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Background document on Energy
Northern perspective

By Climate Action Network

Background Paper on 'Energy'

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This paper provides background information on some topical energy issues for participants in the UNEP 7th Global Civil Society Forum (GCSF), including participants in the regional forums leading up to the GCSF.

Energy is both an engine of development and a source of many of the problems our world faces today. Approximately 80 percent of all energy used in the world comes from fossil fuels, which are one of the major contributors to environmental and health problems at the local, regional, and global levels. The rich part of the world fuelled its tremendous industrial revolution by burning massive amounts of fossil energy but this method of development will not be available in the long run for the rest of the world.

In the near future all countries will have to dramatically change their energy and transport systems for many reasons, foremost the need to avoid disastrous climate change. Our need to change is also driven by the pending peak of conventional oil resources. Whether we are already at this peak or still a few years away, soon supplies will not be able to meet the growing demand, no matter how many new holes are drilled in pristine areas.

In fall 2004, the *European Climate Forum* convened more than 60 scientists to investigate what constitutes "dangerous climate change". Through analysis of new evidence, the Forum concluded that "dangerous climate change is constituted by global warming of more than 2°C over pre-industrial levels for a long period of time".[1] Limiting warming to 2°C above pre-industrial levels with a relatively high certainty requires the equivalent concentration of CO_2 to stay below 400 ppm. This implies a cut in annual greenhouse gas (GHG) emissions of 60 to 80 percent by 2050 globally, from the current level of almost 7 billion tonnes of carbon to less than 2.5 billion.[2] Compared with the Intergovernmental Panel on Climate Change (IPCC) third assessment report from 2001 there is now greater clarity and reduced uncertainty about the impacts of climate change across a wide range of systems, sectors and societies. According to the scientist gathered at the G 8 Exeter climate scientist meeting in 2005 in many cases the risks are more serious than previously thought. The impacts of climate change are already being observed in a variety of sectors and ecosystems. The melting of polar ice and glaciers as well as changes in rainfall regimes have already occurred.[3]

Under IEA's business-as-usual scenario world energy demand will rise by two thirds between now and 2030, the total investment requirement for energy-supply infrastructure worldwide to meet this growth and to replace old facilities comes to a staggering $16 trillion.[4]

Currently, energy subsidies run up to $240 billion a year worldwide, two-thirds of which flow to fossil fuels (coal, oil and gas). In fact, since power generation usually involves burning fossil fuels, adding subsidies for electricity further raises the share to over 80 per cent. World Bank and OECD calculations show that global subsidy removal could reduce CO_2 emissions by about 10 per cent worldwide.[5]

The best way to tackle climate change is to redirect these huge subsidies and investment flows towards low environmental impact energy sources and energy efficiency. Technological options that provide sustainable energy and significantly reduce emissions over the long-term already exist; however, what is lacking is a favourable policy environment required for the implementation of such technological options. Market forces are not able to take long-term strategic decisions for the benefit of society as a whole. Governments have a

[1] European Climate Forum. 2005. *European Climate Forum: The 2 Degrees Strategy*. http://www.european-climate-forum.net/pdf/ECF_strategy_2005.pdf
[2] International scientific meeting at the Hadley Centre for Climate Prediction and Research, Exeter UK 2005 http://www.stabilisation2005.com/Steering_Commitee_Report.pdf.
[3] Ibid.
[4] IEA, IEA World Energy Investment Outlook - 2003
[5] Moor, A. de (2001). Towards a Grand Deal on subsidies and climate change, http://arch.rivm.nl/ieweb/ieweb/Reports/subsidiesclimchange.pdf

key role to play in educating and steering society towards sustainable, environmentally friendly forms of energy through the development of an appropriate long-term policy framework that balances energy supply and demand options. So far, governments have not lived up to their stewardship role. Perhaps half of the forecasted growth in emissions could be avoided by greater energy efficiency alone. Much of these savings could be done at a net financial profit; according to several studies used by the European Commission if EU would curb its energy use by 20% bringing it back to the level it had in 1990 it would lead to savings of at least €60 Bn per year in 2020.[6]

Access to low environmental impact energy sources is essential to poverty alleviation and sustainable development goals. The best strategy would involve a mix of actions on energy efficiency, including conservation measures, renewable energy and radical subsidies reforms.

Bioenergy

Bioenergy, such as biomass fired combined heat and power plants, biofuels or biogas from waste or sewage has the potential to play a major role in global warming mitigation measures and sustainable energy policies. A significant advantage of bioenergy is the ability to derive heat, electricity or transportation fuels. Bioenergy resources also promise to be more regionally distributed than fossil fuel resources.

As with any industrial activity, however, large-scale bioenergy will inevitably involve some tradeoffs with other environmental and social priorities. Large-scale bioenergy will involve very large amounts of land if it is to play a major role in energy supply. For example, displacement of current U.S. gasoline demand would require bioenergy production on over 100 million acres even assuming significant technological improvements, making it one of the top five agricultural crops.[7] Large-scale bioenergy will place similar pressure on land management as current cash crop production and forest product extraction, and will require strong regulatory frameworks to prevent damaging outcomes.

Bioenergy is not necessarily carbon-neutral, as is often assumed, and climate policies must take actual emissions performance into account. Different biomass sources, conversion technologies, and combustion technologies will result in very different lifecycle greenhouse gas emissions. Significant emissions can occur from agricultural inputs and practices, energy requirements for crop cultivation, and biomass and fuel transport. All conversion of biomass into useable fuel or energy requires some energy inputs. The best fossil carbon substitution effects are possible if you use biomass for cogeneration of heat and electricity, while the production of fuel requires substantial amounts of energy. In terms of curbing climate change, the use of biomass as fuel for transport is the least efficient option.

Large-scale bioenergy can lead to pressure for adverse land management decisions. The worst-case scenario is the conversion of natural forest and other high-conservation value lands. This can occur because the forest biomass is used for bioenergy, or simply to clear the land for dedicated energy crop production. In general, bioenergy facilities require large volumes of geographically proximate biomass, with the clear potential for unsustainable forest and agricultural land management practices. Bioenergy development should therefore avoid high-conservation value lands and meet sustainable management criteria.

Large-scale bioenergy can compete with other important land uses, including food production, traditional biomass use, and non-timber forest products. Each of these may have important socioeconomic value, especially for individual communities.

Competition for land and pressure for non-sustainable land management can be greatly ameliorated by improving the yield of biomass crops, and conversion and utilization efficiencies. These must be a high priority for research and development (R&D) and commercialization policies.

Growing biomass can have negative impacts on water supply and quality. Irrigation requirements can be a major problem in arid or semi-arid areas. Soil runoff and use of chemical inputs can degrade water quality. Other environmental considerations include air quality impacts from bioenergy combustion.

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[6] EU Commission, 2005, *DOING MORE WITH LESS, Green Paper on energy efficiency* http://europa.eu.int/comm/energy/efficiency/doc/2005_06_green_paper_book_en.pdf

[7] NRDC, 2004, *Growing Energy: How Biofuels Can Help End America's Oil Dependence* http://www.nrdc.org/air/energy/biofuels/contents.asp

Ensuring the sustainable production of large-scale bioenergy is greatly complicated by the likely international trade in bioenergy and biomass. Most negative impacts will occur where the biomass is produced. Sustainable production will largely be the responsibility of the producing country. There will be competitive pressure for unsustainable production. From a Northern perspective, increased use of imported bioenergy should not simply be a way to export environmental problems. Sustainability criteria for bioenergy production, such as those outlined by a Oeko-Institut study must be developed and applied.[8] Significant amounts of sustainable bioenergy could be produced without resorting to new land or displacing agricultural land needed for social priorities. It is a challenge, but it can be done at an affordable economic cost

Hydropower

By far the most promising avenue for gaining consensus on large hydropower development (above 12 MW) is through the promotion of multi-stakeholder dialogues involving civil society, government and other relevant actors on how to apply the recommendations of the World Commission on Dams (WCD) in specific national or regional contexts.

United Nation Environment Program (UNEP) has been strongly supportive of the WCD report and is committed to promoting its adoption within the UN system. UNEP hosts the Dams and Development Project (DDP), the formal follow-up mechanism to the WCD. The core of the DDP's mandate is to "Promote improved decision making, planning and management of dams and their alternatives building on the World Commission on Dams core values and strategic priorities and other relevant reference materials through promoting multi-stakeholder dialogue at national, regional and global levels . . ."[9]

Multi-stakeholder dialogues facilitated by the DDP on the implementation of WCD recommendations are at various levels of completion in numerous countries including South Africa, Nepal, Germany, Sweden, Vietnam, Thailand, Uganda, and in the 14-country Southern African Development Community. However much more needs to be done to encourage these processes, ensure full civil society involvement, and to ensure the implementation of their recommendations.

The World Commission on Dams was an independent body sponsored by the World Bank and IUCN and containing representatives from a broad spectrum of stakeholders. It was chaired by the then South African Water Minister, Kader Asmal. It issued its final report in November 2000.[10] The WCD report was strongly critical of the practices of the international hydropower industry. Its recommendations establish a progressive framework for decision-making, not just on dams, but on energy and water planning in general. The proposals would make these processes markedly more participatory, transparent, and accountable. It is widely agreed that adopting the WCD recommendations would greatly reduce the rate of construction of destructive hydropower projects and would promote the implementation of sustainable, equitable, and efficient methods of providing energy and water services. Adopting the recommendations would also help mitigate the legacy of harm to communities and ecosystems of existing hydropower projects.

The WCD's recommendations have been adopted in whole or part by a wide range of relevant bodies including the US Overseas Private Investment Corporation, HSBC, the Japanese Bank for International Cooperation and the German development agencies KfW and GTZ. The World Bank has endorsed the WCD's Core Values and Strategic Priorities. The EU requires WCD compliance for large (20 MW or more) hydropower schemes from which carbon credits are used in the European carbon trading system.[11]

Acceptance of Renewable Energy Systems

The world will have to dramatically change its energy and transport systems in the near future to avoid dangerous climate change. Unfortunately, governments have not fulfilled their role in educating people and

[8] Oeko-Institut, 2005. *Criteria for Assessing Environmental, Economic, and Social Aspects of Biofuels in Developing Countries*. http://www.oeko.de/research_engl.htm

[9] Dams and Development Project mission statement, http://www.unep.org/dams/

10 The World Commission on Dams (WCD) report http://www.damsreport.org/

[11] The definition of small hydropower differs between different actors, 10 MW is what civil society promote should be the limit.

guiding societies towards sustainable and low-environmental impact energy sources to meet these looming challenges.

A summary of public opinion surveys carried out in a number of European countries with high levels of wind energy in their energy mix show very strong support for this development. In Germany, the country with the most wind turbines installed (16,649 MW in 2005); a 2002 poll showed that 86 percent were in favour of increasing the share of wind energy to the country's overall energy mix.[12] In Denmark, another pioneer country with the highest share of total electricity production coming from wind (20 percent in 2004), 86 percent of the population supported wind energy and 68 percent wanted Denmark to install even more wind turbines.[13]

When discussing greater public acceptance to renewable energy installations it is important to remember that the '*NIMBY - not in my back yard'* phenomenon where local residents oppose the construction of intrusive facilities, is not limited to wind turbines. Given that renewable energy installations are safe and not environmentally hazardous they face far less opposition than construction of coal fired power plants or nuclear plants do, this said project developers should carry out environment impact assessments and if needed consider relocation of wind parks. In a 1998 study of public perception done in different wind park areas in Navarra, Spain it was found that between 76 – 82 percent were in favour of wind energy and only 2 – 6 percent considered it damaging.[14] Experience has shown that most local citizens accept wind parks when the following principles are respected:

- Keeping sufficient distance from residential areas when erecting turbine parks;
- Choosing quiet turbine designs;
- Keeping the local population properly informed and consulted;
- Carry out Environment Impact Assessment when locating turbine parks;
- Ensuring some sort of financial benefit for the local community, and
- Consulting landowners when choosing a site.

Many of these principles apply to other forms of renewable energy installations as well. Due to their high environmental, social and economical risks, the situation is different for large hydropower dams (above 12 MW). Given the poor track record of previous large dam projects, they should only be developed and financed if they comply with the guidelines of the World Commission on Dams. These recommendations have become the benchmark by which civil society, the media and the interested public at large are measuring all new dam projects across the globe.[15]

Energy and Environmental Policy Coherence

Governments are responsible to ensure that all their policies are internally consistent and coherent. An energy and environment policy needs to be fully integrated in the wider policy of sustainable development. Particularly, the erroneous belief that only rich countries can afford to care about the environment or that environment considerations are anti-growth needs to be addressed. This means raising awareness and educating citizens and policy makers of the heavy toll neglecting the environment has in terms of economic growth as well as human life and well being.

In the same way as new legislation should be reviewed by a judicial body that checks that the new law is written in a comprehensible way and is allocated sufficient funding within the overall budget, governments should make sure that all policy and legislation is reviewed for its environmental and sustainable development impact. This process is greatly facilitated if cross-ministerial working groups are involved from the beginning in all legislative drafts. In order to foster a shared vision within the government bureaucracy, it is the responsibility of senior ministers to publicly support reforms that will help the country towards a more sustainable development.

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[12] European Wind Energy Association, *Wind Energy – the facts*, 2004, www.ewea.org
[13] Danish Wind Industry Association annual report 2004, http://www.windpower.org/media(775,1033)/annual_report_2004.pdf.
[14] Global Wind Energy Council, *Wind force 12*, 2005, http://www.gwec.net/fileadmin/documents/Publications/wf12-2005.pdf
15 The World Commission on Dams (WCD) report http://www.damsreport.org/

Industrialised societies and growing economies are very energy intensive and the production and consumption of energy in different forms have environmental consequences, both in the form of local air pollution and on the global level as greenhouse gas emissions. All too often environment ministries are struggling against entrenched forces within and outside the bureaucracy to address the negative side effects of energy use. A concrete way to change the dynamic of such a situation is to reshuffle what ministries deal with which issues. Sweden, for example, was one of the first countries in the world that created a *Ministry for Sustainable Development.* A key part of this reform was to merge the responsibility for energy and housing issues previously with the Ministry of Commerce and Industry with the 'traditional' environment issues at the Ministry of Environment. This allows the government to take a more holistic view on the different issues of energy and its impact on the environment.

Another important step governments should take is to create or strengthen the role of already existing national councils for sustainable development. These advisory councils could be charged with facilitating a national wide multi-stakeholder process aimed at creating a commonly shared vision of where the country should be in the medium to long term, as well as recommending concrete steps to reach this vision. Inclusive planning processes of energy and infrastructure systems can greatly contribute towards a system that is sustainable and resilient as well as more flexible to change. Given the high cost and long lifetime of many infrastructure investments it makes good economic sense to make sure that they are the right ones.

UNEP could play an important role in convening and facilitating a process where governments could share experience with different policy approaches for overcoming compartmentalised decision-making.

Renewable Energy Uptake in Developing Countries

All long-term scenarios assume there will be a strong increase in global energy demand. More than 60 percent of this growth will take place in developing countries, particularly those with rapid economic growth such as China, India and Brazil. The IEA World Energy Outlook 2004 assumes that by about 2030 total energy consumption by developing countries will match the OECD (current membership). Currently about US$1.7-2 trillion is invested annually into developing energy resources, mostly fossil fuels. Subsidies for conventional energy production and consumption are estimated at US$240 billion annually.[16]

It is doubtful that today's heavy dependence on imported fossil fuels is a realistic and affordable strategy for sustainable development. Even if enough unconventional fossil fuel resources existed to support an ever-growing energy consumption until 2030. Burning all that fossil fuel would lead to further increases in our average global temperature, which in turn would entail irreversible damages to our climate system, human societies and cultures, and our natural environments. Phasing out the oil and coal industries will be politically difficult and to satisfy regional community development interests, removal of subsidies will have to go hand-in-hand with transitional policies and new economic development based on alternative energy sources. Renewable energy technologies are rapidly maturing and gaining ground in markets that are supportive and not heavily distorted by monopolies, fossil fuel subsidies.

Robust renewable energy markets primarily depend on attractive conditions for investors. Open energy markets, viable regulation of grid access for producers, and a stable investment climate are best achieved by feed-in laws like those that are now in places as diverse as Germany, Spain, China, Algeria among others. This requires a political determination by governments to decentralize the energy sector, if necessary abolish monopolistic control of the grid and the energy markets in general, and to push subsidy reform. It also requires a massive effort by governments to either force multilateral development banks to stop funding fossil fuel projects along the recommendations of the Salim Report, or stop giving them funds for such projects and support renewable energies by alternative channels.

Providing modern energy services to the over 1.5 billion people which currently do not receive this will largely have to be realized outside the normal operation of commercial markets, either through regulation that force utilities to extend their coverage in rural with the support of governments. This will be a big issue for development cooperation and will be characterized less by a few mega-projects for institutions like the World Bank, and more by many smaller-sized projects.

[16] Moor, A. de (2001). Towards a Grand Deal on subsidies and climate change, http://arch.rivm.nl/ieweb/ieweb/Reports/subsidiesclimchange.pdf

Role of "Clean" Fossil Fuels

Burning fossil fuels to generate electricity is the largest single source of human-made greenhouse gas emissions, accounting for 37 percent[17] of worldwide emissions. Coal is the most carbon intensive fossil fuel, producing 70 percent more CO_2 emissions for the same energy output as natural gas. Reductions in greenhouse gas emissions in the order of 60-80 percent by mid-century are needed, but clearly can only occur as a result of fundamental changes away from conventional use of fossil fuels.

'Clean fossil fuels' is a misleading term that has been used by the fossil fuel industry to green its public image. Incremental improvements in generation efficiency are a start but are physically incapable of achieving large emission reductions because of the high carbon content of fossil fuels, especially coal. We must avoid locking in a generation of new investment in energy infrastructure with high carbon emissions.

The only conceivable way to continue using fossil fuels and avoid dangerous climate change is through carbon capture and storage (CCS) -- capturing the CO2 emissions and storing them securely in geologic reservoirs. However, CCS faces daunting technical, regulatory, economic, environmental, and public acceptance hurdles.

The most significant technical hurdle concerns the risk of re-release of CO_2 from underground storage into the atmosphere. Leak rates need to be extremely low or the benefits of CCS are negated. Although CO2 injection is common in oil field operations, it has never been conducted on such a scale or with long-term integrity as a key goal. Much research and practical experience is needed on issues including the selection of suitable reservoirs, injection methods, reservoir integrity, long-term monitoring, and remediation of leaks.

Large scale CCS would also need a new regulatory and legal framework to implement best practices. One key policy issue is the assignment and enforcement of liability for any subsequent release of CO2.

CCS would inevitably be more costly than conventional combustion of fossil fuels. Billions of dollars are spent annually to subsidise fossil fuels, the most significant contributor to global warming. These subsidies should not be used to unnecessarily perpetuate fossil fuel use. Governments should not divert public resources away from renewable energy technologies and energy efficiency to support CCS.

CCS will also face hurdles of public acceptability and will require an informed public debate. This includes not only siting and operating storage reservoirs, but also the other environmental impacts of fossil fuel extraction and use.

CCS must not be researched and developed at the expense of other environmentally sound, technologically feasible solutions to climate change. Global warming policy must include a robust and diverse portfolio of response measures. Even if CCS can overcome its many hurdles, it is by no means adequate on its own. We need aggressive deployment of renewable energy and efficiency to meet global energy needs.

Technology development must be coupled with strong policy frameworks that help drive CO_2 emission reductions. This means binding limits on emissions. Without these signals, it is not guaranteed that emissions will be reduced.

Research is increasingly showing that making the transition to a low-carbon economy need not be painful. According to the IPCC,[18] half of the total estimated potential emission reductions possible by 2020 can be achieved with technologies and practices available today at a net benefit. Deep cuts in greenhouse gas emissions are possible by moving to proven technologies like wind, solar electricity, geothermal, small hydro-electric and co-firing sustainable biomass. The role that energy efficiency can play in stabilising and reducing energy demand will also contribute significantly to emission reductions. Sustainable energy policy should be based on diversifying electricity supply by increasing the use of renewables and must include a just transition from coal to clean energy sources.

Hydrogen

[17] World Coal Institute, (2003); International Energy Agency, (2003)
[18] Intergovernmental Panel on Climate Change (2001), Third Assessment Report

Hydrogen fuel could play a long-term role in solving the problems of global warming and energy security but there are two key issues to bear in mind. First, hydrogen is only an energy carrier not an energy source. Hydrogen only plays a positive role to the extent that it is produced from lower-carbon and non-polluting sources. Second, even optimistic predictions for hydrogen expect that significant application is two decades or more in the future. We need aggressive short and medium-term strategies to improve the efficiency and reduce the pollution from vehicles, in addition to long-term development of hydrogen technologies. We cannot afford to wait twenty years or more. In the long-term, we need a diversified portfolio for R&D, and cannot assume that the "hydrogen economy" is the best or only strategy.

Hydrogen is only an energy carrier, so how the hydrogen is produced is extremely important. If done right it could involve diversified renewable energy production. If done wrong it could simply perpetuate reliance on fossil fuels. It also matters greatly how hydrogen is used. Maximum efficiency in utilization is required, indicating a preference for fuel cells over combustion technologies.

All of this will take time to develop new technologies for producing hydrogen, associated vehicle technologies, and energy distribution infrastructure. Deployment on a significant scale will take a decade or more beyond initial commercialization. Increasing fuel efficiency of vehicles over the next two to three decades can reduce much more pollution than hydrogen fuel cells, simply because efficiency technologies are available now for deployment. Similarly, biofuels appear to be more rapidly available and better able to utilize existing infrastructure.

The bottom line is that hydrogen is no silver bullet, and cannot be relied upon because of its long time frame for commercial deployment and uncertain performance.