creia.net/cms\\_eng/\\_code/english/invest/doingproject\\_detail\\_info.php?column\\_id=38&item\\_id=210](http://www.creia.net/cms_eng/_code/english/invest/doingproject_detail_info.php?column_id=38&item_id=210); see also Township Electrification Program [www.nrel.gov/docs/fy04osti/35788.pdf](http://www.nrel.gov/docs/fy04osti/35788.pdf)

The 12 target provinces in this program include Inner Mongolia, Qinghai, Gansu, Xinjiang, Sichuan, Xizang, and Shaanx. The program covers 1065 towns and total investment exceeds RMB ¥ 4.7 billion (568.6 US\$). The whole program will be implemented in two phases. In the first phase, 699 power stations will be built with the total investment RMB ¥ 2.56 billion (309.7 US\$); while in the second phase, another 366 power stations will be built and the total investment of this phase is RMB ¥ 2.13 billion (357.7 US\$) By the end of 2003, 688 PV power stations and 377 small hydro power stations were built. Almost 90% of the PV stations are in operation. It is expected that the program will be completed by the end of 2005.

In the SDDX Program, a bidding procedure was adopted in selecting the contractors. The selected contractors are responsible for the power station design, equipment procurement, site construction, and three years of operation. All the selected contractors are research institutes or enterprises in the areas of PV power station design, construction, and management, having experience in PV power station building.

For securing the quality of the projects in SDDX program and its stable and sustainable operation, NDRC issued a "SDDX Projects Management Requirements and Construction Procedure," and "Regulations on SDDX projects acceptance and operation and maintenance," which lists clear requirements on the construction, acceptance, operation, and maintenance of the projects. At the same time, training materials were prepared for the operators, in which, all the knowledge and skills necessary for operating the projects were incorporated.

In China, several institutions are involved in rural applications of efficiency and renewable energy. The Energy Research Institute (ERI) of the State Planning and Development Commission (SPDC) is the only energy, economy and policy research institute at the national level in China.<sup>241</sup> Its main function is to develop a scientific and technical basis for economic evaluation and assessment of the development of government's energy strategy and policy. ERI operates directly or is affiliated with four other research centers. The Energy Economics and Strategy Research Centre works on energy demand forecast and balance analysis; energy supply sectors; media and long-term development strategies, especially for the supply side; energy pricing; and regulation. The Energy Environment and Climate Change Research Centre, that serves as the secretariat for the Working Group on Climate Change of China, was the leading group in preparing China's first country communication report to the UN Framework Convention on Climate Change (UNFCCC).<sup>242</sup> The Centre for Renewable Energy Development (CRED), a major supporting team to the State Development Planning Commission and the State Economic and Trade Commission on a series of national renewable energy promoting programs, also covers rural energy issues. The Beijing Energy Efficiency Centre, founded by ERI and the US Department of Energy (USDOE), is well known in energy conservation communities not only in China but globally. It has conducted many policy studies of energy efficiency and serves as a major technical supporting team for many national programs.<sup>243</sup>

The China Sustainable Energy Program (CSEP) supports China's policy efforts to increase energy efficiency and renewable energy. The program aims to build capacity in China to analyze energy savings and renewable energy opportunities as well as developing policies to capture those

<sup>241</sup> See generally Energy Research Institute (ERI), State Development Planning Commission (SDPC), <http://www.nira.go.jp/ice/nwdtt/dat/1044.html>. See also <http://www.beconchina.org>.

<sup>242</sup> <http://www.nira.go.jp/ice/nwdtt/dat/1044.html>

<sup>243</sup> *Ibid.*

opportunities. The program has provided assistance to Chinese agencies, experts, and entrepreneurs in solving energy challenges for themselves and their country. At the request of Chinese non-governmental organizations (NGOs), the program lends support to capacity building and technology policy transfer through linking Chinese experts with “best practices” expertise from around the world. When it determines there is an unmet need in the field, the program may convene workshops, commission papers, or take other direct initiatives, in addition to its primary role as a grant-maker.<sup>244</sup>

The National Renewable Energy Laboratory (NREL) is the U.S. Department of Energy’s premier laboratory for renewable energy research and development and a lead laboratory for energy efficiency research and development.<sup>245</sup> It conducts renewable energy and energy efficiency R&D in programmatic areas such as rural energy development, wind energy development, energy efficiency, renewable energy business development, electric and hybrid electric vehicle development, geothermal development and use including renewable energy planning and use under a Protocol Agreement with China.<sup>246</sup> Lawrence Berkeley National Laboratory is the principal US energy efficiency laboratory and has worked in China with the ERI and other agencies for more than twenty years.

Experience in China shows that policy is one of the most influential tools for driving renewable energy development. While renewable energy policy is at its developing stages, there is evidence that China is in the process of perfecting these policies and regulations as well as institutional mechanisms. Currently, China is in the process of implementing the first of its three-phase policies (2000-2005). Although, these policies are yet to be embodied in legislation or regulations, for the period ending in 2005, program goals include:

- Electricity production goals: Reach 1.3 metric tons of coal equivalent (Mte) of electricity using new and renewable energy (excluding small hydropower and traditional use of biomass), with corresponding CO<sub>2</sub> reduction of 10 metric tons and SO<sub>2</sub> reduction of at least 0.6 Mt;
- Remote power: Provide power for 1.3 million families (5-6 million people) in remote areas, at the same time providing employment for 200,000 people through renewable energy;
- Solar water heating: Increase annual solar water heating to 1.1 million square meters with the cumulative amount of 64 million square meters. There will be 5-10 large-scale enterprises with internationally competitive ability;
- Solar electricity: Increase production capacity of solar cells to 1.5 megawatts (MW) each, with a cumulative capacity of 53 MW;
- Wind power: Increase installed capacity of grid-connected wind power to 1.2 gigawatts, with manufacturing capacity of 150-200 MW to meet domestic market demand;
- Geothermal energy: Increase production of geothermal energy to 20 million square meters;
- Bioenergy: Increase supplies from highly efficient bioenergy, including large-scale and mid-scale biogas from industrial organic wastewater, farm waste, and biomass gasification systems to almost two billion cubic meters.<sup>247</sup>

<sup>244</sup> <http://www.efchina.org/home.cfm>.

<sup>245</sup> See <http://www.nrel.gov/>

<sup>246</sup> See “U.S. and China Renewable Energy Development and Energy Efficiency Protocol” <http://www.nrel.gov/international/china/protocol.html>

<sup>247</sup> NREL International Programs, [www.nrel.gov/international](http://www.nrel.gov/international)

In China, small hydropower is considered a potential foundation of rural economic development. The areas supplied with electricity from small hydropower are mostly mountainous areas, which are hard to reach with large national grids and which have suffered from the lack of or shortage of electricity. This has severely restrained the economic development in these areas. In these situations, small hydropower plants have supplied enough electricity to provide lighting, television, refrigeration and cooking heat to homes in rural areas, thus becoming one of the foundations of the economic vitalization process for mountainous areas.<sup>248</sup>

In the field of legislation, the 1995 Electricity Law as well as the newly enacted Renewable Energy Law will together chart the trajectory for a regulatory framework for rural applications of renewable energy in China.

### C. Nigeria

The 1999 Constitution of Nigeria provides the legal basis for off-grid electrification in rural areas falling within each state of the federation in the form of renewable energy by empowering the House of Assembly of each state to establish electric power stations within their respective states, generate and transmit and distribute electricity to areas not covered by the national grid system within that state amongst others.<sup>249</sup>

The Electricity Act<sup>250</sup> is stated to be "An Act to provide for the regulation and control of electricity installations, and of the generation, supply and use of electricity energy."<sup>251</sup> Every undertaking in the development of the sub-sector must comply with this Act. Section 2 provides as follows:

#### **Nigeria Electricity Act of 1998, Section 2**

"This Act and the regulation made there under shall apply in respect of any undertaking for the manufacturing, distribution or supply of electricity established by the Government of a State or any of its agencies to the same extent as the Act and regulations apply in respect of any such undertaking established by any other person or authority."

Source: <http://www.nigeria-law.org/LFN-1990.html>

With respect to hydroelectric power, the Water Resources Act governs water resources development in Nigeria.<sup>252</sup> This Act establishes the legal framework for the development of water resources. It places ultimate responsibility for the proper development of the nation's water resources on the Ministry of Water Resources and Rural Development. The Act vests rights to the use and control of

<sup>248</sup> Gu Shuhua and Liu Wenqiang, "Development of Small Hydropower in China" <http://www.ieglobal.org/ESDVol3No3/smallhydro.pdf>. See also China Rural Energy Enterprise Development (CREED) <http://www.c-reed.org/REED/index.htm>.

<sup>249</sup> See Section 14 to Part II of the Second Schedule to the 1999 Constitution of Nigeria. <http://www.nigeria-law.org/ConstitutionOfTheFederalRepublicOfNigeria.html#Schedules>

<sup>250</sup> Cap. 106 Laws of the Federation of Nigeria 1990. See generally <http://www.nigeria-law.org/LFN-1990.html>, but see author for actual statute.

<sup>251</sup> See the preamble to the Electricity Act.

<sup>252</sup> Decree No. 101 of 1993. See generally <http://www.nigeria-law.org/LFN-1993.html>. See author for actual Decree.

water resources in the state.<sup>253</sup> This does not preclude the rights of individuals to take and use water for domestic<sup>254</sup> or industrial purposes including the generation of hydropower.<sup>255</sup> Nevertheless, a license is required for any person to operate any hydraulic work on the waterways or underground.<sup>256</sup> The mode of application is spelled out under Section 10 of the Act that requires an application for the grant of a license to carry out hydraulic works to be made to the Secretary in such form and manner and containing or be accompanied by such information and document as the Secretary may from time to time prescribe.<sup>257</sup>

Bio-fuels in the forms of wood, charcoal, and biomass constitute at least 70% of the energy consumed all over Nigeria. The demand for wood fuels, for example, is expected to rise by about 350% by 2030 and beyond, while urban consumption is expected to grow by 250% within the same period.<sup>258</sup> The requirement for an environmental impact assessment in respect of any project embarked upon by any private or public authority with likely environmental impact under the Environmental Impact Assessment Act No. 86 1992 all combine to reduce the trend towards massive deforestation in Nigeria.<sup>259</sup>

Other renewable energy resources that could in principle meet almost all Nigeria's needs, such as solar power, wind power, geothermal energy and wave power are not given any specific regulatory prominence. Nevertheless, the Energy Commission of Nigeria Act established the Energy Commission of Nigeria and charged it with responsibility for coordinating and general surveillance over systematic development of the various energy resources of Nigeria including new and renewable energy sources.<sup>260</sup> The Jigawa Alternative Energy Trust fund, with the United States Department of Energy is constructing a solar electric project in Jigawa State. The project is a result of a \$600,000 solar rural electrification and water-pumping project for 3 villages in Jigawa State.<sup>261</sup>

In Nigeria, the regulatory institution specific to efficiency and renewable energy is the Energy Commission of Nigeria (ECN), which was established by the ECN Act No. 109, Laws of the Federation of Nigeria (LFN) 1990, as the agency responsible for the co-ordination and general

<sup>253</sup> Section 1(1) provide of the Water Resources Act provides:

"The right to the use and control of all surface and groundwater and of all water in any water course affecting more than one state as described in the schedule to this Decree together with the bed and banks thereof, are by virtue of the Decree and without further assurance vested in the Government of the federation."

<sup>254</sup> See S. 2 of the Water Resources Act.

<sup>255</sup> Section 3 of the Act states as follows: "Any person or any public authority may acquire a right to use or take water from any water-course or any ground water described in the schedule to this Decree for any purpose in accordance with the provisions of the Decree and any regulation made pursuant thereto."

<sup>256</sup> Section 9(1) *ibid*.

<sup>257</sup> The Secretary referred to here is the Secretary charged with the responsibility for matters relating to water resources. The Federal Government with the Japanese government's technical assistance through the Japanese International Co-operation Agency (JICA) prepared a National Water Resources Master Plan. URL: <http://www.fao.org/ag/agl/aglw/aquastat/countries/Nigeria/index.stm>

<sup>258</sup> See Adesanya Olugbenga M. "Elysian Energy for a Sustainable Nigeria" URL: [http://www.worldenergy.org/wec-geis/publications/default/tech\\_papers/17th\\_congress/2\\_3\\_03.asp](http://www.worldenergy.org/wec-geis/publications/default/tech_papers/17th_congress/2_3_03.asp). Regulations to stem the tide of dwindling forest resources in size and volume can be traced to the basic norm, 1999 Constitution of Nigeria, which provides in Section 20 that: "It is an obligation of the state to protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria." Under Article 24 of the African Charter on Human and Peoples' Rights (Ratification and Enforcement) Act, Cap. 10 L.F.N. 1990, "All people shall have the right to a general satisfactory environment favorable to their development." <http://www.nigeria-law.org/African%20Charter%20on%20Human%20and%20Peoples%20Rights.html>

<sup>259</sup> For Nigeria's EIA Act No. 86 of 1992, see <http://www.elaw.org/resources/text.asp?id=2690>

<sup>260</sup> See S. 1(2) of Cap. 109 L.F.N. 1990. See generally <http://www.nigeria-law.org/LFN-1990.html>. But see author for actual law.

<sup>261</sup> See Jigawa State, NIGERIA, "Extending Opportunities to the Edge of the Desert" <http://www.self.org/nigeria.asp>.

surveillance over the systematic development of energy resources of Nigeria.<sup>262</sup> S. 1(2) of the ECN Act provides for the composition of the Commission. The Departments of the Commission include that of Energy Planning and Analysis (including energy efficiency demand management and conservation, rural energy, and alternative and new and renewable energy sources).<sup>263</sup> The ECN is charged with responsibility for the strategic planning and co-ordination of national policies in the field of energy in all its ramifications and, includes amongst others: preparation, after consultation with such agencies of government whose functions relate to the field of energy development or supply as the Commission considers appropriate, periodic master plans for the balanced and coordinated development of energy, including recommendations for the exploitation of new sources of energy as and when considered necessary. It is also charged with laying down guidelines on the utilization of energy types for specific purposes and in a prescribed sequence.

Although, existing legislation in Nigeria is skewed towards fossil fuels and secondarily hydro-power, there is recognition that an appropriate legal framework is a prerequisite for maximizing investment opportunities in the renewable energy sector, A Nigerian National Energy Policy similar to that of the White Paper on the Energy Policy of the Republic of South Africa in December 1998 will better articulate the framework for rural applications of efficiency and renewable energy.<sup>264</sup>

Electricity regulation in Nigeria is advancing at an impressive pace with the aim of liberalizing the power sector, unbundling NEPA and introducing new and independent players.<sup>265</sup> Within this context, the possibilities of using renewable energy for power generation are immense.<sup>266</sup> A coherent and adequate policy framework on efficiency and renewable energy applications is a logical first-step to optimizing power in Nigeria. One of the tenets of such a policy will be to decentralize authority over regulation of water resources for hydropower, thus eliminating rigidity and unnecessary bureaucracy in the procedure for approving applications inimical to the development of small hydropower schemes (SHP) that would benefit rural communities.<sup>267</sup> SHP is a viable source for renewable energy and although various sites have been identified, none has so far been fully developed. Additionally, attention also is being given to regulating the use of bio-fuels in the forms of wood, charcoal and biomass, which constitute at least 70% of energy consumed throughout sub-Saharan Africa.

## D. Ghana

In Ghana, following a 1983 drought that reduced the Volta Lake to very low levels and resulted in drastic curtailment of electricity production and supply to all sectors of the country, the government was prompted to pursue a program of expanding the power generation base. Even effective generation, transmission and distribution could pose formidable challenges that if not carefully

<sup>262</sup> <http://www.nigeria-law.org/LFN-1990.html>

<sup>263</sup> S. 1(2)(b)

<sup>264</sup> See "South Africa Energy Policy Discussion Document" [http://www.polity.org.za/html/govdocs/green\\_papers/energy1.html?rebookmark=1](http://www.polity.org.za/html/govdocs/green_papers/energy1.html?rebookmark=1). See also <http://easd.org.za/sapol/energywp98-01.html>.

<sup>265</sup> See Bureau of Public Enterprises (BPE), <http://www.bpeng.org/10/addsector.asp?DocID=43&MenuID=38>. USEIA, "Independent Power Projects in Nigeria: March 2003", URL: <http://www.eia.doe.gov/emeu/cabs/nigeria-ipp.html>.

<sup>266</sup> See "Federal Republic of Nigeria National Electric Power Policy adopted by the Electric Power Sector Reform Implementation Committee and approved by the National Council of Privatization", [http://www.bpeng.org/CGI-BIN/cms/sectors/Infrastructure\\_and\\_Network/Power/Power\\_Policy/Electric](http://www.bpeng.org/CGI-BIN/cms/sectors/Infrastructure_and_Network/Power/Power_Policy/Electric) - Microsoft Internet Explorer.

<sup>267</sup> Water from such sources as may be declared by the National Assembly to be sources affecting more than one state are within the Exclusive Legislative List, Part I, Second Schedule to the Constitution of Nigeria.

handled within an enabling regulatory framework, could jeopardize all efforts to make electricity more easily available and affordable. It is within this context that the Energy Commission Act 1997 (ECA) should be appreciated. Some of the functions and objects of the Commission are:

### **Energy Commission Act of 1997, Section 2**

- a. Receive and assess applications, and grant licenses under this Act to public utilities for the transmission, wholesale supply, distribution, and sale of electricity and natural gas;
- b. Establish and enforce, in consultation with the Public Utilities Regulatory Commission, standards of performance for public utilities engaged in the transmission, wholesale supply, distribution and sale of electricity and natural gas;
- c. Promote and ensure uniform rules of practice for the transmission, wholesale supply, distribution and sale of electricity and natural gas.

See <http://www.energycom.gov.gh/downloads/ACT/ACT.doc>

Under Section 11 of the ECA, no person shall engage in any business or any commercial activity for the transmission, wholesale supply, distribution or sale of electricity unless he is authorized to do so by a license granted under the Act. In order to qualify for license under this Act, a person must be a Ghanaian citizen, a body corporate registered under the Companies Code 1963 (Act 170) or a partnership registered under the Incorporated Private Partnerships Act, 1962 (Act 152).<sup>268</sup>

One of the functions of the recently established Energy Commission is to “recommend national policies for the development and utilization of indigenous energy resources.”<sup>269</sup> The phrase “indigenous energy resources” includes renewable energy resources that can be found in Ghana, which includes wind, solar energy, hydropower, geothermal energy and biomass.<sup>270</sup> The Commission also is to “secure a comprehensive data base for national decision making on the extent of development and utilization of energy resources available to the nation.”<sup>271</sup>

In addition to the Energy Commission Act, 1997, there is the Public Utilities Regulatory Commission Act, 1997 (Act 538) that established the Public Utilities Regulatory Commission to regulate and oversee the provision of utility services by the public sector to consumers and related matters.<sup>272</sup> Since this Act makes no distinction between consumers in rural as against those in urban areas, it is to be assumed that it has general application.

In Ghana, principal responsibility for establishing and implementing energy sector policy is the Ministry of Energy. However, the main regulatory institutions in the renewable energy (electricity) sub-sector are the Public Utilities Regulatory Commission (PURC) and the Energy Commission. The PURC is responsible for regulating and overseeing provision of electrical and water utility services

<sup>268</sup> Section 12 of the ECA.

<sup>269</sup> S. 2(a)

<sup>270</sup> See S. 57, the interpretation section.

<sup>271</sup> S. 2(d)

<sup>272</sup> For an examination of the Ghanaian Public Utilities Regulatory Commission Act, see [www.globalregulatorynetwork.org/Files/2ndGRN/Images/Session%20V%20-%20Adu.pdf](http://www.globalregulatorynetwork.org/Files/2ndGRN/Images/Session%20V%20-%20Adu.pdf). See author for the actual law.

to consumers. Its functions include protecting the interests of providers and consumers, approval of rates, monitoring performance standards and promoting competition among service providers.<sup>273</sup>

The Ghana Energy Commission is responsible for regulating, developing and managing the utilization of energy resources. It is also responsible for preparing indicative plans for the development of the energy sector, licensing of public utilities for transmission, wholesale supply, distribution and sale of electricity and natural gas and enforcing performance standards of the utilities. It also is responsible amongst others for the recommendation of national policies for the development and utilization of indigenous energy resources as well as securing a comprehensive database for national decision making on the extent of development and utilization of energy resources available to the nation.<sup>274</sup>

An important provision under the Act establishing the Ghana Energy Commission is the establishment of the Energy Fund in section 41. The monies generated through the Fund shall be applied amongst others, for promotion of projects for the development and utilization of renewable energy resources including solar energy. The sources of monies for the Energy Fund are primarily through a proportion of the government levy on petroleum products, electricity and natural gas.<sup>275</sup> Also, the Ghanaian government has pledged to invest between 20 and 25 million cedis in the promotion of Solar Photovoltaic Technology in the rural areas under the Ghana Poverty Reduction Strategy and the Renewable Energy Road.<sup>276</sup> Since the Commission also is empowered to “determine allocations to be made towards the objectives of the Fund”,<sup>277</sup> and one of the objectives is the “promotion of projects for the development and utilization of renewable energy resources, including solar energy”, more funds could be allocated towards realizing its renewable energy objective under the Act.

Ghana’s energy sector policies are shaped by the framework for meeting its energy sector goals, programs currently being implemented by the Ministry of Mines and Energy in all energy sectors – renewable energy, power, petroleum as well as energy efficiency and conservation. What are particularly impressive are its short, medium and long-term objectives for future development of the renewable energy resources. Even at that, formulating new energy laws or amend existing energy laws with a view to bringing them into conformity with its policy goals on rural applications of renewable energy will establish a regulatory regime, enhancing certainty and predictability for prospective investors in the areas of efficiency and renewable energy applications in rural areas. Since the focus of the Ghanaian Energy Commission Act 1997 is not on so much on rural applications of efficiency and renewable energy as with general electricity generation, transmission and utilization. In focusing attention on modernization, there is need to accommodate firm power-purchase agreements that would enable cost-recovery and profit making for independent power producers (IPPs) and other potential renewable energy developers for rural communities.

<sup>273</sup> See footnote 69 above.

<sup>274</sup> See sub-section on renewable energy legislation in Ghana above.

<sup>275</sup> See Section 41(2) (a) of the Energy Commission Act, 1997 (Act 541). See <http://www.energycom.gov.gh/downloads/ACT/ACT.doc>

<sup>276</sup> “Government to invest in Solar Technology”, <http://www.ghanaweb.com/GhanaHomePage/NewsArchive/artikel.php?ID=52472>

<sup>277</sup> S. 44(1) (b).



## E. Kenya

Kenya's laws and regulations relating to its electricity sub-sector deal specifically with renewable energy. The principal law of the power sector in Kenya is the Electricity Power Act 1997 (EPA) that, inter alia, establishes the Electricity Regulatory Board with powers to process and recommend applications for licenses, set, review and adjust transmission and distribution tariffs, enforce environmental and safety regulations, investigate complaints, ensure there is competition and approve power purchase contracts, and transmission and distribution contracts.<sup>278</sup> The EPA establishes the framework for the regulation of power sector in Kenya. Several other statutes complement the Electric Power Act in the regulation of the power sub-sector. These are:

- The Geothermal Resources Act, Act No. 12 of 1982,<sup>279</sup> which is an Act of Parliament that regulates access to and exploitation of geothermal resources for generation of power. It vests all geothermal resources in the Government and empowers the Minister for Energy to authorize geothermal exploration and grant geothermal licenses subject to payment of royalties and such other terms and conditions as he may deem fit;
- The Environmental Management and Co-ordination Act, Act No. 8 of 1999<sup>280</sup> provides for the establishment of an appropriate legal and institutional framework for the management of the environment in Kenya. The Act outlines environmental impact assessment procedures, including environmental audit and monitoring procedures applicable to electrical infrastructure including power generation and transmission, and environmental quality standards;
- The Water Act, Chapter 372 of the Laws of Kenya 2000<sup>281</sup> vests water resources in the Government and establishes rules and procedures for the use of water. In relation to power projects, water apportionment approval is necessary prior to the construction of pumped-storage schemes. Power generation has to compete with other water uses within the framework of the Water Act.

Kenya has over 100,000 solar home systems installed by the private sector without much public assistance.<sup>282</sup>

## F. Nepal

In Nepal, community mobilization and decentralized energy planning are key elements of its Rural Energy Development Program (REDP). Though non-legislative, the Guidelines published by REDP for tariff determination, district energy planning, environmental management, and community mobilization are quite exemplary in developing rural energy projects in a sustainable manner. Technical guidelines for installation of micro-hydro and solar systems are also available.<sup>283</sup>

<sup>278</sup> See "The Electric Power Act, 1997, No. 11 of 1997", <http://www.erb.go.ke/epa.pdf>.

<sup>279</sup> Ibid. See Business Council for Sustainable Development, Eastern African Geothermal Market Acceleration Conference – MARKET ASSESSMENT REPORT, 2003, <http://www.bcse.org/bcse-eagmacagenda.html> p. 37 of 138.

<sup>280</sup> <http://www.erb.go.ke/legal.htm>.

<sup>281</sup> Ibid. See also Kenya Times, "Water commercialization vital to ensure service delivery" <http://www.kentimes.com/28oct04/insight/ins3.html>.

<sup>282</sup> Ibid.

<sup>283</sup> <http://www.redp.org.np/implement.html>

## G. Uganda

Uganda also has adopted a framework law that includes promotion of renewable energy:

### Uganda - The Electricity Act. 1999.

#### Part VII—Rural Electrification.

64.(2) The Minister shall, once in each year, submit to Parliament, an annual report on the progress and achievement of the Plan which shall contain, information relating to—

- (c) the renewable energy power generation for sale to the main grid and for mini-grids; and
- (d) the installation of solar photo voltaic systems for isolated settlements that cannot be economically connected to the grid.

Source: <http://www.era.or.ug/electricityAct.asp>

## H. The United States

In the United States rural electrification was accomplished through a network of cooperative “self-help electrification programs”<sup>284</sup> financially “jump-started” by the federal government. The program was implemented by a network of Rural Electric Cooperatives that were private, community owned not-for-profit membership corporations formed under the laws of their resident states for the purpose of constructing and operating electric distribution systems and electric generation and transmission facilities.<sup>285</sup> The Cooperatives were composed of rural residents, mostly unsophisticated farmers. The program was a great success. From 1935 until 1960, the proportion of the rural population in the U.S. receiving grid-connected electrical service increased from 11 to 97 percent.

A Presidential Executive Order in 1935 established the Rural Electrification Administration (REA) to administer the program.<sup>286</sup> Later, the U.S. Congress passed the Rural Electrification Act of 1936,<sup>287</sup> establishing the REA as an independent agency authorized to make direct loans to the Cooperatives from the U.S. Department of Treasury. The REA interest on the loans was fixed at the Government’s average cost of borrowing. The REA played a nurturing role by providing the requisite financing along with technical and legal advice. As the distribution network became more established, the emphasis of REA loan activity shifted to construction of power supply generation and transmission facilities.

<sup>284</sup> See J. P. Painuly and J. V. Fenhann, *Implementation of Renewable Energy Technologies – Opportunities and Barriers: Ghana Country Study* (Denmark: UNEP Collaborating Centre on Energy and Environment, 2001), p. 22. URL: <http://unepri-soe.org/RETs/SummaryCountryStudies.pdf> at p. 28.

<sup>285</sup> Richard P. Keck, ARTICLE: REEVALUATING THE RURAL ELECTRIFICATION ADMINISTRATION: A NEW DEAL FOR THE TAXPAYER, 16 *Envil. L.* 39, 40 Fall 1985. Also see website for National Rural Electric Cooperative Association <http://www.nreca.org/nreca/Policy/Regulatory/Regulatory>

<sup>286</sup> The REA’s duties and functions were: “To initiate, formulate, administer, and supervise a program of approved projects with respect to the generation, transmission, and distribution of electric energy in rural areas.” Exec. Order No. 7037, May 11, 1935.

<sup>287</sup> Rural Electrification Act of 1936, 7 U.S.C. §§ 901,950, text available at [http://www.usda.gov/rus/regs/info/100-1/title\\_i.htm](http://www.usda.gov/rus/regs/info/100-1/title_i.htm).

The REA later reorganized as a division of the U.S. Dept. of Agriculture and changed its name to the Electric Program of USDA's Rural Utilities Service, but it continues to provide leadership and capital to upgrade, expand, and maintain America's vast rural electric infrastructure. The Rural Utilities Service continues to make direct loans and loan guarantees to the Rural Electric Cooperatives, now including demand side management, energy conservation programs, and on-grid and off-grid renewable energy systems. Through the Rural Utilities Service, the federal government is the majority note holder for more than 700 electric systems.<sup>288</sup>

#### IV. CONCLUSION

The legislative and regulatory framework for rural applications of efficiency and renewable energy is a combination of policy instruments seeking to set clear goals, legislative requirements and subsidiary instruments that provide legal bases for policy perspectives as well as institutional mechanisms for policy implementation.

Renewable energy has a large and geographically widely spread resource base. However, the following have been observed as obstacles in its application:

- The lack of or inadequate awareness on alternative energy options;
- The lack of reliable data to undertake specific projects;
- Poor or no research and development base or even commercial business models contribute to the difficulty of accessing the latest renewable energy technology,
- Limited financial resources;
- Insufficient number of personnel qualified to administer energy efficiency and renewable energy programs;
- The lack of supporting policies, up-to-date and comprehensive regulations, inefficient infrastructure and equipment for their use; and
- Other constraints such as competition from other energy resources, mainly fossil fuels.<sup>289</sup>

An adequate regulatory framework must, therefore, specifically address these issues in order to put renewable energy squarely on the national agenda.

Additionally, a law on renewable energy must contain provisions on qualifications, application, grant of as well as conditions of licenses and incentives to harness any form of renewable energy including procedures for facilitating renewable energy technologies through effective implementing institutions. Such a law must provide for the rights and obligations of both host country, or rural

<sup>288</sup> USDA's Rural Utilities Service webpage: <http://www.usda.gov/rus/electric/index.htm>

<sup>289</sup> J. Bischoff, "Renewable Energy in Asia-Pacific" World Renewable Energy Policy and Strategy Forum (June 13-15, 2002), <http://www.world-council-for-renewable-energy.org/downloads/WCRE-Bischoff.pdf>

<sup>290</sup> See for example, Rikke Munk Hanwen, "Legislative Measures for Promotion of Renewable Energy: Wind Energy Development in Denmark as a Case Study", in A. J. Bradbrook and R. L. Ottinger eds., *Energy Law and Sustainable Development*, <http://www.iucn.org/themes/law/pdfdocuments/Energy-Law/ENERGY-PUB-prelims.pdf>. pp. 115-137.

community and private investors and impose standards.<sup>290</sup> The vague, aspirational quality of statutory language; a weak judiciary stemming from a lack of independence, the poorly trained, ill-equipped and unmotivated workforce in implementing institutions combine in varying degrees to deflect regulatory will.<sup>291</sup> Developing countries must guard against these in regulating the renewable energy sector.

An example of the regulatory needs to promote renewable energy may be found in the treatment of small hydro projects. Hydropower for rural electrification can help minimize local, regional and global environmental impacts in the long run, while ensuring people's livelihoods.<sup>292</sup> In its study of SHP-based Rural Electrification in China, Hangzhou Regional Centre for Small Hydropower summarizes the impact of rural electrification in the following points:

- An important pillar of economic development in hilly areas, an important source of a country's fiscal revenues, and an important way for local people to shake off poverty and set out on a road to prosperity;
- It promotes structural readjustment of the economy, which is beneficial in resolving deep-rooted structural contradictions, which constrain the economic development of poverty-stricken areas;
- It improves agriculture and rural production conditions and brings about advances in agriculture;
- It promotes the comprehensive utilization of renewable energy resources – wind, water, solar, geothermal and biomass energy just to mention these.

These benefits, not just of hydropower, but for all renewable energy resources, can hardly be realized without a coherent and adequate legislative and regulatory framework that sets out the policy, laws as well as institutional mechanisms for concretizing the gains that will flow from rural applications of renewable energy.<sup>293</sup>

<sup>291</sup> Alex Wang, "The Downside of Growth: Law, Policy and China's Environmental Crisis" [http://www.oycf.org/Perspectives/8\\_103100/downside\\_of\\_growth.htm](http://www.oycf.org/Perspectives/8_103100/downside_of_growth.htm) pp. 5-6.

<sup>292</sup> World Energy Council Committee on Renewables, [http://www.worldenergy.org/wec-geis/wec\\_info/work\\_programme2004/tech/renew/renewables.asp](http://www.worldenergy.org/wec-geis/wec_info/work_programme2004/tech/renew/renewables.asp) p. 1 of 2.

<sup>293</sup> Hangzhou Regional Center (Asia-Pacific) for Small Hydropower, "SHP-based Rural Electrification in China" SHP NEWS Autumn 2004 [www.hrcshp.org/shp/en/pdf/2004/autumnoverview.pdf](http://www.hrcshp.org/shp/en/pdf/2004/autumnoverview.pdf) pp. 5-8 of 24.

# SECTION SIX

## CONCLUSIONS

Energy efficiency and renewable energy hold great promise for a more secure, safer, cleaner and more economic future for the world. For developing countries, they present the opportunity for leap-frogging over traditional energy resources and avoiding the myriad of environmental problems that accompany them. Some of the renewable technologies, however, are not yet cost-competitive. And there still are many barriers of technology transfer, financing, pricing, infrastructure and education and training to be dealt with before these clean resources become universal. Nevertheless, they are the fastest growing of the energy media.

This Handbook has sought to demonstrate legislative solutions that have been adopted around the world that have had success in overcoming many of these barriers. The draftsmen of legislation to promote efficiency and renewable technologies and assure the protection of the environment when they are implemented hopefully will be assisted by these examples.

