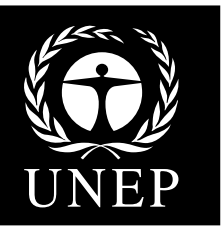


Kenya: Integrated assessment of the Energy Policy

With focus on the transport and household energy sectors

Preface

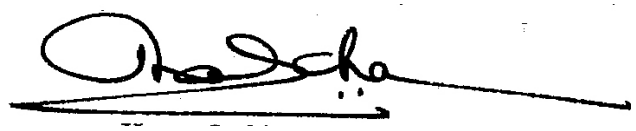
The Ministry of Planning and National Development is charged with the responsibility of policy coordination in Kenya. The Ministry is therefore at the forefront of the search for public policies capable of achieving Kenya's key objectives of restoring economic growth, creating wealth, generating adequate employment and reducing poverty. As a country, considerable progress has been made in this direction, especially with the introduction of the Economic Recovery Strategy (ERS) for Wealth and Employment Creation 2003-2007.

While we are proud of the progress that has been made, we are aware that our policies and planning processes have not been able to fully integrate all the dimensions of sustainable development. There has been a tendency to focus more on economic development and comparatively less on social and environmental dimensions. Yet, if we are to achieve the Millennium Development Goals (MDGs), an adequate level of integration is critical. It is for this reason that the Ministry has keenly supported the Integrated Assessment and Planning (IAP) initiative through to its completion. We are eager to see the implementation of the key recommendations to improve our planning process in the energy sector and also throughout the entire government.

The Integrated Assessment and Planning (IAP) project is a UNEP-led project that seeks to enhance institutional capacity for integration of social and environmental considerations, as well as trade issues, into national and sectoral planning processes. Previously, inadequate consideration of these issues in national and sectoral policy planning and coordination has contributed to environmental and social problems in Kenya, such as adverse human health effects, and degradation of water, air, land, and other natural resources.

The IAP project in Kenya chose to look at the energy sector, which is laudable considering the importance of energy in our country's development. The country has, for the purpose of economic development, formulated policies over time to streamline the energy sector. However, as the report points out, the planning process in this sector did not fully integrate the three dimensions of sustainable development. There is now the need to take a new course by borrowing from the IAP initiative. In other words, energy planning and policymaking should be more sensitive to issues of sustainability.

This report demonstrates that IAP is a proactive and useful tool for integration of economic, social and environmental considerations in planning and policymaking. I would like to thank the United Nations Environment Programme (UNEP) for helping to address shortcomings in our planning process. I would also like to thank UNDP-Kenya for their role in administering the project and the Kenya Institute for Public Policy Research and Analysis (KIPPRA) for its implementation.



Hon. Henry Obwocha
Minister for Planning and National Development
Government of the Republic of Kenya
17th August, 2006

Acronyms and abbreviations

AIDS	Acquired Immune Deficiency Syndrome
BAU	Business As Usual
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPUs	Central Planning Units
DPMC	Department of Price and Monopoly Control
DTIE	Division of Technology, Industry and Economics
EC	European Commission
EIA	Energy Information Administration
EMCA	Environmental Management and Coordination
ERB	Electricity Regulatory Board
ERC	Energy Regulatory Commission
ERS	Economic Recovery Strategy
ESDA	Energy for Sustainable Development Africa
ETB	The Economics and Trade Branch
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse gas
GVEP	Global Village Energy Partnership
HIV	Human Immunodeficiency Virus
IA	Integrated assessment
IAP	Integrated assessment project
ICRAF	International Center for Research in Agroforestry
ICT	Institute for Creative Technologies
IPM	Integrate Pest Management
IPO	Initial Public Offering
IPPs	Independent power producers
ITDG	Intermediate Technology Development Group

KAM	Kenya Association of Manufactures
KEBS	Kenya Bureau of Standards
KENGEN	Kenya Electricity Generating Company Limited
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KPC	Kenya Pipeline Company
KPLC	Kenya Power and Lighting Company
KPRL	Kenya Petroleum Refineries Ltd
LCPDP	Least Cost Power Development Plan
LPG	Liquid petroleum gas
MDGs	Millennium Development goals
MEAs	Multilateral environmental agreements
MOA	Ministry of Agriculture
MOE	Ministry of Energy
MOENR	Ministry of Environment and Natural Resources
MOF	Ministry of Finance
MOPND	Ministry of Planning and National Development
MOTI	Ministry of Trade and Industry
MPND	Ministry of Planning and National Development
MTEF	Medium Term Expenditure Framework
NEMA	National Environment Management Authority
NGOs	Non-governmental organizations
NMIT	New Media and Information Technology
NOCK	National Oil Corporation of Kenya
NSE	Nairobi Stock Exchange
PAN	Peroxyacyl Nitrates
PER	Public Expenditure Review
PIC	Prior informed consent
PIEA	Petroleum Institute of East Africa
PM	Particulate matter
POPs	Persistent Organic Pollutants
REA	Rural Electrification Authority
RETAP	Renewable Energy Technology Assistance Programme
SBC	Secretariat of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
SMEs	Small and medium-sized enterprises
TED	Transportation Energy Demand
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

UNFCCC	United Nations Framework Convention for Climate Change
VAT	Value-added tax
VMT	Vehicle Miles Travelled
VOC	Volatile organic compounds
WSSD	World Summit on Sustainable Development

Executive summary

There is growing recognition, globally and in Kenya, that planning processes have inadequately focused on social and environmental issues. To help address this shortcoming, UNEP launched this Integrated Assessment and Planning (IAP) initiative in Kenya. The initiative aims at identifying critical sustainability issues, defining sustainability criteria and indicators, and recommending appropriate policy options. The general principles of IAP are equitable participation by all relevant stakeholders, local ownership, access to information, transparency, accountability and respect for rules and regulations, independence and objectivity, multi-disciplinary approach, clear terms of reference, and integration into existing planning processes.

The IAP initiative piloted in Kenya is a joint project by UNEP-Geneva, UNDP-Kenya, and the Government of Kenya through the Ministry of Planning and National Development (MOPND). The Kenya Institute for Public Policy Research and Analysis (KIPPRA) was selected as the national implementing institution. The overall goal of the project was to develop institutional capacity for IAP. By assessing energy planning and energy policy in the country, the project highlighted critical linkages between increasing access to energy services and economic development. The project enhanced the country's capacity to integrate economic, social and environmental considerations into planning for the energy sector as well as other national planning processes. Assessment focused on the energy planning process since it has potential for reform and also because the sector's sustainability aspects were easily discernable.

Scenario analysis was the tool used in the assessment. In the first scenario, *Business As Usual,* energy policies and planning are assumed to remain unchanged. Under the *Implementation* scenario, the Sessional Paper No. 4 of 2004 on Energy (Energy Policy) is executed fully. The third scenario is *Win-Win*, in which the Energy Policy is not only implemented fully but the outcome is enhanced with parallel improvements to the Traffic Act, Kenya Roads Board Act and Kenya's transport policy, among others. Using the 2004 levels of economic, social and environmental indicators as the baseline, projections are made for 2030 for each of the three scenarios. The indicators used include level of energy demand, prices, employment, incomes, green house gas and lead emissions, energy-related respiratory disease incidence, and consumption of fuel, charcoal and firewood. The actual assessments were made using evaluations, synthesis and analysis of available data, regular meetings, stakeholder consultation, brainstorming, field surveys and policy mapping.

Broadly speaking, the stakeholders involved included the Kenya Power and Lighting Company (KPLC), the Kenya Electricity Generating Company Limited (KENGEN), the Electricity Regulatory Board (ERB), the Kenya Association of Manufactures (KAM), the Global Environmental Facility (GEF), the Ministry of Energy (MOE), the Ministry of Planning and National Development (MOPND), the National Environment Management Authority (NEMA), the Ministry of Finance (MOF), the Ministry of Trade and Industry (MOTI), the Ministry of Agriculture (MOA), and non-governmental organizations (NGOs) such as Intermediate Technology Development Group (ITDG) and Queconsult.

The assessment shows that the amount of petroleum demanded by the transport sector will rise from 1.9 million tonnes in 2004 to 8.6 million tonnes, 5.3 million tonnes and 6.8 million tonnes in 2030 under *Business As Usual, Implementation* and *Win-Win* scenarios respectively. The price of energy is however expected to rise only gradually as a result of energy conservation, energy efficiency and the use of new technologies, among others. The results also confirm the potential of the Energy Policy provisions to protect human health and the environment, and conserve resources. Effective implementation of these provisions under the modest assumptions made led to a projected reduction of 36.6 Tg/yr of carbon dioxide; an 86 per cent reduction in soil lead; and significant reductions in carbon monoxide, particulate matter, methane, and dinitrogen oxide. The assessment shows, moreover, that the provisions have enormous social benefits such as increased incomes, employment, and improved access to cleaner and modern forms of energy.

There are considerable weaknesses in Kenya's energy planning with no systematic attempts to undertake integrated processes. Most energy projections in Kenya, with the exception of electricity have relied on historical growth and failed to include sustainable supply, conservation, efficiency targets and effects of technology, as well as projected investment requirements. In addition, the process is affected by inadequate stakeholder participation, lack of continuity in representation and insufficient integration of social and environmental issues.

The study finds considerable synergy between the Energy Policy and the Economic Recovery Strategy (ERS) as well as forestry and environmental policies. However, there is little or no integration with other sectoral policies in agriculture and health.

There are major challenges to greater integration and thus the adoption of IAP in the country. These include inadequate human and financial capacity, paucity of data, weakness in the budgetary process, lack of institutionalized planning process (including inadequacy of legal and regulatory provisions), periodic institutional re-alignments of the Ministries, ineffective inter-ministerial coordination, vested interests of big players, limited awareness of the IAP approach, competition from other planning initiatives, and the high cost of detailed assessments and IAP in general.

There are however efforts in the country that need to be nurtured and enhanced. These include: increasing transparency and room for debate; increasing consultation in policy formulation; encouraging participation through parliamentary committees, improved budgetary process, donor coordination and support; building capacity for policy analysis; creation of local ownership and commitment to policy and budgetary process; and strengthening the voices of different stakeholders. Other efforts include enactment of the draft Energy Bill 2006 into law through greater political commitment and legal backing for planning process and public participation. In addition, there is a need to develop and adopt policies that address harmful economic, social and environmental impacts. Such policies may include targeted income subsidies to the poor or marginalized, and micro-enterprises (SMEs), and differential taxation to encourage or discourage the use of certain fuels. The research community can also assist by identifying and developing innovative and cost effective methods of assessment and research into appropriate energy technologies. Private sector organizations such as KAM and non-governmental organizations (NGOs) can also spearhead energy conservation and efficiency education to reduce waste.

The results of this assessment point to the need to restructure the existing energy policymaking processes to become more sustainability-focused. Clear policy guidelines, complete with checklists of the main elements of a sustainability-driven Energy Policy, should be adopted for not just the energy sector but also other sectors, in the future.

Acknowledgements

This publication is based on the results from the Integrated Assessment and Planning (IAP) project implemented in Kenya since January 2004. UNEP would like to begin by thanking the project partner, Kenya Institute for Public Policy Research and Analysis (KIPPRA) for its cooperation and commitment. UNEP is also immensely grateful to the Ministry of Planning and National Development and the Ministry of Energy for their support.

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Notwithstanding the valuable contributions of many acknowledged here, the full responsibility for the content of this report remains with the authors.

United Nations Environment Programme

The United Nations Environment Programme (UNEP) is the overall coordinating environmental organization of the United Nations system. Its mission is to provide leadership and encourage partnerships in caring for the environment, by inspiring, informing, and enabling nations and people to improve their quality of life without compromising that of future generations. In accordance with its mandate, UNEP works to observe, monitor, and assess the state of the global environment; improve the scientific understanding of how environmental change occurs; and in turn, determine how such change can be managed by action-oriented national policies and international agreements. UNEP's capacity building work thus centres on helping countries strengthen environmental management in diverse areas, which include freshwater and land resource management; the conservation and sustainable use of biodiversity, marine and coastal ecosystem management; and cleaner industrial production and eco-efficiency, among many others.

UNEP, headquartered in Nairobi, Kenya, marked its first 30 years of service in 2002. During this time, in partnership with a global array of collaborating organizations, UNEP achieved major advances in the development of international environmental policy and law, environmental monitoring and assessment, and our understanding of the science of global change. This work also supports the successful development and implementation of the world's major environmental conventions. In parallel, UNEP administers several multilateral environmental agreements (MEAs), including the Vienna Convention's Montreal Protocol on Substances that Deplete the Ozone Layer, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (SBC), the Convention on Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam Convention, PIC), the Cartagena Protocol on Biosafety to the Convention on Biological Diversity, and the Stockholm Convention on Persistent Organic Pollutants (POPs).

Division of Technology, Industry and Economics

The mission of the Division of Technology, Industry and Economics (DTIE) is to encourage decision makers in government, local authorities and industry to develop and adopt policies, strategies, and practices that are cleaner and safer, make efficient use of natural resources, ensure environmentally sound management of chemicals, and reduce pollution and risks for humans and the environment. In addition, it seeks to enable implementation of conventions and international agreements and encourage the internalization of environmental costs. UNEP DTIE's strategy in carrying out these objectives is to influence decision-making through partnerships with other international organizations, governmental authorities, business and industry, and NGOs; facilitate knowledge management through networks; support implementation of conventions; and work closely with UNEP regional offices. The Division, with its Director and Division Office in Paris, consists of one centre and five branches located in Paris, Geneva and Osaka.

Economics and Trade Branch

The Economics and Trade Branch (ETB) is one of the five branches of DTIE. Its mission is to enhance the capacities of developing countries and transition economies to integrate environmental considerations into development planning and macroeconomic policies, including trade policies. ETB helps countries develop and use integrated assessment and incentive tools for achieving poverty reduction and sustainable development. The Branch further works to improve our understanding of environmental, social, and economic effects of trade liberalization and the effects of environmental policies on trade, and works to strengthen coherence between Multilateral Environmental Agreements and the World Trade Organization. ETB also helps enhance the role of the financial sector in moving towards sustainability. Through its finance initiatives, ETB also helps enhance the role of the financial sector in moving towards sustainability.

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1. Introduction

1.1 This report

There is emerging concern in Kenya that planning at the national level has concentrated on economic issues with less attention paid to social and environmental issues. To address this shortcoming, UNEP launched an initiative on integrated assessment and planning (IAP) for sustainable development in Kenya. The objective of the project is to develop institutional capacity for integrated assessment and planning in the country by testing IAP methodologies on the energy planning process. This report examines the energy planning and policymaking process in light of IAP principles and methodologies. It also explains how other sectors such as agriculture, water, transport, health, and trade are integrated into energy planning with sustainable development.

The report presents the results of an *ex ante* assessment of the Sessional Paper No. 4 of 2004 on Energy (Energy Policy) with particular reference to transport and household energy sectors. The assessment and findings are useful to policymakers, civil society and other parties who are increasingly concerned about the effectiveness of the planning process in the country.

Chapter 1 of this report discusses the IAP project, the project process and sustainable development challenges. Chapter 2 examines the energy sector in Kenya while Chapters 3 and 4 provide analytical scenarios of the transport and household energy sectors respectively. They are finally followed by the report's conclusions and recommendations.

1.2 The project

In November 2004, MOPND in Kenya decided to participate in a UNEP-sponsored and UNDP-administered project on IAP. The proposed policy area was the energy sector. The objective was to make Kenya's energy policies responsive to national environment protection and poverty reduction needs as well as economic and trade imperatives. The Kenyan assessment was expected to succeed by involving key stakeholders in analysing implications of different energy policy options. The government requested KIPPRA coordinate the implementation of this project.

IAP has a number of objectives. Firstly, it aims to generate information and acquire strategic insights into sustainable development aspects and identify critical sustainability issues. Secondly, it seeks to identify policy options that take into account sustainability goals and objectives. Thirdly, it defines sustainability criteria and indicators. Lastly, IAP builds commitment for sustainable development at different levels, national or otherwise.

The general principles of IAP are equitable participation by all relevant stakeholders, legitimate local ownership, access to information, transparency, accountability, and respect of rules and regulations. Specific guidelines include:

- Integration of existing assessment/planning processes, to strengthen methods, ensure continuity and avoid duplication.
- Clear definitions and agreements on the general purpose, scope and extent of the assessment/planning process.
- Clear ownership based on motivated demand.
- Local funding or co-funding arrangements.
- Involvement of multiple sectors and disciplines from different levels.
- Equitable participation, including affected communities and sectors.
- Access to and efficient use of information sources.
- Independence and objectivity.
- Transparent and equitable working modalities.
- Informing and influencing decision-markers.
- Facilitating an international learning network.

The IAP process as currently formulated incorporates a self-evaluation framework to review existing planning processes on sustainability issues. To this end, it uses modules to identify the key issues. Furthermore, it provides a logical structure to systematically generate information, analyse the information to create functional insight, and generate the required output. The following eight modules make up the applied practical framework for IAP:

1. Stakeholder mapping and analysis
2. Defining key sustainability values
3. Defining key sustainability goals
4. Identifying main problems and opportunities
5. Analysing causes of sustainability problems
6. Defining policy options and objectives
7. Assessing policy options and objectives
8. Defining sustainability indicators.

The initial focus of the assessment was a UNDP-led initiative, "Global Village Energy Partnership" (GVEP), which was launched in August 2002 during the World Summit on Sustainable Development (WSSD) in Johannesburg. The initiative aimed to enhance access to modern energy services while improving socio-economic development and reducing poverty. It had the following major steps: (a) production of comprehensive energy baseline data; (b) assessment of national priorities in relation to development and poverty reduction, and in light of energy needs and linkages; (c) national stakeholders' workshops; and (d) monitoring and evaluation of energy–poverty linkages.

The project eventually did not target GVEP, largely due to limited knowledge of the project at the beginning. The project team came to realize that the GVEP was not suitable as the subject of assessment, since it was not a policy, programme or plan, but an assessment in its own right. If the IAP were to be applied to GVEP, it would be an assessment of another assessment. Furthermore, by the time the IAP project started, GVEP had not yet taken off the ground and had no results to be analysed. The project team, following discussion with UNEP and UNDP, decided to apply IAP to the national energy policies instead, utilizing inputs from GVEP as they became available. At the same time, the team recognized that a full assessment of the national

energy policies would take up a much longer time and more resources than what was available under this project. The project team chose to focus on the transport[1] and household[2] sectors, given their importance in overall energy consumption as well as in economic, trade, social, and environmental terms. The shift serves to illustrate how an integrated approach can be applied to specific public policies and influence the way policies are formulated in future.

1.3 Process

The IAP project process was conducted in a number of steps. The first step involved forming a project Steering Committee, chaired by the Permanent Secretary of Ministry of Planning and National Development (MOPND). The Committee comprised of permanent secretaries or their representatives in the Ministry of Trade and Industry (MOTI), Ministry of Energy (MOE), Ministry of Environment and Natural Resources (MOENR), Ministry of Agriculture (MOA) and Ministry of Water & Irrigation (MOWI). Other members came from Intermediate Technology Group (ITDG), Kenya Association of Manufacturers (KAM), National Environmental Management Authority (NEMA), Electricity Regulatory Board (ERB), UNDP, and the Kenya Institute for Public Policy Research and Analysis (KIPPRA).

KIPPRA, as the implementing institution, was mandated to undertake review of literature, prepare background papers on the project, and carry out the assessment. The first event of the project was the first mid-term review in Geneva where KIPPRA presented the first draft work plan. Thereafter, a background paper was developed: "Enhancing capacity for IAP in Kenya: Case of the global village energy poverty reduction plan." In May 2005, a representative from UNEP-ETB branch visited KIPPRA to familiarize himself with the project and the Kenyan research team. The background paper was presented in the first stakeholders' workshop in August 2005. The participants in this workshop helped to identify suitable indicators for the environmental, social, and economic dimensions of sustainable energy development. The assessment of the Energy Policy begun immediately after the workshop.

Broadly speaking, main stakeholders involved were the Kenya Power and Lighting Company (KPLC), the Kenya Electricity Generating Company Limited (KENGEN), the Electricity Regulatory Board (ERB), the Kenya Association of Manufactures (KAM), the Global Environmental Facility (GEF), MOE, MOPND, MOF, MOTI, MOA, the National Environment Management Authority (NEMA), and NGOs such as Intermediate Technology Development Group (ITDG) and Queconsult.

The preliminary assessment results were presented at the mid-term review workshop in September in Geneva. The final stakeholders' workshop was held in April 2006.

1.4 Methodology

The main analytical tool used was scenario analysis. This tool was selected to explore the range of possible outcomes from alternative policy options. In its current form, the Energy Policy does not describe options, limiting its capacity to achieve socio-economic goals and environmental sustainability. Three scenarios were built for this assessment:

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[1] Fossil fuels constitute 22 per cent of the national energy supply, 67 per cent of which is consumed by the transport sector. The other 33 per cent of fossil fuels consumed are taken up by industries and power generation. Lack of proper records on industries prevented the sector's inclusion in this report.

[2] Biomass energy (mainly firewood and charcoal) constitutes 70 per cent of national energy supply, 90 per cent of which is consumed by households. Numerous studies have been undertaken in the recent past, hence the sector is well understood. The other 10 per cent of business energy is consumed by communal institutions and kioks.

- **Scenario of "Business As Usual".** In this scenario, energy planning remains the same as if the Energy Policy were never introduced. Economic, social and environmental indicators established for 2004 and projected to 2030 formed the baseline outcome.

- **Scenario of "Implementation"**. This scenario assumes that the Energy Policy has been implemented fully. The scenario explores the outcomes of this decision for the short term (to 2007), medium term (to 2015) and long term (to 2030).

- **Scenario of "Win-Win"**. Not only is the Energy Policy fully implemented, complementary improvements to other policies, such as the Traffic Act, Kenya Roads Board Act, 1st National Communication to the United Nations Framework Convention for Climate Change (UNFCCC) and draft Transport Policy, are made. This is meant to address weaknesses of existing policymaking which fails to integrate social and environmental issues and give adequate coverage to conservation, efficiency and energy mainstays such as biomass[3].

Using 2004's levels of economic, social and environmental indicators as baseline figures, projections are made for 2030 for each of the three scenarios. The indicators used are: quantities of demand, energy prices, employment levels, incomes, greenhouse gas and lead emissions, energy related respiratory disease incidence, and consumption of fuel, charcoal and firewood.

The actual assessment for the three scenarios was made using:

- Review, synthesis, and analysis of available data. A number of reports were reviewed from ERB, KPLC, KENGEN, ITDG, MOE, a GEF-KAM project, and other institutions and projects in the energy sector.

- Documentation of the Energy Policy. An attempt was made to document the stages of policymaking, the decision-makers and those consulted in the writing of the Sessional Paper.

- Regular peer review meetings, stakeholder consultation and brainstorming. The expectation was to get multi-disciplinary expert views on the energy sector, what should be done, and the future direction of the sector. Criteria such as energy sector membership, disciplinary orientation of members, stakeholder consultations and sector hearings, among others, were considered.

- Field data. Short and simple surveys supplemented available information. A survey instrument including a matrix of the Energy Policy planning process was used.

- Policy mapping. Current policies in Kenya such as the water policy, forest policy, environmental policy, and agricultural policy were assessed on their degree of integration with the Energy Policy in energy.

1.5 Kenya: An overview

Economic challenges

Kenya faces a number of economic, social and environmental challenges. During a period of 40 years, the country fell from one of the most promising developing countries in sub-Saharan Africa, both in terms of growth and social development, to a stagnated economy struggling to find a new roadmap of sustained growth. Between 1972 and 2003, for example, despite real GDP growing at an annual average rate of about 3.3 per cent, per capita real GDP only grew at about 0.2 per cent per annum, reflecting growing population

[3] The major source of energy in Kenya.

pressure. Available data also revealed that real per capita income in 2003 (about US$426) was well below the figure the country achieved in the late 1970s.

In 2003, the economy continued with its gradual economic recovery by posting a real economic growth rate of 1.8 per cent, up from 1.2 per cent in 2002. The recovery strengthened further in 2004 when the economy grew 4.3 per cent[4] and in 2005, 5 per cent. Despite these gains, however, the country's poverty status remains largely unchanged. It is estimated that it would take 350 years for real capita income to double from its level in 2003.

Kenya's trade policy objectives currently focus on moving towards a more open trade regime, strengthening and increasing access to overseas and regional market for her products (especially processed goods), and further integration into the world economy. To achieve these objectives, Kenya has taken several measures, including reforming the trade regime under the structural adjustment programmes, engaging in several regional and bilateral trade negotiations, and actively participating in negotiations to increase the openness of multilateral trading systems. The trade reforms are documented and articulated in the 1979-84 National Development Plan and subsequent development plans, such as Sessional Paper No. 1 of 1986 (which marked a major turning point in liberalization of the trade policy framework), Sessional Paper No. 2 of 1997, and the Economic Recovery Strategy Paper (2003-2007). The necessary reforms spelt out in these documents have either been completed or are presently being implemented.

External trade plays a vital role in Kenya's economic development. Growth in exports averaged about 7.4 per cent in the period 1997-2003 although this was not enough to narrow the trade deficit (imports also grew at about 6.2 per cent over the same period). Kenya's export trade remains dominated by a few products, mainly tea, horticulture, and coffee. Between 1997 and 2003, these commodities on average accounted for 46 per cent of domestic export earnings. The contribution of coffee and petroleum products to export earnings over this period, however, fell significantly. Export earnings from horticulture, on the other hand, continued to increase, rising by an average of 18.7 per cent over that period. Non-food industrial supplies account for an average of 30 per cent of yearly total imports.

Imports of industrial machinery averaged 13.7 per cent of total imports over the period 1997-2003. This was closely followed by imports of crude petroleum and petroleum products, with their respective shares being 10.5 per cent and 9.1 per cent. The imports of petroleum products recorded the highest growth during the period, at an average of 21.2 per cent.

The high cost of energy is one of the biggest bottlenecks to economic activity in the country (KIPPRA, 2005). Kenya continues to lose out on foreign direct investments partly because of this problem, with considerable penalties on socio-economic development. Available data shows that the cost of electricity in Kenya is four times that of South Africa, the country's main competitor in the region, and more than three times that of China (KIPPRA, 2005).

The problem of high cost is compounded by unreliability of supply. On average, Kenyan companies lose 9.5 per cent of production because of power outages and fluctuations. This excludes the losses from damaged equipment as a result of power interruptions, which could be up to Ksh 1 million for a company in 2001. Inefficiency in energy use is also one of the factors impeding the competitiveness of the country's products in international markets.

[4] The high growth rate in 2004 is partly attributable to the adoption of a new data system, the SNA 1993, which added hitherto poorly captured economic sectors such as SMEs and the horticultural sector.

Access to adequate energy services is essential in both rural and urban areas. Lack of such access reduces the potential for achieving major structural changes in rural economies, required for income-generating activities and poverty alleviation. Access to electricity in rural areas is only 4 per cent compared to the national average of 15 per cent (Kamfor, 2002), one of the lowest in developing countries. Yet the Government of Kenya has been spending, since 1973 huge amounts of money under the Rural Electrification Programme. There is thus huge unmet demand in the country, particularly so in rural areas.

Demand for electricity exceeds generation capacity during peak periods. Kenya, for a long time, was importing electricity from Uganda. The situation has, however, changed in recent times with Uganda experiencing major supply shortages due to expansion of the industrial sector and lack of investment in generation. It is Kenya that currently exports electricity to Uganda.[5] The supply problem in Kenya is particularly acute during droughts when dam reservoirs are low or when some of the hydroelectric generating plants are out of service (Kamfor, 2002). There is also considerable loss of power during transmission and distribution, partly due to outright theft. The presence of several institutions in the power sector with overlapping responsibilities also creates confusion and waste. In the petroleum subsector, the main constraint is high prices arising from the oligopolistic nature of the subsector.

In summary, the current energy system is not sufficiently reliable and affordable to support high economic growth. Productivity of the majority of the people in Kenya's eight provinces and in the rural areas is constrained by a lack of access to commercial energy. Households, entrepreneurs, and industry are constrained when it comes to economically viable ventures and investments. This in turn reduces their access energy, initiating a vicious cycle.

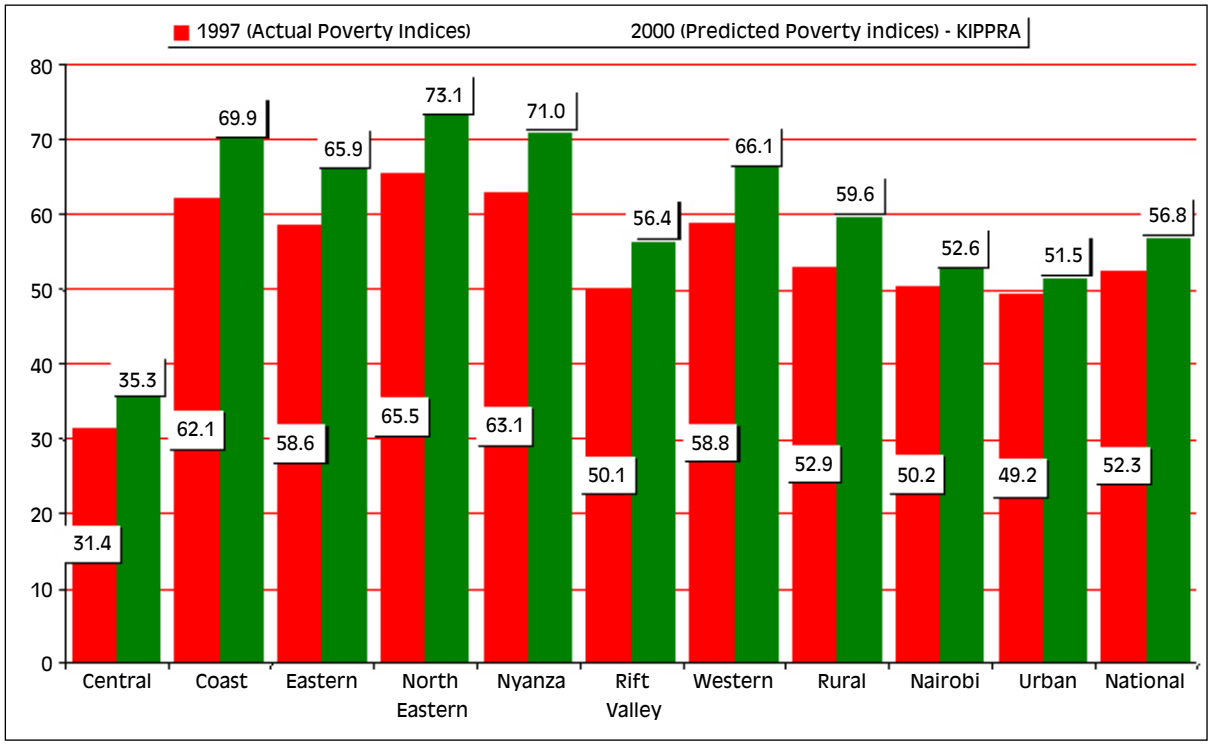
Social challenges

The social challenges Kenya faces include a HIV/AIDS pandemic, gender imbalance, high levels of insecurity, high levels of unemployment and underemployment, unequal access to education, low quality of education, and high levels of poverty. Among these, poverty, which signifies deprivation of necessities of life and opportunities for human development, is the most challenging, and directly or indirectly worsens the other problems. The proportion of people living below the poverty line and who predominantly subsist on natural resources increased from 48 per cent in 1994 to 52 per cent in 1997 and again to 57 per cent by 2003. This has been caused by the poor performance of the Kenyan economy and worsening income distribution. According to the 1997 Welfare Monitoring Survey III (WWMS III) the absolute poverty line stood at Ksh 2,648 (about US$35) per adult per month in urban areas and Ksh 1,239 (about US$17) in rural areas.

Poverty estimates (Mwabu *et al.,* 2002) show that rural poverty is higher than urban poverty. While the national headcount index increased 4.5 points in 1997-2000 (see Figure 1), rural poverty increased 6.7 points and urban poverty 2.3 points.

[5] KENGEN now intends to sell 50 mw of power to Uganda.

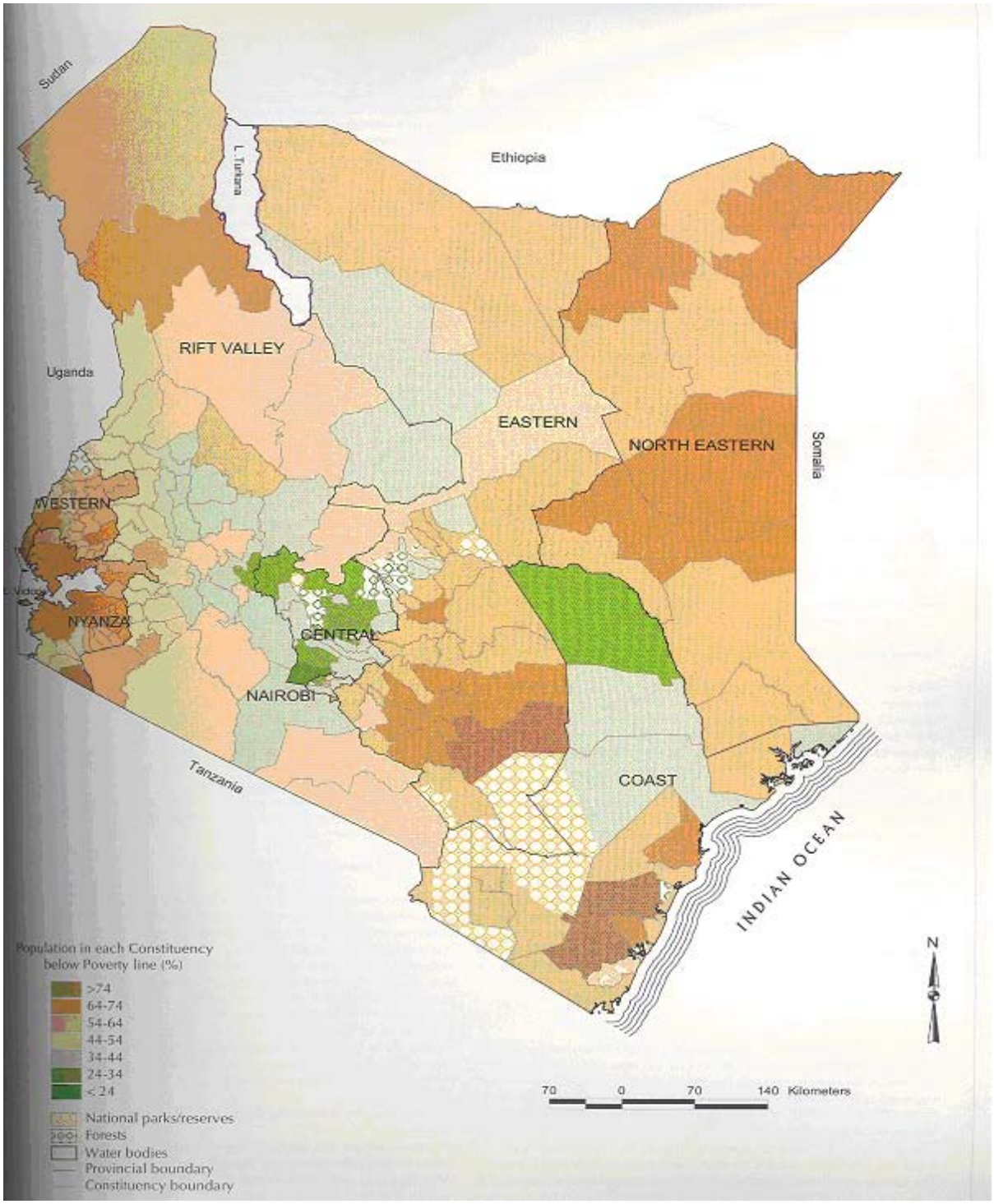
Figure 1: Headcount poverty indices, 1997-2000



Source: Mwabu *et al.*, 2002

There are wide regional variations in poverty rates with North Eastern Province being the poorest and Central Province better off than all the others. Figure 2 shows poverty mapping of the country.

Figure 2: Map of regions in Kenya and poverty status



Source: CBS, 2005

Welfare monitoring studies indicate that a large part of the household budget of the rural poor (83 per cent) and urban poor (64 per cent) goes to food consumption. This means that the poor have little to spend on other essential services such as energy. Lack of access to modern and clean forms of energy affects sustainable development in various ways. Indoor air pollution from biomass use has been causally linked with serious and widespread health problems, especially for women and children. This reduces labour productivity and exacerbates poverty. Besides, household income now has to be spent on treatment costs, leaving less disposable income to meet other needs.

The poor face another problem of high cost of fuelwood and charcoal. The long hours women need to search for wood reduces time available for other productive activities. Of Kenya's 20,000 educational institutions, about 90 per cent use wood fuel to prepare meals. The time taken by school children to search for fuelwood could otherwise be spent on learning (RETAP, 2001). Increasing shortage of wood fuel and the high cost of charcoal may lead to the poor to use dried dung, resulting in a decrease of organic fertilizers available for agriculture and worsening indoor air pollution. In urban areas, the lowest income households also depend on firewood.

Environmental challenges

Kenya's main productive sectors (agriculture, fisheries, mining, and timber) depend on raw materials provided by the natural environment. These sectors accounted for 23.7, 0.5, 0.5 and 1.1 per cent of GDP in 2004 respectively (Economic Survey, 2005; see also Table 1). Therefore, natural and environmental resources make a very important contribution to the country's economy.[5]

Table 1: Economic contribution of environmental goods and services in Kenya

Contribution	Value (US$ in millions per year)
Gross returns to national economy from wildlife	350
Consumer surplus from protected areas	450
Value of forest use to local households	94
Value of watershed catchment protection	50

Source: Emerton *et al.* (2001)

Despite this importance, the environment and natural resources are facing various challenges due to weak management and various other problems. Table 2 summarizes these challenges and their implications on energy.

[6] Various methods were used to estimate the contribution of the various environmental goods and services. These included a participatory environmental assessment of domestic resource utilization (by forest-adjacent households) and differences between downstream production values and soil and water conservation replacement costs, among others.

Table 2: Environmental challenges and links to energy

Environment /resource	Issues/problems	Links to energy
Water	Water resources and catchments are degraded or destroyed. Water pollution has increased with emissions of organic water pollutants having risen by about 100 per cent between 1980 and 2000 to reach 53,029 kg per day. There are also cases of high concentrations of heavy metals such as lead, mercury, zinc and cadmium, in the country's rivers and lakes.	Essential for hydropower and growth of trees for biomass energy. Energy production and use can lead to water pollution.
Weather	Increase in frequency of droughts, floods, other disasters and emergencies	Low power supply; emerging expenditures crowd out funds for investment in power sector; climate change due to greenhouse gases produced in the energy sector.
Soil	Soil erosion and soil degradation	Siltation of rivers and dams leads to low generation of hydropower.
Wildlife	Natural habitats lost, poaching, encroachment and human wildlife conflict	Limited income contributes to increased poverty and hence low access to energy.
Air	Increase in air pollution. Carbon dioxide emissions have risen from 5.8 million tonnes (0.2 tonnes per capita) in 1990 to 9.4 million tonnes (0.3 tonnes per capita) in 2000.	May lead to global warming, which has likely effects on desertification and low hydropower generation.
Forests	Increase in deforestation. Between 1990 and 2000, Kenya lost, on average, 931 square km of forest, equivalent to 0.5 per cent of forest area, per year. A total of 67,184.6 hectares of forest were excised in 2001 alone. As a result, protected forests cover only about 1.6 per cent of Kenya's land surface area, against a global benchmark of 10 per cent.	Low rainfall and siltation of dams leading to less hydropower. Lack of biomass energy.
Biodiversity	High biodiversity loss, overexploitation, conversion of ecosystems to alternative uses, and weak mechanisms for regulating the introduction of alien species.	No direct link with energy.
Solid wastes	Accumulation of solid wastes is a common feature of urban centres	Solid wastes may be used to produce sustainable energy.

As is evident in Table 2, there are multiple links between energy and the environment. Excessive use of wood fuel (used by 80 per cent of the population in Kenya) for instance leads to damage of catchment areas from deforestation, and soil, water and wind erosion. Some of these effects in turn cause reduced river channels, and silting of the rivers with follow-on effects on hydropower development and use. For the Kenyan economy to become more competitive and dynamic, more reliable, affordable and sustainable energy is critical. This will require among others, judicious management of the country's environment and natural resources.

2. The energy sector in Kenya

2.1 Sources of energy in Kenya

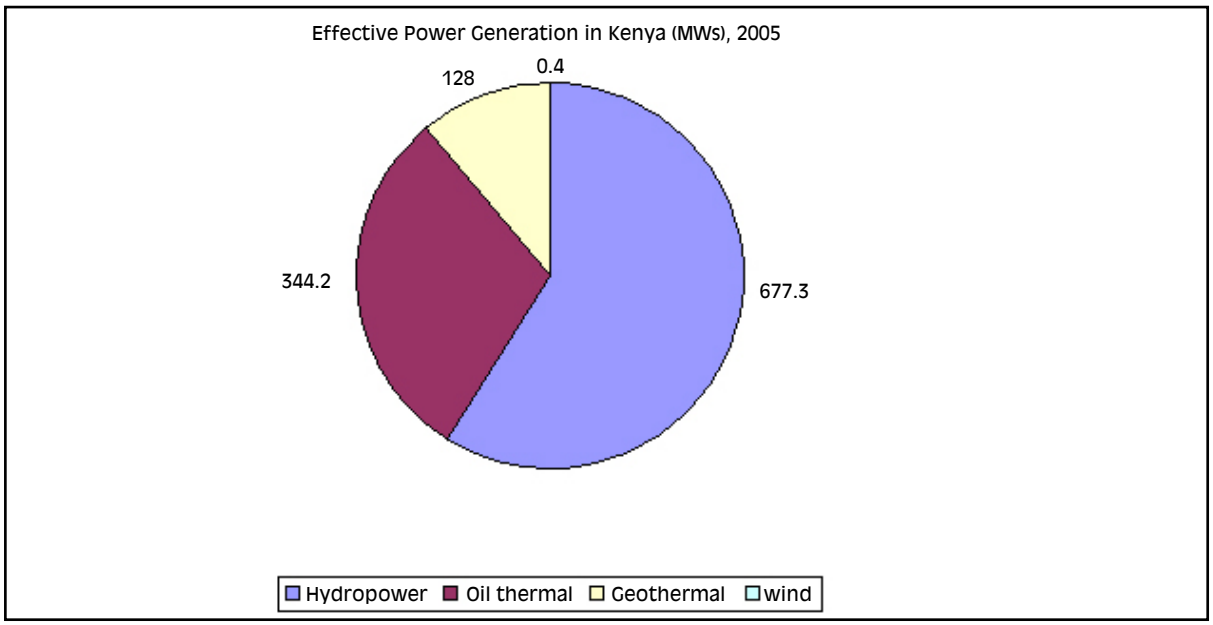
There are three main sources of energy in Kenya. These are wood fuel, petroleum and electricity, accounting for 70 per cent, 21 per cent, and 9 per cent of total energy use respectively. Renewable energy is also becoming important although it remains insignificant in the country's overall energy mix.

Electricity

The major sources of electricity are hydro, geothermal and thermal power. The installed power capacity, in June 2005, was 1155.0 MW.[7] The breakdown was: hydropower at 677.3 MW, oil thermal power at 344.2 MW, geothermal power at 128 MW, and wind power at 0.4 MW. The effective capacity was 1066.9 MW (KPLC, 2005; see Figure 3).

The key players in the power sector are KPLC, KENGEN, ERB, MOE, and independent power producers (IPPs). KPLC is 48.4 per cent government-owned and is the only licensed public electricity transmitter and distributor. The generation of electricity in Kenya has several players, chief among them being the state-owned KENGEN, and three IPPs. KPLC has power purchase contracts with KENGEN and the IPPs. KENGEN accounts for more than 82 per cent of the country's total installed generation capacity.

Figure 3: Sources of electricity in Kenya



[7] The effective capacity was about 92.4 per cent of this, or 1066.9MW.

IPPs entered the domestic market in late 1997 when Iberafrica and Westmont began commercial production with a combined capacity of 87 MW. The entry of IPPs was a response to crippling shortages in power supply. IPPs are largely foreign-owned, their contracts are rigid and the unit cost of their electricity is very high (Ikiara and Mutua, 2003).[8] Currently, there are three large IPPs (Iberafrica, Tsavo Power, and orPower Inc.)[9] each with an installed capacity in excess of 10 MW. Westmont did not renew its license with ERB after 2004.

The Government of Kenya faces several challenges in improving electricity generation and distribution to meet increasing industrial and residential demand. Some of the major challenges include:

- Connecting a minimum of 150,000 new consumers per year to the electricity grid, including expansion of the Rural Electrification Programme.
- Reducing the cost of electricity in Kenya, which is higher than costs of regional economic competitors in South Africa and Egypt.
- Investing in upgrading of the national electricity grid to provide constant high quality power especially to industrial consumers.
- High consumer tariffs due to operational inefficiencies and high taxes (e.g. VAT at 16 per cent).

Petroleum

Petroleum fuels are the most important source of commercial energy in Kenya, and are mainly used in the transport, commercial and industrial sectors. The country relies entirely on imported petroleum products. Imports of petroleum accounted for 16 per cent of the total import bill in 2002 and consumed 31 per cent of the country's foreign exchange earnings from merchandise exports. Consumption of petroleum products was 2.4 million metric tonnes, with per capita consumption at 76.2 kg. Projected growth in this demand, with Kenya's anticipated economic recovery, is 2 per cent per annum (Ministry of Energy, 2004).

Kenya's oil imports have not seen major shifts apart from sharp increases during the power crisis of 1998-2000 when the country imported extra tonnes of oil to meet increased demand. In 1998, the country imported 2157.7 tonnes of crude petroleum and 1387.8 tonnes of petroleum fuels. This declined to 1493.4 and 1023.5 tonnes respectively in 2002, mainly due to a strengthening of hydroelectric generation and easing of the power crisis.

The petroleum sector has been liberalized and the only direct government involvement in the petroleum industry is in the oil refinery it co-owns through the Kenya Petroleum Refineries Ltd (KPRL) with three private companies (Shell, BP and Chevron) on a 50-50 equity basis, and the oil storage facilities at Kipevu, capable of holding 1.5 million barrels.

Kerosene as a cooking and lighting fuel is important for the poor in rural and urban areas and has in some cases served as a substitute for wood fuel. Hence, any efforts to increase kerosene consumption will undoubtedly relieve pressure on wood use. Indeed, the government has often used tax reduction or non-increase for kerosene for this purpose and also as a poverty mitigation measure. Key emerging concerns in this regard are the impact of kerosene on the levels of indoor air pollution, the consequent health impacts on the poor, and the adulteration of other fuels with kerosene.

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[8] It should be noted, however, that contracts with IPPSs are much more flexible and can be ended or revised within a short period.

[9] There is another IPP, Aggreko, contracted in April 2006 to supply power to hedge against any anticipated shortfall. The IPP is currently supplying 44 mw of power.

The market structure for the petroleum sector is not adequately competitive and the cost of energy is therefore rather high. The entry into the market by many small-scale fuel suppliers has injected some competition in the market. There have been, however, some complaints of adulterated fuel.

Regulatory functions in the petroleum sector are shared among various players including the MOE, provincial administrations, local authorities and the Kenya Bureau of Standards (KEBS). The Petroleum Institute of East Africa (PIEA), a voluntary membership institution patronized by major oil companies, plays a key role in capacity building and awareness creation. It was anticipated soon after the time of writing that this sector would have come under the overall guidance of the proposed Energy Regulatory Commission (ERC), which would be built upon the existing ERB.

Biomass fuels

Wood fuel has remained the most important source of energy in Kenya, meeting over 70 per cent of the country's total energy consumption needs. Eighty per cent of the population depend on it. (Mugo and Kituyi, 2002). It provides 90 per cent of rural households' energy requirements and 85 per cent in urban areas. This state of affairs has major implications on sustainable development. Unsustainable harvesting, given the lack of efforts in reforestation and on-farm planting of wood lots, has often led to soil degradation, deforestation and associated diseases. According to the Poverty Reduction Strategy Paper for Kenya for the period 2001-2004, demand for wood fuel outstripped supply, and the country was likely to have faced a wood fuel deficit of 4.1 million tonnes in 2005.

About 47 per cent of the Kenyan households use charcoal. Some 82 per cent of urban households use the fuel compared to only 34 per cent of households in rural areas. Total charcoal production is about 2.4 million tonnes (or 67 million bags of 36 kg each).[10] Charcoal continues to be harvested from trust lands and gazetted forests, an annual business worth Ksh 17 billion (Ministry of Energy, 2004). Improved charcoal production technology has had minimal impact on recovery and production. Some of the charcoal in Kenya are dubbed environmental friendly and exported but accurate figures are unavailable.[11]

Biomass is seen as the poor people's source of energy. The rich use charcoal mainly for roasting meat during parties, and as fuel in their fireplaces to warm themselves during the cold months of June and July (Kituyi and Mugo, 2002).

Renewable energy resources

Renewable energy resources include solar energy, windmills, power alcohol and biogas. Programmes for their increased use have been formulated and are intended to supplement and conserve, where appropriate, other major sources of energy. Since they are renewable, these sources of energy have the potential to contribute to social, economic and environmental dimensions of sustainable development. Other potential sources of energy in Kenya are nuclear power and natural gas. The contribution of renewable energy sources (other than biomass) to the overall energy supply is minuscule. However, with concerted efforts, renewable energy may be significant in the years ahead.

[10] The Standard, Wednesday July 20th 2005: Science 5.

[11] In the 1960s, a large company in Western Kenya produced over 70,000 tonnes of sustainable charcoal annually and exported 35,000 tonnes to the Tororo Cement Factory in Uganda.

2.2 Formulation of the Energy Policy

Kenya experienced unprecedented power shortages in 1999 and 2000, which had a major impact on the country's economy. The shortages also underscored the need to write an overall national energy policy. Consequently, MOE formed a Sector Working Group in 2001 with the mandate of producing a Sessional Paper on energy (see Annex 2). The group comprised of representatives from departments and parastatals from the Ministries: the Department of Renewable Energy, KPLC, KENGEN, the National Oil Corporation of Kenya (NOCK), the Kenya Pipeline Company (KPC) and ERB. A consultant funded by the World Bank and the Petroleum Institute of East Africa[12] was involved with the working group. The Permanent Secretary of MOE provided leadership.

The Sector Working Group relied on previous reports[13] and policy statements[14] of 1982, 1987 and 1994. Four subgroups were formed to deal with renewable energy, power, biomass and petroleum and had the responsibility of drawing up suitable policies. The Sector Working Group was essentially multi-disciplinary, involving, as it did, the participation of engineers, economists, foresters, environmentalists and journalists.

As part of an effort to produce a Sessional Paper, a series of retreats and stakeholder meetings were held at Nyeri, Mount Kenya, Mombasa and Nairobi between July 2001 and February 2004. The policy has since been printed. Although some provisions in the policy have been implemented, it is yet to be launched officially. In October 2004, the final draft was transmitted for printing as Sessional Paper No.4 on Energy (Energy Policy). It spelled out Kenya's national energy approach with specific strategies and their implementation modalities.

Weaknesses in the Energy Policy process

In the past, the planners were exclusively the ministries concerned. In the case of energy, these were MOE and MOPND. All policies were formulated through deliberation in advisory committees attached to various ministries. These forums provided an important arena for government and industry to exchange viewpoints and minimize differences.

This has, however, changed over the years, due in part to donor pressure and changing global politics. Stakeholders are increasingly being consulted and otherwise involved in policy formulation. The trend seems to be moving towards a more consultative nature and representation of different type of stakeholders as evidenced by the recent tariff consultations by ERB. Consultation is also made for infrastructure sector hearings during national budget preparations. However, the concern has been the adequacy of consultations and the extent to which the views of stakeholders are incorporated. Furthermore, the weak and the vulnerable members of the society are often not adequately involved.

In the case of the Energy Policy however, stakeholders were only involved twice, when they should have been involved from the very initial stages and throughout the whole process. For instance, the initial committee should have been made up of representatives from KAM, civil society, academia and research institutes, among others. There was also some confusion with the policy process. There are a number of instances where completed work was discarded necessitating the process to begin anew. The proceedings were neither systematic nor well organized. Even with little public consultation, it was unclear the extent to which stakeholder views[15] were featured in the final policy document, given the number of times the draft

[12] A voluntary private organization of players in the Petroleum Industry.

[13] Key amongst reports is the Beijer Institute of the Royal Swedish Academy of Science's "Energy and Development in Kenya – Opportunities and Constraints 1984".

[14] Such as 1987's "National Energy Policy and Investment Plan".

[15] Some stakeholders claimed that their views were not factored into the policy document.

was discarded and restarted. There was also no consistent representation from some organizations implying little benefit from institutional memory. Issues that had been dealt with earlier on were re-introduced with each new draft, slowing down the progress of the policy process considerably.

Even though most of the groups formed were multi-disciplinary, important organizations such as NEMA were represented at only two stakeholder meetings and in none of the task forces. This is likely to have limited their contribution on environment and energy issues. The absence of independence during draft reviews could also have affected objectivity.

The IAP project revealed a number of weaknesses in the energy planning and policy process in Kenya. First of all, planning has focused on electricity and petroleum sub-sectors and tended to neglect other sources of energy such as biomass. Estimates of demand and supply of biomass fuels, for instance, have not been reliable in the past (Kituyi, 2002). In essence, no one has established the real demand and supply of this form of energy upon which majority of the poor rely. Secondly, there has been no systematic attempt to undertake an integrated and holistic approach to energy planning. Moreover, with the exception of electricity, most energy projections in Kenya relied on historical growth, which often produced inaccurate figures. This also hampered "out-of-the-box" thinking in the planning process. The projections used have failed[16] to include conservation and efficiency targets, and the effects of technological developments on those.

A related critical weakness is that national planning in its entirety has not been guided by a nationally shared purpose or vision. The process has always been presumed to be the sole responsibility of government, with other stakeholders only serving as critics or commentators who have no role in the realization of the vision.

MOPND has also been plagued with periodic mergers and separations from/with MOF, usually on the basis of political considerations and other expediencies.[17] This trend often reduced the Ministry's capacity to conduct national policy development while overseeing its management and implementation. The last two separations of the Ministries in 2003 saw such adverse effects as MOF taking over significant human and infrastructural capacity, undermining the functions and responsibilities relating to the planning mandate.

Weak linkages between MOPND and the line Ministries, down to the poor coordination between officers at the provincial and district levels, constitute another source of ineffectiveness in the Kenyan planning process. The Central Planning Units (CPUs), which are the main organs MOPND uses to connect with and receive technical advice from its counterparts, are overly focused on budget related matters and weak on policymaking responsibility. The CPUs also lack dialogue and consultation within themselves, resulting in the inability to fully coordinate sector priorities in terms of shared purpose and responsibilities.

In addition, CPUs are noted for the lack of specialized skills even within line Ministries. Currently, the economists working on the frontline of government do not have unique or even relevant specialist skills, apart from basic economic theory and statistics that are minimum requirements. Yet, economists are usually valued by being generalists, in an age and time when planning issues are increasingly specialized. A review of specialization is needed to put competence at the head of planning divisions. There is also the need for a combination of economic, environmental and social disciplines to produce balanced plans.

[16] With the exception of electricity.
[17] This problem is reflected not just in MOPND but many other Ministries.

In terms of staffing levels, a needs assessment has established that the current staffing in MOPND was standing at 383 instead of the required 727. The Ministry lacked a clear training policy, with the result that many officers were undertaking training and capacity building programmes that were not relevant to their work. The physical location of the Ministry in the Treasury Building has left some of its departments and semi-autonomous agencies to operate from outside of the premises. Finally, the Ministry's infrastructural realities, with insufficient development of needed ICT skills, effectively undermine its potential to spearhead national integrated planning.

2.3 Energy Policy aims and weaknesses

Kenya has set in action a number of policies in the past to address energy issues in support of its development challenges. The national Energy Policy under assessment has a number of broad objectives including ensuring the adequate, reliable, cost effective and affordable supply of energy to meet development needs, while protecting and conserving the environment. The specific objectives are:

1. Provide sustainable quality energy services for development
2. Utilize energy as a tool to accelerate economic empowerment for urban and rural development
3. Improve access to affordable energy services
4. Provide an enabling environment for the provision of energy services
5. Enhance security of supply
6. Promote development of indigenous energy resources
7. Promote energy efficiency and conservation as well as prudent environmental, health and safety practices.

The Energy Policy in Kenya has evolved through sessional papers, regulations and Acts of Parliament. The landmark policy paper that set the basis for development of the country, Sessional Paper No. 10 of 1965, dwelt on the Electric Power Act (CAP 314) that had been used to regulate the sector. Sessional Paper No. 1 of 1986, which was another landmark policy blueprint, however did not focus much on the power sector. Instead, it called for the establishment of the Department of Price and Monopoly Control (DPMC) within MOF to monitor acts of restraint of trade and to enforce pricing in the various sectors including petroleum. The next significant legislative development came in 1997. The Electric Power Act of 1997 was legislated to replace CAP 314 and take on board new developments, and to facilitate private sector participation in the provision of electricity. Nevertheless, the Act was still inadequate in terms of providing incentives to the private sector and accelerating electrification in the country. The Electric Power Act of 1997 led to the establishment of ERB in 1998, with the objective of regulating the generation, transmission and distribution of electric power in Kenya. The same Act unbundled generation from transmission and distribution of power, functions that were at the time being carried out by KPLC. Consequently, KENGEN was established in 1998. The Electric Power Act 1997 also provided for rural electrification on a limited scale using renewable energy technologies.

There have also been policies and Acts of Parliament in the petroleum subsector. The Petroleum Act Cap 116 has been in use in the petroleum sector for a long time. There was also the Petroleum Exploration and Production Act enacted in 1984, which gave the National Oil Corporation of Kenya (NOCK) the mandate to oversee oil exploration activities in the country. A major development in the energy sector had been the Sessional Paper No. 4 of 2004 on Energy. The Energy Policy proposed the replacement of Cap 116 with new legislation consistent with a liberalized petroleum sub sector that would, *inter alia*, establish a one-stop shop for licensing importers and wholesalers of petroleum fuels, establish an inspectorate to enforce compliance with petroleum regulations, and oversee petroleum industry operations. The petroleum industry was liberalized in 1994 just like most markets in Kenya at that time. A draft Energy Bill 2004 has also been tabled in Parliament.

A draft Energy Bill, prepared with the participation of stakeholders will soon be tabled in Parliament. The Bill proposes to harmonize the legislations concerned with the various energy subsectors. It intends to address the current disparities in regulations and bring regulation and enforcement of energy sector activities under one body, the ERB.

Box 1 presents the specific measures that are planned for implementation within the Sessional paper.

Box 1: Summary of measures contained in Sessional Paper No. 4 on Energy

- Electricity subsector
  1. Creation of the Energy Regulatory Commission (ERC) to regulate the energy sector. It will serve as a one-stop shop for permitting and licensing of generation, and ensure transmission and distribution, as well as environmental rehabilitation on project completion or abandonment.
  2. Establishment of a state owned Geothermal Development Company (GDC) in charge of geothermal resource assessments and sale of steam to future IPPs and KENGEN for electricity generation.
  3. Creation of a Rural Electrification Authority (REA) to accelerate pace of rural electrification.
  4. Unbundling of KPLC into two entities, one for transmission which will be state owned and the other for distribution which will be privately owned.
  5. Privatization of KENGEN harmonize throughout over time starting with an Initial Public Offering (IPO) of 30 per cent of its equity on the Nairobi Stock Exchange (NSE).
  6. Promote private or community owned vertically integrated entities operating either renewable energy power plants or hybrid systems, to coexist with licensed electricity distributors.
  7. Allow power generation companies to access bulk electricity consumers through power transmission network.
  8. Creation of a domestic power pool with a provision for wholesale and retail markets to create competition and thus reduce the cost of electricity.
  9. Privatize or concessioning of isolated power stations to reduce operating costs and thus free up resources for rural electrification expansion.
  10. Increase lifeline tariffs on domestic consumers of up to 50 kWh per month to at least cover the cost of generation.

- Petroleum subsector
  1. Divestiture of government interests in oil refining and marketing, and eventually in the Kenya Pipeline Company (KPC).
  2. Promote investments in oil refining including supply and distribution of petroleum products throughout the country.
  3. Financing strategic stocks by the government and private sector, equivalent to 90 days demand in the medium to long term.
  4. Enhance explorations for fossil fuels particularly hydrocarbons through subdivision of exploration acreage into smaller blocks and collection of additional geological agrochemical and geophysical data to attract more oil prospecting companies.
  5. Renewable energy.
  6. Design incentive packages to promote private sector investments in renewable energy and other off-grid generation.
  7. Licence charcoal trade.
  8. Provide requisite support for research and development in emerging technologies like cogeneration and wind energy generation.
  9. Promote cogeneration in the country's sugar belt through an attractive bulk tariff regime.

Gaps in the Energy Policy

There are a number of gaps in the current energy policy that were identified through stakeholder consultations. The Policy does not give adequate coverage to poverty, gender, biomass fuels (particularly charcoal production), energy processing marketing, and renewable energy. The Policy is also silent on deliberate proposals or provisions to decongest and improve quality roads, target road improvement as a fuel reduction option, and eliminate leaded gasoline and ordinary diesel. Although the government is committed to phasing out leaded gasoline as per the Dakar Declaration of 2001, there have been no deliberate policy statement and strategy in the Energy Policy. Provisions such as promotion of mass transport in cities; construction of ring roads, flyovers and by-passes; repair of dilapidated roads; promotion of use of bicycles; gradual elimination of very old vehicles from the roads; quality monitoring of smoke and vapour emitted from vehicles; and annual vehicle inspection programmes should all have been part of the Energy Policy. Some of these are special provisions from the Traffic Act, Kenya Roads Board Act, and the First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC). Finally, there are no implementation strategies and targets for biomass energy.

2.4 Consistency of Energy Policy with other policies

As part of the IAP project, a policy mapping exercise was carried out to identify the general linkages between the Energy Policy and the national development policies on one hand, and related sectoral polices on the other. A number of sectors were deemed crucial to the achievement of energy sector objectives, such as water, agriculture, forestry, universities and research institutes. The import of this mapping analysis was to assess the alignment of the Energy Policy with national development objectives spelt out in the ERS, and the degree to which the Policy concerned itself with issues in related sectors, and vice versa for other sectoral policies

The details of this exercise are provided in Annex 1. Major conclusions are:

- The forestry policy largely contributes to the objectives of the Energy Policy. These two policies are considerably integrated, as there are provisions in each policy for mutual support. However, integration needs to be deepened further.

- The environmental policy is fairly well integrated with the Energy Policy. The policy includes the development of energy issues and legislation, EIA for all energy projects, incentives for energy conservation and private sector investments, among others. Likewise, the Energy Policy makes provisions for environmental protection and conservation.

- Although there is some evidence of integration of water and energy policies, there is little recognition of the needs of the water sector in the Energy Policy. Yet, energy is essential for sourcing and supplying water to users.

- Although the Energy Policy is not very explicit, there are health, environmental and safety regulations to mitigate the adverse impacts of energy systems. However, the health policy seems to ignore the energy sector yet critical services cannot be provided without energy.

- The poverty reduction strategy provides for rural electrification and increasing private sector participation in power generation, transmission and distribution. Although the Energy Policy recognizes poverty alleviation, there are no clear provisions to achieve that. To deepen the integration, provisions are needed to ensure lower costs of energy for the poor and the micro and small enterprises.

- There is little or no integration with the other sectoral policies analysed.
- In policymaking or revisions of the Energy Policy in the future, it is imperative that integration with related sectors be seriously considered.

3. Assessment of Energy Policy in the transport sector

There is no comprehensive Transport Policy yet in place, except a draft from February 2004. The draft document identified eight challenges, which were:

- Poor quality of transport services
- Inappropriate modal split
- Unexploited regional role of the transport system
- Transport system not fully integrated
- Urban environment pollution
- Institutional deficiencies
- Lack of a vision for the transport sector.

The main elements of the Transport Policy, when completed, would be:

- Establishment of the Department of Transport

- Consolidation of transport functions under one Ministry, and separation of policy making, regulatory and service provision functions

- Consolidation of urban public transport

- Promotion and integration of non-motorized and intermediate means of transport (NMITs) into the transport systems. The specific objectives are to:

    - Harmonize NMITs and their concomitant infrastructure into technical, legal and institutional mandates of transport agencies, so that they play a complementary role to other transport modes.
    - Incorporate NMITs in the urban and rural road network, including provision of incentives to support local manufacture of their vehicles.
    - Provide appropriate basic road infrastructure and other amenities including pedestrian crossing, walkways, and footbridges for NMITs.
    - Establish appropriate curricular training for NMIT operators on proper transport infrastructure and maintenance of vehicles, and to facilitate behaviour change on roads.
    - Register and regulate NMIT vehicles and brand animals used for transport at grassroots levels for purposes of identification in case of an accident.
    - Establish standards and specifications for NMITs, including their registration and branding animals used for transport, and develop a system to regulate their use.

In light of the poor safety and security record of the transport sector in Kenya, the draft Transport Policy called for the formation of a National Transport Safety Board.[18] Other policy proposals include the incorporation of transport research, health aspects of transport and ICTs into the transport sector to enhance performance of the sector.

3.1 Market situation for liquid fuels

Transportation is the major market for liquid fuels in many developing countries, accounting on average for half of total consumption. Unlike other end user sectors, possibilities for fuel switching in transport are limited. Given the existing stock of transport equipment, virtually the entire increase in consumption of transport fuels would involve petroleum products. A rapid expansion in consumption of petroleum products could seriously exacerbate economic management problems in Kenya, since:

- The cost of energy has significant impacts on economic activities especially energy intensive ones such as cement, steel, pulp and paper production.

- In a liberalized market such as Kenya's, energy prices are a significant determinant of the competitiveness of local suppliers relative to imports. Hence, high energy prices affect negatively domestic wealth creation, balance of payments and employment creation since consumers would opt for cheaper imports.

- In addition, high energy prices reduce the country's exports due to their high costs of production, assuming other factors are efficient.

A clearer understanding of energy consumption and its growth trend in the transport sector is, therefore, important not only for energy management but also for wider macroeconomic policy aims:

- First, the transport sector, which consumes about two-thirds of all petroleum fuels used in the country, offers opportunities for savings on imported fuels through energy conservation and fuel substitution.

- The transport sector has a real opportunity for a suitable fiscal policy (taxation) to manage demand and economic activity. This instrument has been used to curtail wasteful consumption of motor fuels in the past, particularly petrol.

- Transportation options encourage modes of transportation that have economies of scale and attendant fuel efficiency.

- Cost effective fuel efficiency standards and energy conservation measures in the transport sector are critical for competitiveness, locally and internationally.

To project such relationships into the future, we use historical data on transport energy consumption, vehicle stocks, associated prices and income variables. A number of key factors affect Transportation Energy Demand (TED) in Kenya. Growing demand for transportation fuels is influenced by population, economic growth, and increase in Vehicle Miles Travelled (VMT). Also contributing to the demand for transportation energy are consumers' vehicle preferences, fuel prices, and regulatory policies. Changing land-use patterns, length of road networks and increasing traffic congestion also affect transportation energy demand. Until the 1980s,

[18] The Board would be responsible for the development of a comprehensive National Aviation Safety and Security Programme, an Integrated Road Safety and Security Programme, and domestication of the International Ship and Port Security Code, among others.

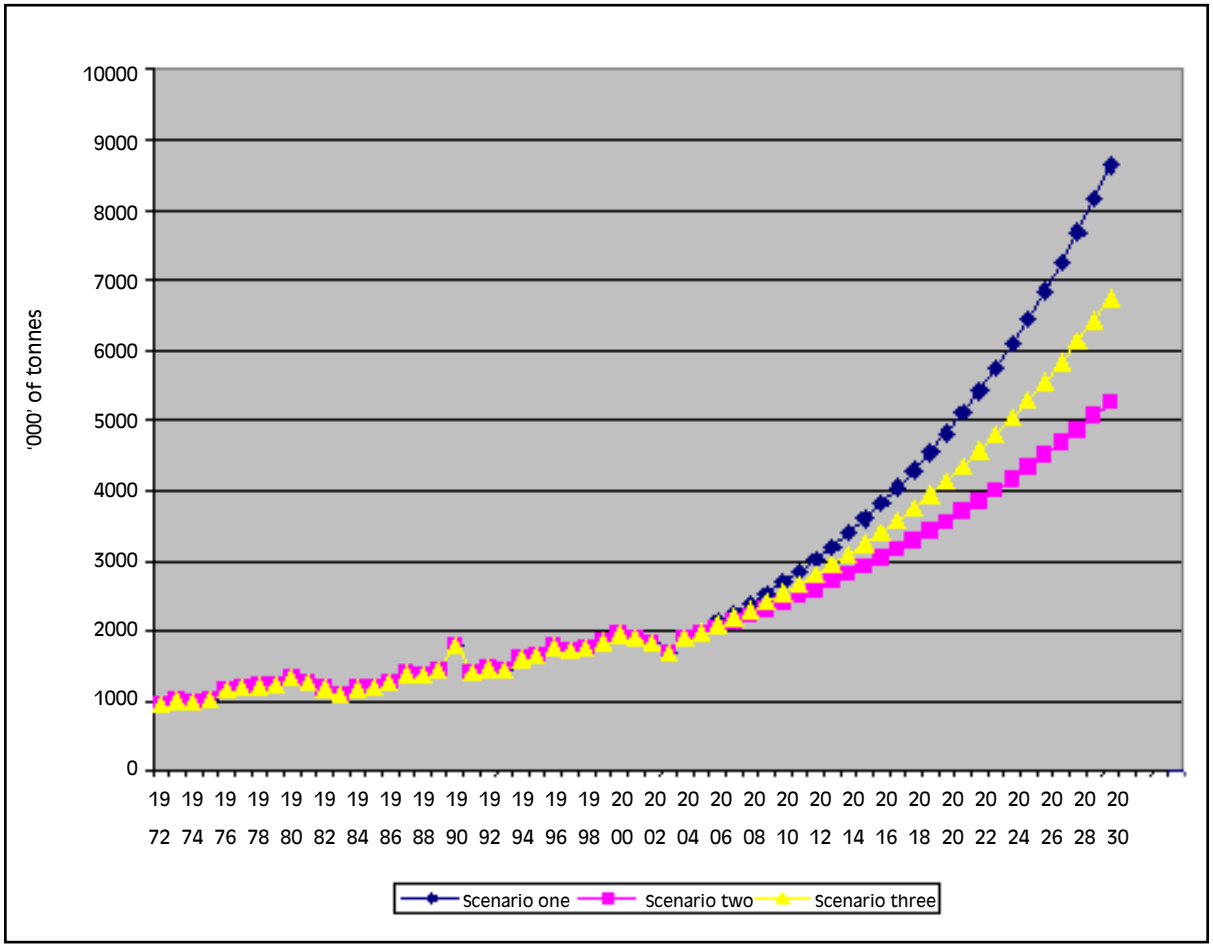
the state had a remarkable period of economic and population growth, which helped to drive up the demand for transportation fuels and transportation services. High petroleum dependence, both petrol and diesel, is the result of expansion in road transport and the shift from coal to diesel on the railways.

Table 3 and Figure 4 depict projected petroleum demand by transport sector under the three scenarios, each with a different growth rate assumed (6 per cent, 4 per cent and 5 per cent, respectively). Past tendencies of petroleum demand were used to estimate the *Business As Usual* scenario's of 6 per cent growth rate.

Table 3: Projected petroleum demand in transport sector under three scenarios

Scenarios	Growth rate of transport petroleum demand (%)	Projections (thousand tonnes)				
		2004	2007	2015	2025	2030
Business As Usual	6	1899.68*	2262.55	3606.16	6458.08	8642.37
Implementation	4	1899.68	2136.88	2924.47	4328.08	5266.81
Win-Win	5	1899.68	2199.12	3249.10	5292.43	6754.64

Figure 4: Projected transport petroleum demand, 2004-2030



The lower growth rate of 4 per cent for *Implementation* scenario is due to changes in vehicle technologies, increase in energy taxes as a result of environmental and fiscal reasons, and the use of bio-diesel. There is considerable potential for technology improvements in Kenya, for example in smaller and lighter cars, low or zero emission vehicles, or hybrid cars. Energy efficiency in the transport sector is increasing gradually. Under the *Win-Win* scenario, demand is expected to increase as a result of higher economic growth.

All trends indicate that transport energy demand will grow in the future, but the growth rate will depend on how the Transport Policy is implemented. Significant opportunities are there for more efficient transport paths under the Integrated National Transport Policy, which lowers energy consumption per vehicle and offers environmental benefits. With deteriorating motorization conditions in the country, improved mass transit systems are a priority in meeting the future demands of the vast majority. Overall traffic management in Kenya needs to be improved so that congestion can be reduced. Restricted zones in the city centres, complemented by efficient mass transit systems, are an option. Other measures are better freight transport, improved vehicle efficiency, alternative/cleaner fuels, system efficiency, promotion of non-motorized transport and land-use planning.

Given the projected demand of transport petroleum, the price for energy services in the sector will increase in all the three scenarios. Light diesel is mostly used in public transport, industry and small-scale agriculture. This type of fuel has the potential to either improve or worsen the welfare of the poor since it is used in many activities. Light diesel is also used in thermal electricity generation and therefore has an impact on both domestic and commercial electricity prices. The average price of electricity will increase because new power development is carried out on the basis of a rolling 20-year Least Cost Power Development Plan[19] (LCPDP). This means that new sources of electricity to be developed will be more expensive than those already available. Even the line power fee[20] will be adjusted to reflect the new cost of power generation. The subsidy will only remain for users who limit themselves to 50 KW. The rest will have to pay a price of Ksh 6.65 for the first 50 units, when previously they only paid Ksh 1.55. Even KPLC employees who are currently enjoying a subsidy will now have to pay more unless the company decides to pay for them.[21] Likewise, KPLC installations will also be served at the commercial and industrial rates.

However, the increase in prices is expected to be gradual because of: economies of scale and new geothermal generation technologies, use of single units of 70 MW, the possibility of obtaining viable coal in Kitui/ Mwingi that will lower overall electricity generation costs, and the possibility of using liquefied natural gas from either Iran or Tanzania[22] (which is cheaper than paraffin). There is also the likelihood of Kenya tapping into the South African power grid. The possibility of using concrete or metallic poles rather than those made of wood, which are replaced every six years, should also be explored.

Both quantities of energy produced and consumed are also expected to increase (see Annex 4). The demand will increase due to population growth and increases in per capita incomes. Consequently, petroleum supply will need to increase through increasing the number of generation plants, use of more agro-forestry products and more imports.

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[19] A national electric power development plan listing an array of viable power projects starting from the least costly to the most expensive. However, this is not part of the Energy Policy.

[20] The power tariff policy is based on two principles: economic criteria that uses long run marginal cost principles (future costs over a long period of time for stable prices), and tariff costing based on financial requirements of the industry (prices fluctuate due to fluctuations in trading currencies) (Electricity Regulatory Board, 2005).

[21] Electricity Regulatory Board, 2005

[22] Engineer Peter Kinuthia, KPLC, personal communication.

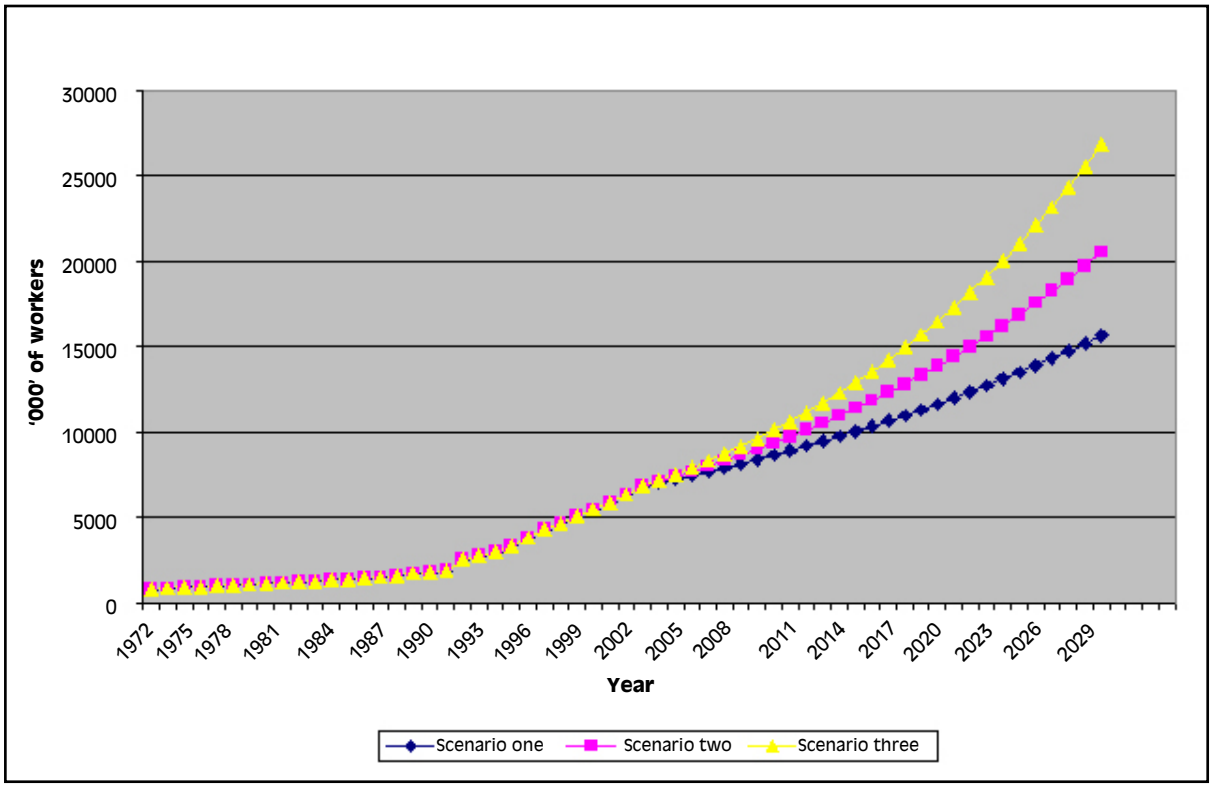
The contribution of the transport sector to GDP is another important economic indicator. Under the scenario of *Implementation*, the share of transport in GDP is also expected to increase due to:

- Anticipated efficiency gains and improvement in transport, which is likely to trigger higher productivity in the overall economy.
- Efficiency in transportation, which is likely to lower the cost of production and enhance competitiveness at the domestic and international levels.

The contribution of the transport sector will further increase under the *Win-Win* scenario largely due to implementation of the Transport Policy. Road infrastructure is expected to improve, bypasses and ring roads around major urban centres are to be established, and public transport will be streamlined.

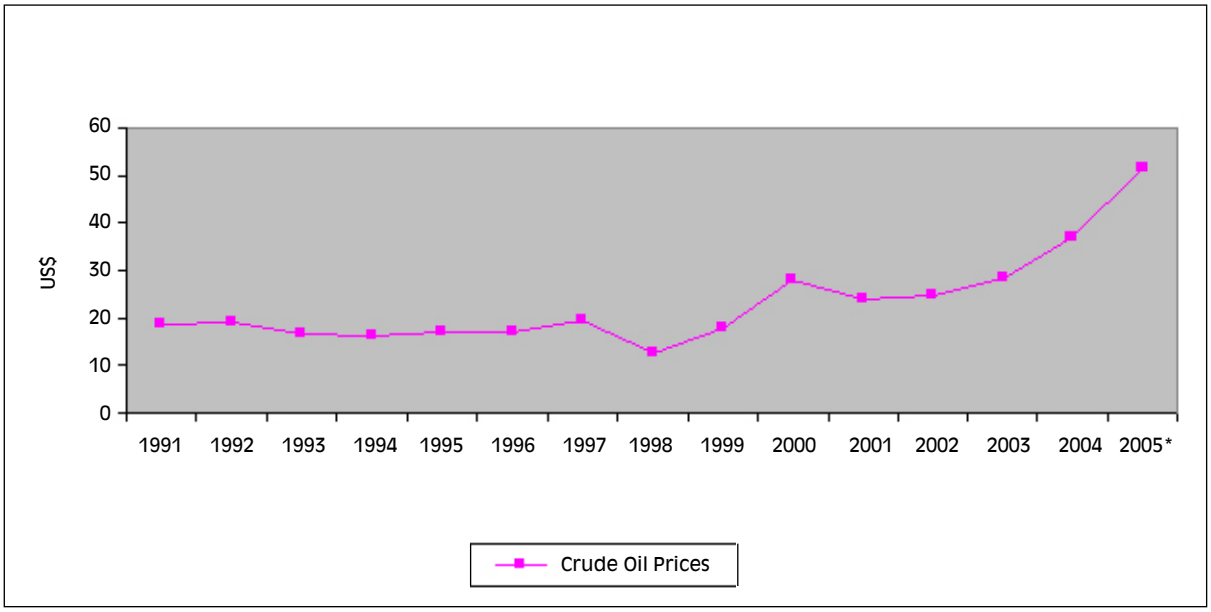
Employment in the transport sector is projected to reach 15.7 million, 20.5 million and 26.86 million by 2030 (growing at 3 per cent, 4 per cent and 5 per cent respectively) under *Business As Usual*, *Implementation* and *Win-win* scenarios, from a level of 6.8 million people in 2002 (see Figure 5).

Figure 5: Employment in the transport sector, 1972-2030



Energy imports for the transport sector are expected to grow along with petroleum demand. An area of uncertainty however exists in the international price of oil, which has been on an upward trend (see Figure 6).

Figure 6: Crude oil prices



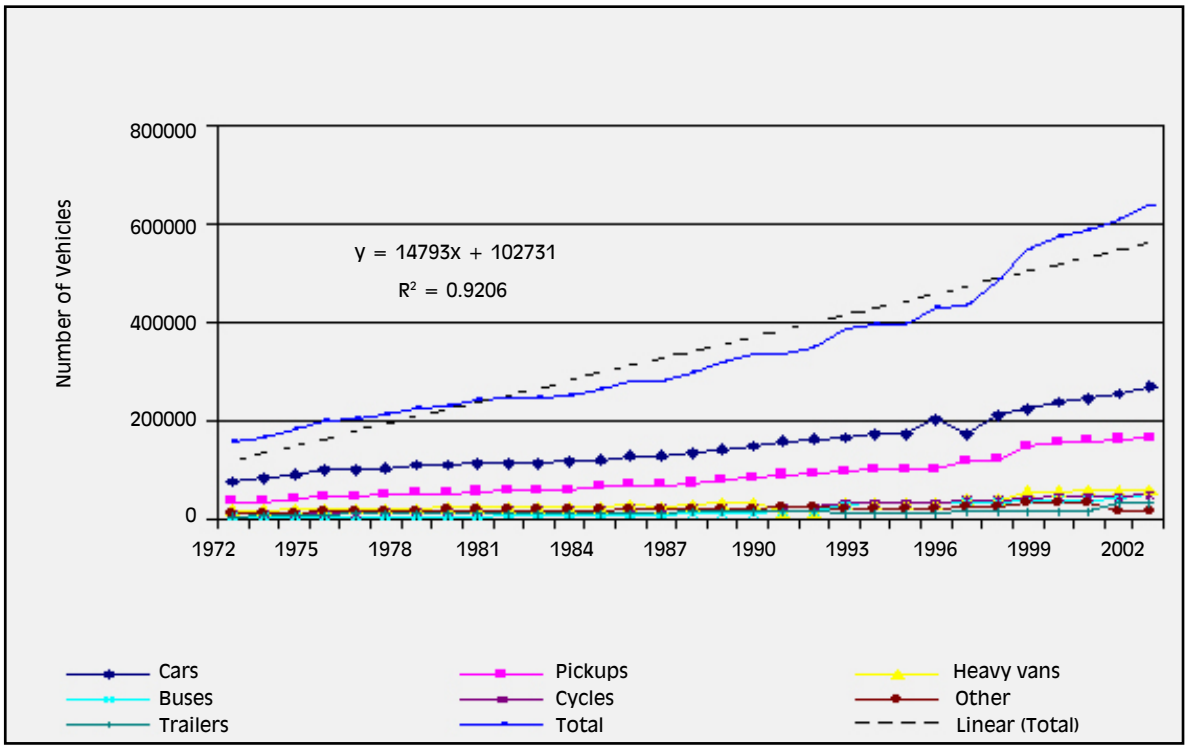
Other economic indicators include efficiency in generation and distribution of energy, especially electricity. Available figures show that the loss in distribution is not so much dependent on the source of electricity but rather the distance and links between generation and load or demand areas. With this in mind, the current lost electricity for KPLC is estimated to be 18.4 per cent, inclusive of distribution and theft. Currently, KPLC[23] has managed to reduce system losses[24] to 18.2 per cent. This figure is expected to decline to 15 per cent by 2007 and 12 per cent by 2025. Under *Win-Win* scenario, expected distribution loss is much lower. This is also partly due to efficiency gains in transport and therefore higher productivity.

3.2 Pollution from motor fuel emissions

Petroleum supplies at 22 per cent of total primary energy is largely (67 per cent) consumed in the transport sector[25] while the rest is mainly consumed in industrial processing and power generation. Kenya recorded an erratic increase in transport fuel consumption (both diesel and gasoline) between 1992 and 1995, after which it grew steadily (at a linear trend r^2 of 0.997). National consumption in 2004 stood at 597,000 tonnes of gasoline and 890,000 tonnes of diesel.[26] Figure 7 shows major trends in motor vehicle registration between 1972 and 2002. About 33,500 units were imported in 2003.[27] By mid 2004, over 700,000 vehicle units were already licensed to ply Kenyan roads, a figure increasing by an average of 30,000 units per annum.[28]

[23] The Standard Newspaper, 18th October 2005.
[24] KPLC has invested a total of Ksh 285 million in reinforcement and expansion of the transmission system. They also undertook $153 million worth of distribution system reinforcement and upgrade under the donor-funded Energy Sector Recovery Project (ERSP). This project aimed to improve efficiency, reliability, access and quality of energy supply.
[25] Government of Kenya, 2004
[26] J. Murutu, KPRL, personal communication, 10th November 2005.
[27] Senelwa K (2004). Motor Industry Survey 2004. The Standard Group, Nairobi.
[28] Mwai M. (2004). Motor Industry Survey 2004. The Standard Group, Nairobi.

Figure 7: Trends in vehicle population growth, 1972-2002



The transport sector has recently emerged as a key contributor to regional air pollution due to a growing number of vehicles in the rapidly growing cities. Emissions of pollutants, mainly carbon dioxide (CO_2), nitrous oxides (NO_x), dinitrogen oxide (N_2O), sulphur dioxide (SO_2), volatile organic compounds (VOCs), lead and particulate matter (PM) are the result of diesel and gasoline combustion by motor vehicles. SO_2 is mainly associated with diesel while lead is derived from leaded gasoline that has been on the Kenyan market for most part of the last decade. At the reported fuel consumption levels in 2004, 1.93 Tg (1Tg = 10^{12} g) of CO_2 from gasoline and 2.94 Tg CO_2 from diesel have been emitted. A detailed account of emissions are shown in Table 4.

[29] UNEP-PCFV

Table 4: Greenhouse gas emissions from the transport sector in 2004

				Old models (>10 years)			New models (<10 years)			Overall		
Vehicle Type	**Vehicles[a]** (%)	**Fuel[b]** (tonnes)	**Type**	**CO_2** (Gg)	**CH_4** (Mg)	**N_2O** (Mg)	**CO_2** (Gg)	**CH_4** (Mg)	**N_2O** (Mg)	**CO_2** (Gg)	**CH_4** (Mg)	**N_2O** (Mg)
Passenger cars	46	379834	Gasoline	872	118	214	356	48	38	1228	166	252
Light duty trucks (pick-ups)	26.3	217166	Gasoline	498	87	211	204	35	39	702	122	250
Light duty trucks (pick-ups)	10	369295	Diesel	866	22	63	354	9	26	1220	31	89
Heavy duty trucks	7.7	284357	Diesel	666	37	20	272	12	8	938	49	28
Minibuses and buses	6.4	236349	Diesel	554	16	41	226	6	17	780	22	58
Others	3.6											
TOTAL				**3456**	**280**	**549**	**1412**	**110**	**128**	**4868**	**390**	**677**

[a]*Source:* KRA, 2002; Registrar of Motor Vehicles.
Age brackets for vehicles : <10 years (28 per cent), 10 – 15 years (20 per cent), >15 Years (52 per cent)
[b]Calculated from KPRL data (personal communication) and fuel consumption ratios (KRA,2002), i.e. 72.4 per cent gasoline and 24.3 per cent diesel.
[c]Densities of fuels used for conversions (730g/l gasoline and 827g/l diesel) and emission factors for the various gases were reported by Environment Canada, 2000.

Similarly, ambient concentrations of lead in urban centres today stand in the range of 0.4–1.3 µg/m^3.[30] The lead content in gasoline in Kenya is 0.4g/l, since only 4 per cent of the gasoline consumed in the country in 2004 was unleaded.[31] The proportion has since increased to 30 per cent[32] in 2005. This implies that 245 million litres of leaded gasoline were consumed in 2004, releasing about 98.1 tonnes of lead of which 75 per cent ends up in air, soils and plants.[33]

There are other emissions such as SO_2 (5.545 ug/m^3 per capita) NO_2 (2.464 ug/m^3 per capita) and CO_2 (0.3 tonnes per capita). Current levels are far below the maximum allowable levels of 50 ug/m^3 for SO_2 and 100 ug/m^3 for NO_2 respectively, an advantage as Kenya can trade in emissions at the international level. Moreover, any increase in emission levels is not expected to be dramatic with NEMA, increasingly stringent on the enforcement of environmental standards.

A number of factors explain the composition and magnitude of the above pollutants. The first is traffic congestion, which translates into loss of time and fuel. Much of the road network in Kenya is run down and in dire need of rehabilitation. The poor condition is attributable to lack of routine maintenance, corruption in road construction contracts leading to approval of substandard work, increased traffic volumes, overloading, and non-prioritization of roads in government expenditure. There has also been no investment in road networks in key Kenyan cities to meet growing demand in transportation. Kenya's urban population has grown steadily at an average 7 per cent per annum over the past decade, putting pressure on static transportation systems. The roads now carry over ten times the amount of traffic they were designed for.[34] It was estimated that

[30] UNEP (2005). Report of the Secretary General for the CSD-14.
[31] World Bank (2004). Progress towards phasing-out leaded gasoline. *The World Bank Clean Air Initiative in Sub-Saharan African Cities* (April, 2004).
[32] J. Murutu, KPRL, Personal communication
[33] Waweru BW (2005). Determination of lead dietary exposure among Nairobi residents and implications for public health and policy. *BSc Dissertation*, Department of Chemistry, University of Nairobi.
[34] Mwai, 2004.

50 million vehicle hours were lost in 2002 in Nairobi owing to congestion at peak hours, wasting an estimated 63 million litres of fuel worth US$25 million.[35]

The second factor is the prevalence of old vehicles with poor fuel efficiencies. The influx of cheap second hand vehicles onto Kenyan roads (mainly from Japan and United Arab Emirates) can be attributed partly to economic policy reforms in the early 1990s, which liberalized many aspects of international trade. For instance, between 1992 and 2001, vehicle population in Kenya grew by 46 per cent, on the back of mostly reconditioned vehicles.[36] The number of new cars registered continues to grow by 30,000 units annually, most being reconditioned vehicles. Emissions of CH_4 and N_2O from fuel combustion are technology dependent. Old cars are inefficient in their consumption of fuel and emit up to 20 times more N_2O per litre of gasoline than newer models.[37] Low-income levels in the country have driven the importation of such vehicles in recent years.

The third factor is the continued refining and sale of leaded gasoline and ordinary sulphur-diesel. The KPRL, for example, is still producing leaded gasoline and high-sulphur diesel. Various studies have been conducted in the recent past with recommendations to convert the Mombasa facility into a modern refinery for unleaded gasoline or shut down operations. It will cost only US$20 million to convert the refinery.[38] Many neighbouring countries such as Uganda, Rwanda and Burundi depend on the refinery for their petroleum products which makes it a part political decision.

Finally, the fuel type is also an important factor. CO_2 and SO_2 emissions from vehicles are particularly dependent on the type of fuel. Diesel for example emits 2,730 g of CO_2 while gasoline emits 2,360 g.[39] The future choice of diesel or gasoline will dictate the degree of emissions.

With these four factors, the study attempts to identify policy gaps in the current Energy Policy (see Table 5). The proposed actions will also be the added prescriptions for the *Win-Win* scenario for the transport sector.

[35] Govenment of Kenya, 2004.
[36] *idem*
[37] Environment Canada (2002). Emission factors for mobile sources
[38] UNEP (2005). GEO Year Book 2006 *In Preparation*. UNEP DEWA, Nairobi.
[39] Environment Canada, 2002.

Table 5: Policy gaps of the Energy Policy in transport

Policy recommendation	IAP proposed action	Related Energy Policy provision
Decongest and improve quality of roads	a) Promote mass transport in cities, e.g. use of buses and trains.	Promote mass transportation of goods and services 6.6.6.2 (1d).
	b) Expand road network through construction of ring roads, fly-overs and by-passes.	None
	c) Repair all dilapidated major roads and those in urban residential areas.	None
	d) Promote bicycle use through price incentives and construction of cycle ways.	None
Promote efficient fuel consumption	a) Gradually eliminate very old vehicles from roads.	None
	b) Lower the age limit of second hand vehicle imports from the current eight years.	Review and enforce standards for second hand vehicle imports 6.6.6.2 (1b)
	c) Promote good driving and vehicle maintenance practices.	None
Eliminate leaded gasoline and ordinary diesel from the market	a) Convert KPRL into an unleaded gasoline and low sulphur diesel refinery.	Increase local fuel production and market access to motor fuels of high quality consistent with international standards 6.2.1.2(vi)
	b) Encourage imports of unleaded gasoline and low sulphur to meet deficit.	As above.
	c) Re-introduce alcohol blending of gasoline.	Reintroduce power alcohol as a motor fuel 6.2.1.2(viii).
	d) Promote local production and use of bio-diesel.	Review viability of production, marketing and use of bio-diesel 6.2.1.2(ix).

3.3 Business As Usual scenario

Under this scenario, it is assumed that:

- The road network remains as it is now and continues to depreciate for another 20 years, with no new major investments to ease congestion other than the usual piecemeal patches to cover pot-holes.

- Population growth in urban areas remains steady at 7 per cent, putting more pressure on the existing transportation system, with more vehicles, second hand or otherwise, being purchased (see Figure 4). This gives a projection of 960,730 vehicles to hit Kenyan roads in 2030.

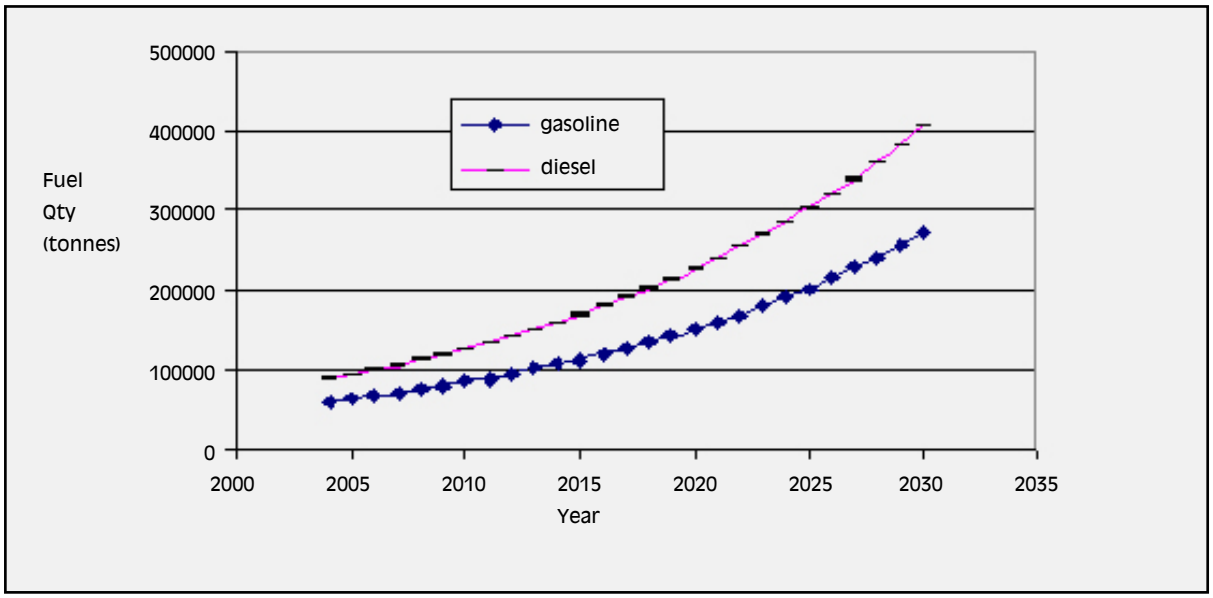
- The government does not undertake any serious steps to modify KPRL facilities to produce unleaded gasoline or to convert them into storage premises for imported unleaded fuel.

- Petroleum companies continue to import all unleaded fuel (30 per cent of all gasoline consumed) and sell locally refined leaded gasoline.

- The market also remains accessible to both ordinary and low-sulphur diesel brands at current market shares.

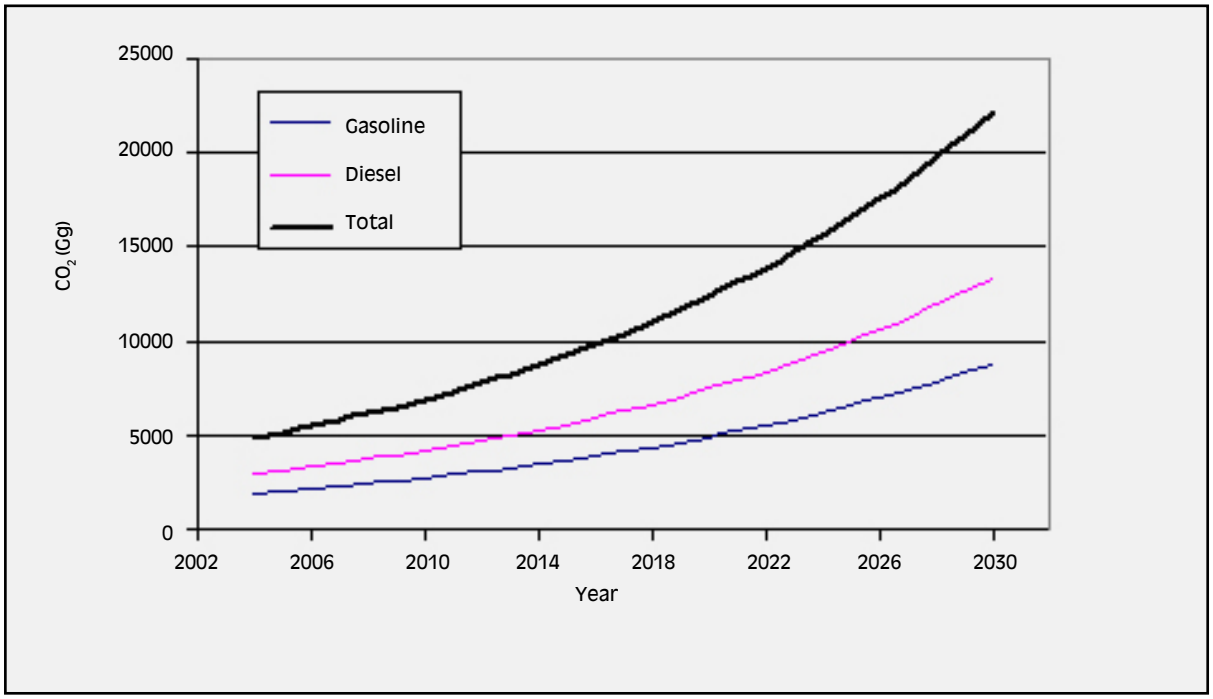
- The annual 6 per cent growth rate of gasoline and diesel demand projected by KPRL is sustained (see Figure 8).

Figure 8 : Projected growth in diesel and gasoline consumption (Business As Usual)



A range of implications can be derived from *Business As Usual*. A steady increase in the atmospheric concentrations of key pollutants commonly found in the transport sector, such as greenhouse gases (GHGs), nitrogen oxides (NO_x), sulphur dioxide (SO_2), lead and particulate matter (PM_{10}), is envisaged. They are assumed to increase at the same annual rate (6 per cent) as fuel demand. Higher than expected amounts of methane (CH_4) and dinitrogen oxide (N_2O) will also result from the growing numbers of old vehicles on the roads. By 2030, over 75 per cent of all vehicles on the roads will be older than 15 years. Figure 9 shows how CO_2 emissions from diesel and gasoline will increase under this scenario.

Figure 9: Projected growth in CO_2 emissions from motor fuel consumption (Business As Usual)



The assessment shows that emissions of greenhouse gases will increase. Kenya is a party to the Convention on Climate Change, which commits to avoidance of any increase in these gases. Others gases such as NO_x and SO_2 are the primary causes of acid rain, which be carried long distances by winds. Air polluted with weak sulphurous, sulphuric or nitric acids reacts with calcite in marble and limestone in city buildings and monuments, leading to roughened surfaces, removal of material and loss of curved detail. Car coatings are also permanently damaged by acid rain especially when acidic gases or particles are mixed with dew. Injury and eventual death of vegetation are the key effects of acid rain. Forests and crops in high mountainous regions are susceptible to destruction since they are exposed to greater amounts of acidic clouds.

These emissions also cause photochemical smog, which is a growing problem in most developing country cities, including Nairobi and Mombasa. The smog refers to haze or ground-level ozone arising from complex chemical reactions where sunlight breaks down chemical compounds such as volatile organic compounds (VOCs) and NOx from motor vehicles. Ozone pollution originating from urban areas can be transported to rural locations hundreds of kilometres away. Respiratory ailments, including asthma, emphysema and bronchitis represent the primary health problems from human exposure to ground level ozone. Children are particularly susceptible to ozone-related illnesses since they spend most of their time outdoors.

An increase in cases of respiratory diseases is also expected to result from inhalation of Peroxyacyl Nitrates (PAN) and particulate matter (both PM_{10} and $PM_{2.5}$) by the public walking in public or trapped for long hours in traffic jams, which will put pressure on the already weak medical system. Thousands of Kenyans running small businesses in exposed places along major city roads and open-air markets are at risk from respiratory diseases. Lead inhaled or ingested through vegetables is also known to cause, *inter alia*, IQ losses in children under 6 years of age and delayed puberty in young girls.[41] Other negative health impacts are low attention span and hyperactivity in children, and increased risk of cardiovascular disease, hypertension and increased blood pressure in adults.
There is therefore cause for concern with the growing number of vehicles on Kenyan roads and the number of children being enrolled in urban-based foundation schools. Any increase in the gaseous and particulate emissions will not auger well for Kenya, a signatory to the Dakar Declaration of 2001 on the phase-out of leaded gasoline.

3.4 Implementation scenario

The Energy Policy has the following key elements on the transport sector:

- **Taxation.** This instrument has been used and will continue to be used to reduce wasteful consumption of motor fuels, particularly petrol.

- **Fuel economy**. The Government will develop and enforce standards for fuel efficiency of motor vehicle engines and also continue to enforce speed limits to achieve savings in petroleum fuels, in addition to reducing road accidents throughout the country.

- **Awareness raising on opportunities to conserve fuel**. Measures will continue to raise awareness on the various methods of conserving fuel such as good driving and maintenance practices.

- **Alternative form of transport**. Other transportation options will be encouraged such as mass transportation of passengers and cargo to encourage economies of scale and fuel efficiency.

[41] Selevan *et al.* (2003). Concentrations of lead and delayed puberty in girls. *The New England Journal of Medicine* 348: 16 – 21.

Under this scenario, three key policy provisions found in the Energy Policy are implemented. These are *inter alia:* (a) reviewing and enforcement of the policy on standards for second hand vehicle imports into the country; (b) activities aimed at encouraging local production and increasing market access to motor vehicle fuels of high quality as well as re-introducing power alcohol in the fuel mix (promoting unleaded gasoline and low-sulphur diesel); and (c) promoting mass transportation of passengers and goods. These policies and measures are all meant to achieve energy efficiency and conservation in the transport sector, and to influence quality fuel supply and distribution.

Table 6 presents the assumptions made in implementing the policy provisions and the quantified impacts on the environment as measured by CO_2 reduction. Also reduced along with CO_2 are all other key pollutants. Promoting mass transportation by reviving and expanding the railway network on one hand, and enforcing more stringent requirements for second hand vehicle imports on the other, lead to a cumulative reduction in CO_2 of 8.8 Tg, or about 40 per cent of the *Business As Usual* scenario in 2030. The proportion of old and newer vehicles will dictate the magnitude of N_2O emissions for gasoline vehicles and CH_4 in the case of diesel vehicles. A special policy provision banning the use of vehicles older than a given age limit will be useful in reducing emissions further.

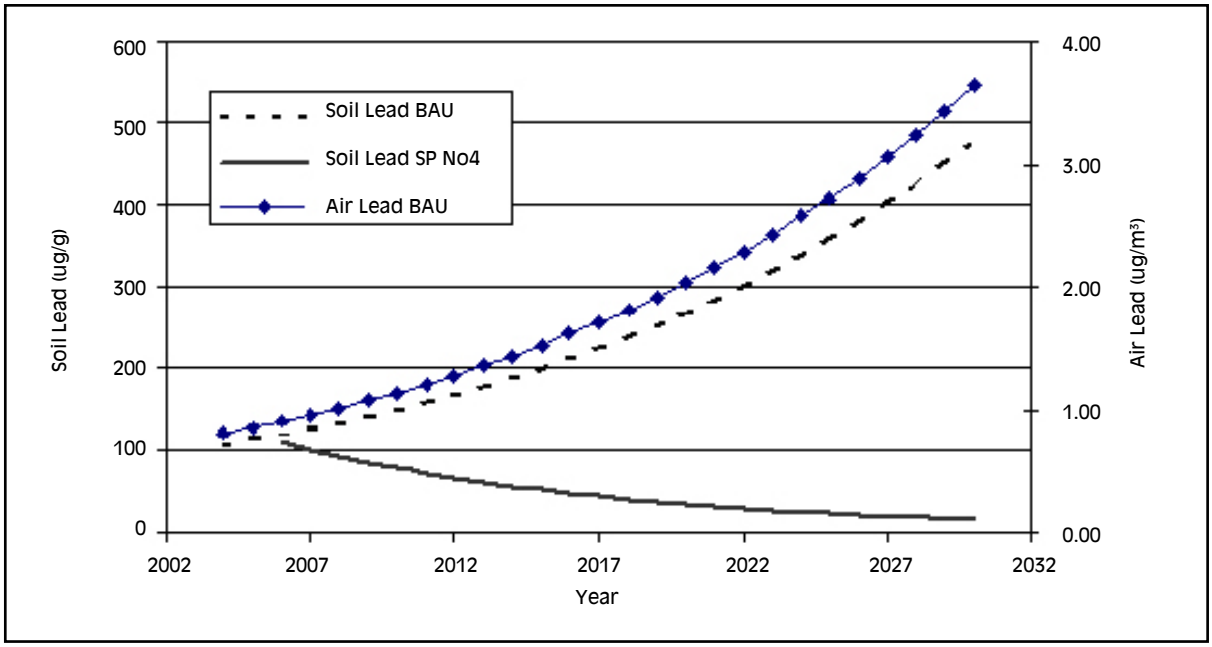
Table 6: Environmental implications of implementing Energy Policy (transport sector)

Energy Policy provision	Scenario assumptions	Environmental implications
Promoting mass transportation of goods and services 6.6.6.2(1d)	a) Railway network expanded and modernized for Nairobi city passenger transport. b) Project begins in 2007, ends 2009 c) Project eliminates 10 per cent of buses and minibuses by 2010 d) Annual 5 per cent reduction in emissions.	CO_2 reduction of 619 Gg by 2010 8160 Gg by 2030.
Review and enforce standards for second hand vehicle imports 6.6.6.2(1b)	a) Ban importation of all vehicles older than 4 years b) These are 70 per cent of all vehicle imports c) Ratio of gasoline to diesel cars is 72.4:24.3 d) Policy implemented in 2006.	CO_2 reduction of 44.7 Gg in 2007 677.6 Gg by 2030
Increase local fuel production and market access to motor fuels of high quality consistent with international standards 6.2.1.2(vi) Re-introduction of power alcohol as a motor fuel 6.2.1.2(viii)	a) Refinery technology is modified to produce unleaded gasoline b) More import of unleaded gasoline is allowed to meet any deficit c) 70 per cent total consumption of gasoline in 2004 d) 75 per cent lead emission ends up in plants and soil.	Stopping 172 tonnes/year (2004) of lead into environment. Soil lead reduction by 100 μg/g in 2007 14.7 μg/g by 2030

Although the Government is committed to phasing out leaded gasoline from the market, Kenya being a signatory to the Dakar Declaration of 2001, there is no specific provision in the Energy Policy to this end. The recommendations in Table 6 will see a reduction in soil lead concentration from 105 µg/g in 2004 to 14.7 µg/g in 2030, a 86 per cent reduction, while ambient air concentrations of lead (currently at 0.4-1.3 µg/m^3)[42] will fall to undetectable levels in urban centres within the first year of implementation. Figure 10 illustrates this projection.

[42] Waweru, 2005

Figure 10: Impact of phasing out leaded gasoline



Lead from the atmosphere, which lands on soils, has low mobility and tends to stay in the top inch (the upper 2-5 centimetres). However, deeper layers of soils that are disturbed or turned over may be contaminated. The downward movement of lead from soil by leaching is very slow under most natural conditions.[43] We can assume a modest 1 per cent loss per annum through leaching. In contrast, plants are efficient at absorbing soil lead, albeit slowly, and retain the lead that has been taken up. Plants take up about 7 per cent of the lead in soil although excessive lead kills them. Shallow-rooted plants, such as grasses and common vegetables, are particularly vulnerable to lead contamination that originated in the atmosphere.[44] An 8 per cent annual loss of lead from roadside and urban soils could be seen following the phase-out of leaded gasoline from the market.

Implementation of this scenario will lead to more efficient fuel consumption, significantly reduced emissions of GHGs, SO_2, PMs, NO_x and VOCs, and hence lower cases of respiratory ailments among the populace. Reduced risk of human exposure to lead through vegetables is also anticipated. Less chemical damage to crop and physical property through acid rain is also expected under the scenario.

3.5 Win-Win scenario

This scenario envisions implementation of Energy Policy as proposed in the previous section, with the addition of new legislation to fill identifiable gaps in Kenya's integrated energy planning. It also involves implementation of regional or international agreements to which the Government may be a signatory. Additional policies and legislation governing other sectors are also identified and proposed for integration purposes. Special provisions from the Traffic Act, Kenya Roads Board Act, and the First National Communication to the UNFCCC are assumed to be implemented. A summary of the assumptions and anticipations can be seen in Table 7.

[43] Available from: http://atsdr1.atsdr.cdc.gov:8080/cxlead.html
[44] Available from: http://www.itmonline.org/arts/lead.htm

Table 7: Environmental implications of Win-Win scenario (transport sector)

Win-Win provisions	Scenario assumptions	Environmental impacts
Republic of Kenya (2002): Government committed to building road bypasses around towns to ease traffic congestion and to reduce fuel wastage during peak hours (6.3.3a)	a) Construction of by-passes, ring roads and flyovers in the city of Nairobi b) Construction between 2007 and 2009 c) Congestion reduced by 30 per cent d) 50 per cent of all motor vehicles are found in Nairobi, half of which traverse the city daily e) Vehicles travelling on CBD roads reduce at 5 per cent per annum as a result of expansion f) Fuel loss in traffic jam is 1.26 litres/hour per vehicle.	CO_2 emission reduction by 0.16 Gg in 2010 2.06 Gg by 2030
Kenya Roads Board Act (2003): Established to avail funds and maintain the road network in the country	a) All dilapidated roads in Nairobi city and suburbs are repaired to international standards. All work commences in 2006. b) Reduces fuel consumption by 5 per cent per hour c) Gasoline to diesel ratio is 72.4 to 24.3.	CO_2 emission reduction by 3.08 Gg in 2007 43.7Gg by 2030
Government of Kenya (2002): Zero-rated duty on bicycles encouraging their use	a) Increase number of bikes among low class citizens in Nairobi city b) Construction of special bike paths and pedestrian walkways c) 2000 bikes purchased in 2003 in response to Michuki Rules replacing 20 26-seater diesel minibuses d) 500 bikes purchased annually, replacing 5 minibuses, each consuming 60 litres of diesel per day for 330 working days annually.	CO_2 emission reduction by 1.28 Gg in 2007 19.53 Gg by 2030
Proposed: The government gradually eliminates old vehicles from its register to reduce fuel losses and air pollution	a) Deregister all motor vehicles older than 25 years of age b) Vehicles in this category are 25 per cent of total vehicle population c) 5,000 vehicles will attain this status in 2007 and thereafter 1 per cent annually.	CO_2 emission reduction by 360 Gg in 2007 7713 Gg by 2030
Traffic Act: • Rule 27 (1) on quality of smoke and vapour emitted from vehicles • Section 51(1) on the type of fuel to be used in a given vehicle • Vehicle Inspection Manual (1999) on compulsory annual vehicle inspection with smoke as key parameter. *Government of Kenya (2002):* On promoting awareness on engine tuning through driving schools	a) Strict enforcement of the Traffic Act b) Raising driver awareness on good driving and maintenance practices reduces fuel consumption by 5 per cent per annum c) Restructure driving school curricula.	CO_2 emission reduction by 40.4 Gg in 2007 521.3 Gg by 2030

Overall efficient implementation of all the assumptions made in Table 7 leads to a total reduction of CO_2 of 8.3 Tg by the year 2030, or about 37 per cent below the anticipated *Business As Usual* emissions.

Apart from interventions that reduce the number of inefficient vehicles on the roads, the other option to bring about significant reductions in GHG emissions involves improving the quality and scale of road networks in the country. It was estimated that an hour spent in traffic jams in Nairobi wasted, per car, 1.26 litres of fuel.[45] There is no Energy Policy provision targeting road improvements as a fuel reduction option. However this transport sector intervention is well recognized as a measure for climate change mitigation by the First National Communication to the United Nations Framework Convention on Climate Change (UNFCCC).[46] A big challenge lies in implementing existing policies and laws, including the Traffic Act.

A significant reduction in CO_2 is expected as a result of road improvements. Other key pollutants are also expected to reduce significantly. Various government departments are already implementing some of the measures (see Box 2).

Box 2: Ongoing projects to reduce GHG and lead emissions

1. The Government began property demolitions along the stretch of proposed by-pass paths in February 2004. About Ksh 5 billion was needed for the construction of the three by-pass roads around Nairobi. Total collections from the fuel levy fund rose from Ksh 1.5 billion in financial year 1994/1995 to Ksh 9 billion in financial year 2004/2005. About Ksh 9 billion will be required annually to maintain 65 per cent of the 64,000 km network. In addition, about Ksh 45 billion is required in a one-off operation to rehabilitate the remaining 35 per cent of the classified network that is in poor state and therefore not maintainable.

2. In a bid to contribute to global efforts aimed at phasing out leaded gasoline use, the petroleum industry in Kenya spearheaded the introduction of unleaded gasoline at the same pump price. Use of the unleaded brand has been on the increase since, albeit slowly owing to: (a) lack of awareness, and (b) inadequate infrastructure to market the brand nationally. The same applies to low sulphur diesel, which is just gaining entry into the Kenyan market.

3. Innovation on the part of the KPRL in November 2005 led to the improvement of existing infrastructure, including changes produce two grades of unleaded gasoline i.e. 91 octane premium and 87 octane regular grade (J. Murutu, personal communication). This was with a view to beat the 31 December 2005 deadline set by the Dakar Declaration.

4. The Kenya Pipeline Company, the only white oil product pipeline within East and Central Africa, has performed its mandate fairly well by transporting over 90 per cent of oil products consumed in Kenya. To maximize its potential, pipeline extension from Eldoret in Kenya to Kampala in Uganda is at an advanced stage, with the actual construction having begun in 2005. This mode of fuel transportation has replaced a significant number of freight trucks that would have had to traverse the city of Nairobi daily, compounding the congestion and air pollution challenge. ▶

[45] Government of Kenya, 2000.
[46] Government of Kenya, 2002.

5. MOPND has concluded negotiations with a German railway investor to construct a Ksh 300 billion railway line linking Nakuru in Kenya and South Sudan.

6. A South African company, Sheltam Rail, which recently was issued a concession to run the Kenya-Uganda railway plans to invest a total of US$80 million. However, nothing is earmarked for the city commuter segment of the railway. The Kenya Railways has undergone three decades of decay to the point where it now needs about Ksh 40 billion to upgrade its infrastructure and rehabilitate the railway.

7. Implementation of the Road Maintenance Levy Fund (RMLF) Act of 1994, which consists of an automotive fuel levy and transit toll collections, is meant to go towards public road maintenance. Funds have been raised but have gone towards rehabilitating sections of major roads instead. The 1998 establishment of the Kenya Roads Board (KRB) to manage the RMLF, as well as the maintenance, repair and rehabilitation is key to road network development.

8. The government has zero-rated duty on bicycles thereby encouraging their use. As a result, bicycles are being used as taxis *(boda boda)* in many western Kenya towns. This contributed to job creation and emission reduction through foregone vehicle use.

9. NEMA in 2003 September set up a taskforce to devise appropriate phase-out strategies for leaded gasoline in Kenya.

10. Production of ethanol from sugarcane molasses is an existing enterprise in Kenya with two major firms, Kisumu and Muhoroni, already producing large volumes for industrial purposes. The policy challenge is, therefore, to make the domestic production of power alcohol competitive with motor gasoline to facilitate its re-introduction as a motor fuel blend.

11. On-going efforts by NEMA are on the development and possible enforcement of air quality standards.

3.6 Summary and conclusions

The amount of petroleum demanded by the transport sector will rise from 1,899,680 tonnes in 2004 to 8,642,370 tonnes, 5,266,810 tonnes and 6,754,640 tonnes in 2030, under the *Business As Usual*, *Implementation* and *Win-Win* scenarios respectively. The states of affairs under the last two scenarios are desirable as the import bill of petroleum will decline and also less pollution will be expected. However, the price of energy services is expected to rise over time despite energy conservation, energy efficiency, and the use of new technologies in generation. The contribution of the transport sector to GDP itself is expected to increase under the *Win-Win* and *Implementation* scenarios, compared to *Business As Usual*. This is due to efficiency gains in transport and therefore higher productivity. Employment in the transport sector is projected to reach 15.7 million, 20.5 million and 26.86 million by 2030 under *Business As Usual*, *Implementation* and *Win-Win* scenarios respectively, from a level of 6.8 million people in 2002.

From Table 8, one can infer that implementation of the improved Energy Policy will lead to reductions of key pollutants beyond the other two scenarios and bring about added economic development.

Table 8: Projected GHG and lead levels, and fuel consumption in 2030

Indicator	Base year 2004	Business As Usual 2030	Implementation 2030	Win-Win 2030
CO_2 (Tg)	4.9	22.2	13.9	3.6
CH_4 (Gg)	0.4	1.8	1.5	0.5
N_2O (Gg)	0.7	3.1	2.5	0.5
Lead ambient ($\mu g/m^3$)	0.8	3.6	Not detectable	Not detectable
Lead soil ($\mu g/g$)	105.0	477.7	14.7	14.7
Fuel total (mill tonnes)	1.5	6.8	5.7	1.4
Gasoline (mill tonnes)	0.6	2.7	2.2	0.4
Diesel (mill tonnes)	0.9	4.1	3.5	1.0

Under the *Business As Usual* scenario, the petroleum industry and the Government gain the benefit of increasing oil revenues and taxes, while the public run the risk of worsening health and environment degradation. The other scenarios, *Implementation* and *Win-Win*, favour public health and the environment while laying the burden on the private energy sector, from producers to generators. The Government also receives less taxes due to lower fuel volumes traded.

The achievement of any benefit from the Energy Policy, all said and done, requires the government and other relevant agencies to:

- Streamline coordination of activities by different government departments.
- Harmonize energy efficiency and traffic pollution prevention policies and laws scattered among sectoral policies and laws.
- Integrate considerations on climate change mitigation in the UNFCCC.

4. Assessment of the Energy Policy: Household sector

4.1 Urban and rural household energy choices

Studies have shown that there is a shift from biomass fuel to kerosene and liquid petroleum gas (LPG) by mid income urban households, and to LPG and electricity by higher income urban households (TERI, 1992; Reddy and Reddy, 1994). In rural areas, the pattern is different. Studies in western and central Kenya (Mugo, 1997; Mugo, 1999) found that all households regardless of socio-economic status used woody or high quality crop residues (like maize cobs[47]) before changing to other forms of biomass energy for cooking. In western Kenya, all the maize cobs were used before the population turned to wood or maize stalks, and in central Kenya, all the coffee and tea prunings and maize cobs were used before the population turned to wood or other lower forms of residues.

Therefore, in rural households of a given area, the types of fuels used for cooking were nearly uniform among all income groups. However, as scarcity increased, the better-off switched to using wood while the poorer groups of society turned to lower forms of crop residues. In Bungoma, it was found that all households preferred wood fuel for cooking (Mugo, 1997). Maize cobs were the next favourite followed by kerosene, gas, electricity and charcoal. In urban areas, the choice of cooking fuel depends on income while those in the rural areas decide based on available alternatives, which can change from region to region. Policy interventions and plans for sustainable energy supply have thus to be customized to regional needs.

4.2 Pollution from household energy consumption

Production and consumption of solid fuels (firewood and charcoal), and liquid fuels (kerosene and LPG), are a key source of a range of gaseous and particulate pollutants. These include CO_2, CO, N_2O, NO_x, CH_4, NMHCs and PMs. These gases and aerosols have a range of impacts on human health and the environment. CO_2, CH_4 and N_2O are greenhouse gases (GHGs) with potential effect on global warming, while others such as NO_x, CH_4 and CO are precursors to important secondary products such as tropospheric ozone, which has serious impact on vegetation and human health particularly in high altitude regions. PMs and CO are also well known respiratory health hazards. Unsustainable charcoal and fuel wood production can also contribute to deforestation and desertification.

Although quality of data is still lacking, there is indication of rapidly changing demand for these fuels in rural and urban areas. Demand for charcoal has dropped from 2.91 million tonnes in 1997[48] to 2.48 million tonnes in 2000[49], and to 1.6 million tonnes in 2004.[50] The use of forestry and agricultural residues shows an increase from 1.37 million tonnes in 1997 to 2.9 million tonnes in 2000. Demand for firewood decreased

[47] Gross heating value of air-dried maize cobs is 18.9 MJ/kg compared to 20.0 MJ/kg of air dried wood.
[48] Kituyi, E., 2000.
[49] Government of Kenya, 2004.
[50] ESDA (2005). National Charcoal Survey.

slightly from 15.42 million tonnes in 1997 to 15.1 million tonnes in 2000. The use of kerosene and LPG for cooking continues to grow steadily in both rural and urban markets. For instance, Kenya had fewer than 50,000 household LPG cylinders in use in 1995, confined to a few key urban areas. However, by 2002, over 700,000 cylinders were in use throughout the country.[51] The growing use of kerosene was in part attributable to convenience and competitive pricing especially as charcoal price was rising..

Table 9 presents estimates of consumption of the various fuels in Kenya for the year 2004. Consumption that year produced emissions of 53.4 Tg of CO_2. The levels of other gases and particulate matter are also estimated.

Table 9: Fuel consumption estimates in the household sector for 2004

Fuel type	Quantity of fuel	Emissions (Gg)				
		CO_2	CH_4	N_2O	PM	CO
LPG[a]	41,884 tonnes	129	0.002	0.01	0.02	0.62
Kerosene[a]	305,825,000 litres	729	0.3	0.02	0.2	15.4
Charcoal production[b]	10,667,000 tonnes	18134	440	1.4	245	2539
Charcoal consumption[b]	1,600,000 tonnes	4330	12.6	0.3	3.8	216
Firewood[c]	14,600,000 tonnes	23068	40.9	1.0	13.1	1035
Residues[c]	4,940,000 tonnes	7044	13.8	0.3	350.2	333
Total	-	53434	507	3	613	4139

[a] PIEA (2005): Petroleum Insight, Oct-Dec edition. p25. Kerosene density of 810g/l.
[b] Estimates from ESDA (2005) National Charcoal Survey. *Energy for Sustainable Development Africa*, p74.
[c] Projection using 1997 national data of Kituyi (2000) and 2000 Kamfor (2002).

From Table 9's emission figures of gases and particulates, emission factors for charcoal, wood and fossil fuels are calculated in Table 10, derived from a range of empirical measurements in countries (Kituyi, 2000).

Table 10: Emission factors for charcoal compared to wood and fossil fuels

Fuels	Fuels (g per kg of dried fuel)					
	LPG	Kerosene	Charcoal making	Charcoal use	Firewood	Residues
CO_2	3085	2943	1700	2706	1580	1426
CH_4	0.05	1.1	41.2	7.9	2.8	-
N_2O	0.15	0.1	0.13	0.2	0.07	-
PM	0.51	0.7	23	2.4	0.9	-
CO	14.9	62	238	135	70.9	67.4

[51] ESDA (2003). A New Energy Policy for Kenya? Policy Briefing No.1, Energy Alternatives AFRICA Ltd.

Several factors are responsible for the above levels of emissions from households. The use of inefficient fuel conversion technologies, including poor stove engineering characteristics, is one of the factors. Other parameters include moisture content, type of fuel, and type of food being cooked, among others.[52] Efforts at policy and technical interventions in atmospheric and indoor pollution must be aware that improved charcoal and firewood cookstoves have demonstrated their potential to save 10-50 per cent of fuel[53], but are yet to reach the majority of the market. Similarly, efficient charcoal kilns with potential recoveries of 30-45 per cent are not well known. Over 95 per cent of the kilns used in the country are inefficient, with 8-20 per cent conversion efficiency.

The cost of alternative clean energy options is too high for most poor households to afford. Although the cost of renewable energy technologies such as PV systems have fallen significantly over recent years, they remain uncompetitive compared to alternatives such as kerosene. LPG is out of the reach of most of the population due to tariffs and duties (18 per cent VAT and import duty on LPG, and 18 per cent VAT on cylinders and appliances).[54] Poor energy policies and legislation also explain emission composition and magnitude.

Unsustainable wood production practices are another factor determining the level of emissions from households. Charcoal production for nearly 80 per cent of urban households[55] destroyed over 50,000 hectares of the country's dryland savannah woodlands and rangelands in arid and semi-arid regions in 1989.[56] Trees felled from clearing land for agriculture and settlement is another source of charcoal. The forested area also continues to diminish each year. Charcoal production is more intensive than wood gathering, continuing until wood resources at a site are exhausted. The demand for biomass fuels in 2000 stood at 35 million tonnes, of which only 15 million tonnes were sustainably supplied.[57] Despite the potential of agroforestry to supply firewood from most parts, this option is yet to be fully exploited owing to land tenure problems.[58]

Using the four considerations above, a range of realistic actions for implementation are proposed for the *Win-Win* scenario by the IAP team. These are presented in Table 12 where they are compared against the Energy Policy provisions.

4.3 Business As Usual scenario

Under this scenario, a number of assumptions are made. Demand for biomass fuels (including residues) is expected to reach 53.4 million tonnes in 2020.[59] Without any policy intervention, the wood fuel deficit of 20 million tonnes reported for 2004 will grow to 33 million tonnes by 2020.[60] Availability and access to firewood on communal land is expected to diminish in most parts of the country, leading to lower consumption levels. A downward trend in firewood consumption to 11.8 million tonnes in 2030 is therefore expected. Currently, over 80 per cent of all fuelwood is sourced from farmlands, up from about 47 per cent in 1980s[61], a finding that is expected to remain true.

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[52] Kituyi, 2001a.
[53] ESDA, 2003.
[54] Ibid.
[55] Government of Kenya, 2004.
[56] Bess M (1989) Kenya Charcoal Survey Final Report and Annexes. By 2004, annual forest loss as a result of charcoal production had reached 160,000 ha.
[57] Government of Kenya, 2004.
[58] Kituyi, 2001b.
[59] Government of Kenya, 2004.
[60] Ibid.
[61] Kituyi, 2002.

An assumption is also made that poverty will remain at current levels with households not able to switch to cleaner fuels and remain unable to afford improved firewood cookstoves such as the *kuni mbili (maendeleo)* model.[62] As a result of the rising fuelwood crisis, demand for residues for cooking will continue its upward trend to 18.2 million tonnes in 2030. However, food production (mainly maize) will also grow to match this demand level. Since the realistic supply of crop and wood residue is unlikely to meet this level of demand, it is likely that the rural poor will revert to other less efficient forms like dung, as they have demonstrated to do.

Table 11 identifies the gaps in the Energy Policy when it comes to the household sector and presents integrated recommendations that will be assumed in the *Win-Win* scenario.

[62] Maendeleo model of stoves designed by the Maendeleo Ya Wanawake Organisation, a Kenyan women's NGO, as a fuel saving device. It requires about two pieces of wood to make a typical meal, hence the name kuni mbili.

Table 11: Gaps in Energy Policy for household sector and IAP recommendations for Win-Win

Policy recommendation	IAP proposed action	Related Energy Policy provision
Remove barriers to the adoption of efficient wood fuel stoves and kilns	a) Develop stove standards and enforce their implementation	None
	b) Promote access to micro-finance facility or other innovative financing mechanism	None
	c) Develop and implement capacity building initiatives for stove and kiln artisans	• Sec. 6.3.1: Offer training to Jua Kali artisans for manufacture, installation and maintenance of efficient stoves
	d) Legalize and regulate charcoal trade.	• Sec. 6.3.1/2: License charcoal production to motivate sustainable production. • Sec. 6.6.5/1: Integrate environmental costs of wood fuel harvesting in charcoal license fee
	e) Increase efficiency and accelerate adoption of improved woodstoves and charcoal kilns.	• Sec. 6.3.1/3: Increase adoption rate of improved cookstoves in rural and urban areas • Sec. 6.3.1/4: Improve efficiency of cookstoves from current 30-35 per cent to 45-50 per cent by 2020. • Sec. 6.3.1/5: Promote introduction of efficient charcoal kilns
Develop comprehensive energy policy and legislation for Kenya with sufficient recognition for the biomass sector	a) Commence energy legislation development process	None
	b) Sensitize policymakers to need for strengthening biomass energy focus.	None
Promote sustainable wood production	a) Promote reforestation of areas cleared for charcoal production through incentives	• Sec. 6.3.1/6: Promote fast-maturing trees, establishment of commercial woodlots, peri-urban plantations • Sec. 6.4: Promote growing of appropriate tree species for bio-diesel production
	b) Strengthen capacity for agroforestry and farm woodlot development among communities.	None

Policy recommendation	IAP proposed action	Related Energy Policy provision
Promote increased access to clean energy alternatives (grid power, renewables, LPG and kerosene)	a) Waive all VAT and duty on products and accessories	• Sec. 6.4: Allow duty-free imports of renewable energy hardware to promote wide usage
	b) Develop and implement standards for Renewable Energy Technologies (RET)	None
	c) Expand training of energy technology support staff	• Sec. 6.4: Development of appropriate local capacity for manufacture, installation and maintenance and operation of RETs.
	d) Extend fuel and RET distribution infrastructure to rural areas	• Sec. 6.2.1.2: Expand retail networks for LPG and kerosene and common user storage facilities • Construct storage and filling facilities in major towns
	e) Expand access to micro-credit to the rural and urban poor	None
	f) Strengthen private sector and civil society participation	• Sec. 6.1.3/3: Facilitate entry of independent players in generation and supply of power in off-grid areas • Sec. 6.6.6 Encourage private sector technical and financial support
	g) Accelerate rural electrification programmes	• Sec. 6.1.3: Speed up grid extension and off-grid projects to target 20 per cent rural households by 2010 • Develop small hydro and hybrid systems using RETs and oil-fired technologies
	h) Adjust electricity tariffs to accommodate the rural enterprises.	• Sec. 6.6.5/2: Electricity consumer tariffs will meet social equity objective of affordability for the underprivileged

Charcoal consumption has been falling due to dwindling quantities of woody biomass on trust lands, depreciated at a rate of 50,000 ha/year.[63] No charcoal is expected in the market by 2012 at the current rate of consumption. However, with complex fuel mixes (using charcoal alongside other fuels to meet daily energy requirements) anticipated for urban households[64], there will still be charcoal on the market consumed at 0.8 million tonnes per year, or half the current rate of use. The urban communities have over the past decade adopted (and will continue to adopt at a higher rate) the fuel-saving *KCJ* charcoal stoves. Over 85 per cent of urban households used these stoves in 2002[65] compared to 47 per cent in 2000[66] and 13 per cent in 1997.[67] This growth has not benefited from any direct policy intervention.

Under this scenario, it is also assumed that 90 per cent of all kerosene and LPG are consumed by households for cooking activities and that their consumption continues to grow at 2 per cent per annum (PIEA estimate) to 0.38 million tonnes for kerosene and 63.1 million tonnes for LPG in 2030. These increments will be in response to the growing demand for fuels, particularly in urban areas..

The *Business As Usual* scenario poses a range of implications for human health and the environment. Table 12 shows the levels in fuel demand and the resultant emission levels for various atmospheric gases under consideration. Under the *Business As Usual* scenario, the household sector is expected to contribute towards global warming through emissions of 61.7 Tg of CO_2, 420 Gg of CH_4 and 13 Gg of N_2O into the atmosphere in the year 2030.

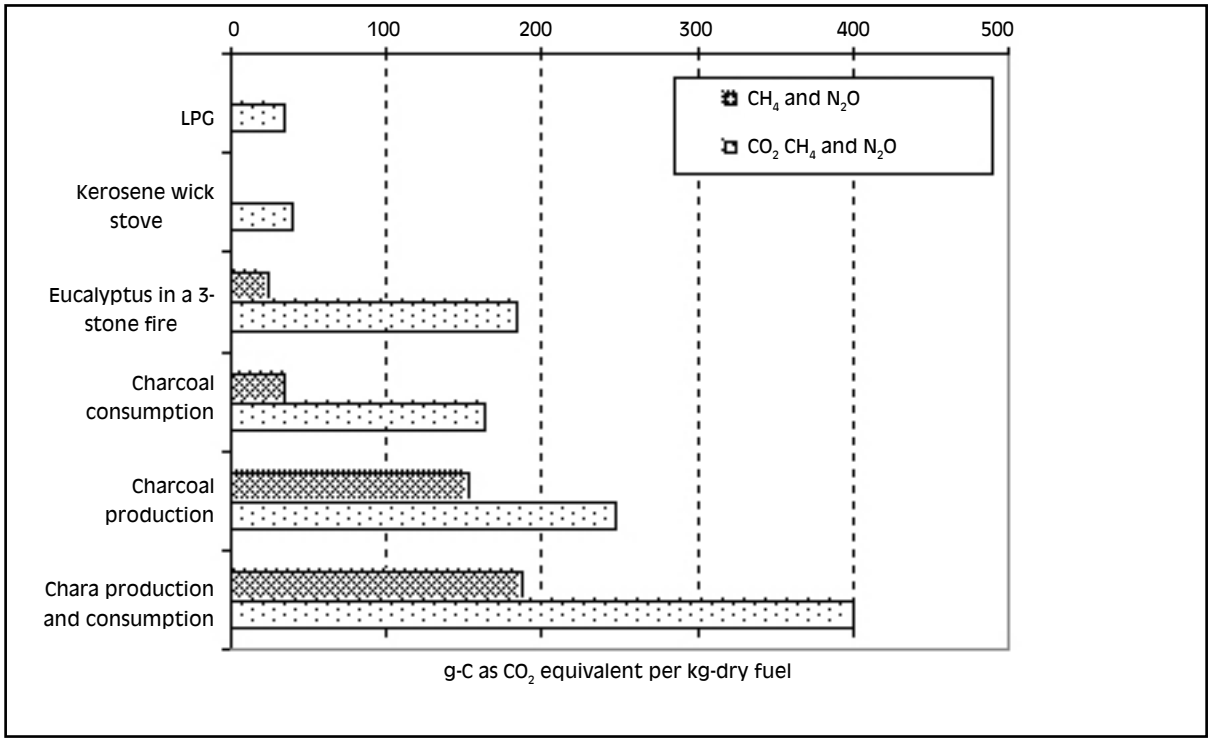
Table 12: Nett emission levels in 2030 (Business As Usual)

Fuel	Fuel demand	Emissions (Tg/year)				
	(million tonnes)	CO_2	CH_4	N_2O	PM	CO
LPG	0.07	216.0	0.004	0.01	0.04	1.04
Kerosene	0.38	1118.3	0.4	0.0	0.3	23.6
Charcoal making	8.0	13600.0	329.6	1.0	184.0	1904.0
Charcoal use	0.8	2164.8	6.3	0.2	1.9	108.0
Firewood	11.8	18644.0	33.0	0.8	10.6	836.6
Residue	18.2	25953.2	51.0	1.3	16.4	1226.7
Total	**-**	**61696.3**	**420.3**	**12.8**	**245.4**	**5039.1**

Figure 11 shows the differences in global warming impacts of the different household energy options. The large impact of charcoal is mostly the result of methane emissions.

[63] ESDA, 2003.
[64] Mazrui NM (2005): Impact of household fuel change on the chemistry of the local troposphere, climate and health: The case of Nairobi (1997-2005) *BSc Dissertation*, Department of Chemistry, University of Nairobi.
[65] Bess M (2002): Keynote speech on policy dialogue on sustainable energy in Kenya. 21 May 2002. Nairobi. Energy Alternatives AFRICA.
[66] Kamfor, 2002.
[67] Kituyi, 2002.

Figure 11: Comparison of global warming impacts of household energy technologies



Since wood fuel production is not sustainable in Kenya due to the wood fuel deficit, it is reasonable to assume that all the CO_2 and N_2O will contribute to global warming, with none re-absorbed by plants on re-growth. Furthermore, a phenomenal 245 Gg of particulate matter and 5 Tg of CO are expected to be emitted. The two are grim heralds of poor respiratory health due to high indoor air pollution. CO in particular has high potential to form low-level ozone that is toxic to high altitude fauna and flora.

Apart from the tropospheric impacts, charcoal production in 2030 is expected to lead to the clearance of 80,000 hectares of woodlands and savannas in the arid and semi-arid lands, down from 160,000 hectares in 2004. Charcoal production is contributing to woodland depletion at the rate of 0.05 hectares for every tonne of charcoal produced in improved kilns (which are very rare), and 0.1 hectares in the case of common traditional earth kilns.[68]

4.4 Implementation scenario

Under this scenario, the goal is to implement all the provisions relevant to household energy supply and demand in the Energy Policy. Various assumptions are made for that purpose (see Table 13). The assumptions are a set of realistic proposals for action, which, if implemented, will lead to significant environmental gains.

[68] Wamahiu, 2001.

Table 13: Energy Policy provisions and Implementation scenario assumptions

Energy Policy provision	Scenario assumptions
Legalize charcoal production to motivate sustainable production (Sec. 6.3.1/2)	• People be trained in stove and kiln production and use. • Charcoal kiln of average 30 per cent efficiency will be certified and adopted by all registered charcoal producers. • Woody biomass on 0.05 hectares of land is needed to produce 1 tonne charcoal using this kiln. • The producers belong to a self-regulating grouping that lobbies for their interests including training, credit access, etc.
Improving stove efficiency from current 30-35 per cent to 45-50 per cent by 2020 (Sec. 6.3.1/4) Increase adoption rate of improved cookstoves in rural and urban areas (Sec. 6.3.1/3)	• Improve efficiency of all improved stoves to 40 per cent. • Accelerate adoption rate to 10 per cent for kuni mbili firewood stoves in rural areas, and 100 per cent for KCJ charcoal stoves in urban areas. • Trained artisans produce high quality stoves readily acceptable by the market.
Speed up grid extension and off-grid projects targeting 20 per cent rural households by 2020 (Sec. 6.1.3) Facilitate entry of independent players in generation and supply of power in off-grid areas (Sec. 6.1.3/3) Encourage private sector technical and financial support (Sec. 6.6.6) Adjust electricity consumer tariffs to meet social equity objectives (Sec. 6.6.5/2) Allow duty-free importation of renewable energy hardware to promote wide usage (Sec. 6.4)	• Increase access to off-grid power options and rural electrification to 30 per cent rural folk by 2030. • Private public partnerships are put in place to oversee project implementation. • Consumer tariffs for rural electrification and mini-grids are adjusted to make power affordable to the low-income groups. • Duty waived for renewable energy hardware including accessories. • Sufficient manpower trained to support the growing demand for services. • Efforts aim to reduce national kerosene consumption by 20 per cent (mainly for lighting).
Integrate environmental costs of wood fuel harvesting in charcoal license fee (Sec. 6.6.5/1) Promote fast-maturing trees, establishment of commercial woodlots, peri-urban plantations (Sec. 6.3.1/6)	• Will make people more responsible. Renewal of license with evidence of having planted trees of specified amount to have fees waived. • Assume 30 per cent cleared woodland is sustainably replanted by charcoal dealers using appropriate tree species by 2030.

Legalizing charcoal is expected to lead to capacity building of human resources, institutions, and technologies including agroforestry and other sustainable fuelwood production techniques, improved charcoal kiln design and maintenance as well as business skills.

Various models of achieving these have been studied.[69] Furthermore, trade in charcoal needs regulation and appropriate standards in place. Charcoal will be traded as any other commodity on the market and its production and retail taxed to give revenue to the Government. Regulation requires the use of specific vegetation types and approved kilns in select locations. The producers and marketers will be required to have permits that compel them to plant a minimum number of trees for each felled. They will also need to verify the survival of such trees as a precondition for license renewal.

[69] ESDA, 2005; Kituyi E, 2004.

Improving stove efficiency calls for sustained research and development efforts, which in turn, requires collaboration by artisans and R&D institutions. Currently, improved charcoal and woodstoves boast efficiencies of 30-35 per cent.[70] Acceleration of adoption of these stoves will be achieved if the public is presented with higher quality stoves that last longer and are affordable. This will need quality standards and financing schemes, aspects that have not been clearly recognized by the Energy Policy. There is also need for training of artisans in the production of these devices. Achieving 100 per cent adoption in urban areas may be possible if these key barriers are eliminated. In the rural areas, things remain difficult owing to the high levels of poverty. However, innovative financing and integration of social-cultural considerations in the design of stoves may see 10 per cent adoption rate in the rural areas.

Many parts of the country hold considerable potential for development of small scale hydroelectric power projects.[71] The full commercially exploitable hydropower potential in Kenya is estimated at 2300 MW, while the potential of small, mini, micro and pico-hydro schemes is estimated at 3000 MW.[72] Achieving the target of connecting 30 per cent of rural households to off-grid and rural electrification schemes is possible so long as other parameters such as financing for technology access are made available. By 2003, Kenya boasted of 150,000 solar home systems made from photovoltaic units, operational in rural and peri-urban locations and contributing 1.3 MW of power.[73] Although prices for most renewable energy technologies continued to fall over the last decade, they have not been competitive enough to motivate changes. Efforts such as tax waivers and tariff adjustments will go a long way in making clean energy affordable.

Accelerating access to LPG and kerosene is easily achievable with Kenya's ready market, which continues to grow even in the absence of government support. In 1995, the market demanded 50,000 cylinders, which grew to more than 700,000 cylinders by 2002. Nevertheless, promoting kerosene and LPG is a short to medium term measure that should be phased out to be replaced by renewables.

Integration of environmental costs of fuelwood production in charcoal licensing schemes encourages producers and traders to be more responsible. Through legal associations of charcoal producers, it will be easier to monitor the trade, tree species used and types of kilns, etc. The groups encourage their members to perform sustained tree planting, and lower or waived license renewal fees. Apart from programmes by charcoal producers and traders, other organized tree planting/reforestation programmes exist and can be emulated. However, much of their success hinges on sustained capacity building of modern tree production technologies in rural communities, an aspect not stressed by the Energy Policy. The full range of environmental gains is summarized in Table 14.

[70] Government of Kenya, 2004.
[71] ESDA. 2003.
[72] Multimba SN (2002). Sustainable energy in Kenya series: Overview of available energy sources and current policies. May, Energy Alternatives, AFRICA.
[73] Ministry of Energy (2001). Study on Solar Photvoltaic (PV) quality and service specifications and market preparation.

Table 14: Environmental impacts of implementing Energy Policy (household sector)

	Emissions avoided (Gg/yr)					Resources conserved	
	CO_2	CH_4	N_2O	PM	CO	Woodland (ha)	Wood (mill. tonnes)
Legalizing charcoal	9010	218	1.0	122	1261	40000	5.3
Improved efficiency/adoption	13458	300	1.0	167	1772	12000	1.2
Access to electricity	224	0	0	0	5		
Integrating costs						24000	1.6
Gains	22692	518	2	288	3038	76000	8.1
Gains as percentage	37%	122%	13%	118%	60%	95%	40.7%

In 2030 alone, Kenya will conserve about 76,000 ha of woodland that would have otherwise been converted to charcoal. This is a 95 per cent reduction from the *Business As Usual* scenario. Fuelwood savings of about 8.1 million tonnes will be realized in 2030 alone, or about 41 per cent of the demand for charcoal and firewood that year. There is a general reduction in emissions of all key gases investigated, the most notable being CH_4 and PM where 100 per cent emission reductions are realized. A marked improvement in indoor air quality leads to reduced risk of respiratory diseases. Similarly, the risk of plant and animal exposure due to toxic levels of tropospheric ozone in high altitude areas is reduced owing to significant reduction in precursor concentrations (CO and CH_4, and consequently NO_x). The global warming effect is similarly reduced, mainly due to CH_4 reduction from the adoption of improved charcoal kilns.

The most important policy action is that of simultaneously legalizing charcoal production and transportation and regulating the trade through stringent licensing conditions that integrate environmental costs of fuel wood harvesting. This increases more efficiency kilns and tree planting in select areas. While meeting the fuelwood demand of 0.8 million tonnes of charcoal and 11.8 million tonnes of firewood, 64,000 ha of woodlands with 6.9 million tonnes of woody biomass will be conserved. It is an option the government is strongly advised to pursue.

4.5 Win-Win scenario

Table 15 shows the additional policy proposals relevant to this scenario to address the gaps identified in the Energy Policy.

Table 15: Scenario proposals for the Energy Policy

Intended policy goal	Additional provisions
Remove barriers to the adoption of efficient wood fuel stoves and charcoal kilns, and cleaner energy options including RETs, LPG and kerosene.	• Develop and enforce standards for RETs, including biomass stoves and kilns. • Promote access to micro-finance facility or other innovative financing mechanisms for the rural and urban poor.
Develop comprehensive energy policy and legislation for Kenya with sufficient recognition for biomass sector.	• Regular briefings for policymakers on the role of biomass energy in rural development. • Develop and review a comprehensive national energy legislation. • Streamline land tenure legislation to promote increased ownership of land.
Promote sustainable wood production.	• Strengthen capacity for Agroforestry and farm woodlot development among rural communities.

Implementing additional proposals will not necessarily lead to additional environmental gains but will serve to accelerate the implementation of the main policy provisions. It is arbitrarily assumed that effective and efficient implementation of these proposals will lead to a further 30 per cent increase in LPG consumption, a 20 per cent reduction in kerosene use and a 30 per cent reduction in charcoal production and firewood use. Poor quality cookstoves from unscrupulous dealers have been a major reason for their rejection by the market over the past decade. Setting standards for stoves and kilns and requiring producers to demonstrate observance through a certification or labelling scheme is imperative. Standards for sustainable charcoal production also cover the use of certain tree species, tree harvesting methods, harvesting areas, approved kilns in specified locations, and replanting for charcoal production.[74] The proposed Biomass Energy Development Agency (BEDA)[75] could oversee the regulatory function.

The role of micro-credit schemes in increasing access to energy technologies cannot be overstated. Successful cases in Kenya include the Global Environmental Facility- Small Grant Programme (GEF-SGP) implemented by RETAP, a local NGO. The seed funding of US$50,000 from GEF to enable 200 schools purchase to improve their stoves grew to 565 schools after four years due to a revolving fund scheme worth US$98,000 created by this seed money.[76] Numerous other innovative funding mechanisms exist among communities and organizations, which could be repackaged to suit different programmes.

To eliminate ambiguities in mandates of government departments and Ministries in handling energy issues, as well as legislate for biomass energy, it is critical to have policymakers who are aware. Current policy and legislation are skewed towards electricity and petroleum, despite the fact that over 80 per cent of the population in Kenya rely on biomass energy for their daily cooking needs. Given the urgency needed to bring about sustainability in production and consumption of charcoal, policy provisions to raise awareness for parliamentarians is necessary.[77] Informed politicians will not only be equipped to enact legislation but also lobby for sufficient budgetary allocations for the purpose of biomass energy development.

[74] ESDA, 2005.
[75] Ibid.
[76] RETAP Eco-Schools Project Report.
[77] Key conclusion of the Parliamentary Forum on Energy Legislation and Sustainable Development, 5–7 October 2005, Cape Town, South Africa.

There is also the need to build capacity among communities in technologies for farm forestry development. These include blending indigenous farm forestry techniques with modern agroforestry approaches in the promotion of select tree species and in specific locations to increase biomass production. Institutions such as World Agroforestry Centre (ICRAF) and local NGOs and CBOs can facilitate this. Almost all mention of biomass supply is found today in the country's sustainable development discusssions. Given the level of environmental gain expected from replanting denuded areas, it is critical that policy provisions on capacity development are included.

Land tenure is ignored in the Energy Policy. A clear provision on property rights is needed to ensure motivated communities that actively participate in tree planting on their farms and avoid conflicts over natural resources.[78] Over 80 per cent of fuelwood today comes from private farmlands with diminishing access to most indigenous gazetted forests and fencing off of newly acquired private lands.

4.6 The special case of fuelwood and charcoal use

Biomass energy (mainly firewood and charcoal) meets 70 per cent of total primary energy needs in Kenya, four-fifths of which is consumed by households. Most people in rural areas as well as the poor in urban areas use firewood and charcoal as a source of energy. This observation has implications for poverty reduction. For the short and medium term, most of the effort should target sustainable production and consumption of wood fuels. The indicators assessed are consumption levels, proportion of population with access to wood fuel, employment created, incomes earned, and health impacts of indoor air pollution.

Consumption of fuelwood

Fuel wood is the key source of energy in the rural areas providing over 89 per cent of household energy. The quantity of fuelwood considered adequate varies from place to place and depends on household consumption characteristics, which are further determined by availability of fuel wood, the types of stoves used and the climate conditions. In western Kenya 0.77 tonnes of fuelwood are expended per capita per year (Mugo, 1989). The figure is 0.74 tonnes for central Kenya (Christiansson *et al.,* 1981). The range would be between 0.35-0.8 tonnes a year.

In 2000, Kenya's overall per capita wood energy consumption was estimated at 627 kg for rural households and 877 kg for urban households (Government of Kenya, 2002). Unrestrained consumption of fuelwood has been estimated at 1,015 kg/yr and 709 kg/yr for the tea zone and coffee zones of Kirinyaga District respectively. The figure for the maize zone of Vihiga was 821 kg/yr. These estimates were made from household cooking experiments carried out during the dry season suggesting that they could have been underestimated as heating needs were not reflected. The average from the above estimates is 848 kg/yr, which can be rounded to 1,000 kg/yr with the inclusion of house heating. For the purpose of this analysis, 1,000 kg is assumed as the unrestrained level of wood fuel consumption for a single person using a traditional stove.

The time taken to gather fuelwood is an important factor in the welfare of rural households. As scarcity and inadequate access to firewood increase, the time spent in gathering fuelwood tends to increase. This reduces the time available for other activities. For example, in Kenya, the time needed to gather fuelwood was reported as 196 hours and 133 hours yearly for the tea and coffee zones of Kirinyaga District. For the maize zone of Vihiga District, the estimate was 140 hours (Mugo, 1999) and the maize zone of Bungoma, 36 hours if the wood is harvested from the farm (Mugo, 1997). However, if the wood is collected from the forest (as in Kirinyaga) and bush (Bungoma), the time required is 1200 hours and 130 hours per year, respectively. The cost of fuelwood compared to other household expenditures can give an indication of scarcity level.

[78] Kituyi, E., 2002.

In order to project fuelwood consumption under the three policy scenarios, the following assumptions are made:

- The proportion of people living in urban areas is assumed to be 35 per cent, as per the 1999 population census. Although the trend is towards rural-urban migration, it may be mitigated if the proposed supply of power to the rural areas takes place.

- The 627 kg consumption per year per person in the rural areas (Kamfor, 2002) is within the critical range. It is therefore not expected to fall and even if it does, good quality biomass fuels like crop residues will fill the gap.

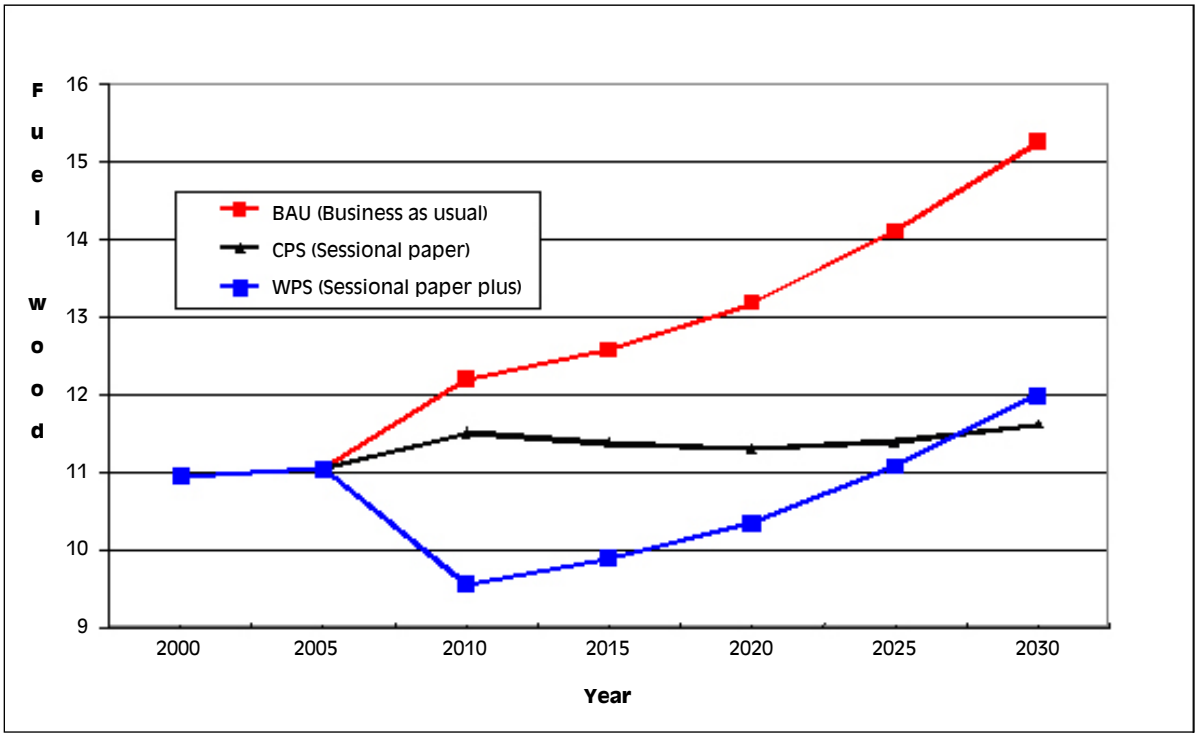
- The traditional stoves are estimated to have 10-15 per cent efficiency compared to 25-30 per cent for improved ones (Njoroge, 1994). For the purpose of this analysis, every household that adopts an improved stove reduces its fuelwood consumption by 50 per cent. In addition, those that adopt second generation improved stoves with 45-50 per cent efficiency (to be developed after 2020) will also reduce consumption by another 50 per cent.

- Conservation and fuel management knowledge are assumed to contribute to fuel reduction of 10 per cent while fireless cookers reduce consumption by an average of 40 per cent (Mugo and Poulstrup, 2003).

Under the *Business As Usual* scenario, Kenya's rural per capita fuel wood consumption of 627 kg/year is already at the critical level, suggesting that it is unlikely to fall further. If there is no policy intervention (see Figure 12), household fuel wood consumption in total will increase by 38 per cent from 11.06 million tonnes in 2005 to 15.25 million tonnes in 2030. The extra 4.2 million tonnes of wood demanded will be obtained from standing stock leading to woodland degradation[79] and deforestation[80]. At an estimate of 50 tonnes/ha, this may be equivalent to 84,000 hectares of plantation forest, or even more of natural closed or open woodlands, being affected.

[79] Degradation refers to a reduction in the tree and shrub coverage of woodlands.
[80] Deforestation refers to complete clearance of woodlands.

Figure 12: Projected fuel wood consumption for three scenarios, 2000-2030



As Figure 12 shows, under the *Implementation* scenario, fuel wood consumption will increase but at a lower rate than *Business As Usual*, due to the increasing adoption of improved fuel wood stoves. Despite the increasing population, consumption will decrease slowly and stabilize due to efficient utilization. Consumption will increase by 5 per cent from 11.06 million tonnes in 2005, and up to 11.62 million tonnes in 2030. If the supply increases by more than 5 per cent, there will be no deficit in supply.

Under this scenario, fuel wood stove manufacturers are expected to produce about 372,600 improved stoves in 2010, which will increase to 2,879,600 stoves by 2030. They will get an income of Ksh 168 million and Ksh 1,296 million in 2010 and 2030, respectively (see Annex 3).

Under the *Win-Win* scenario, with additional technologies on the market taken on board, there will be a large drop in consumption of fuelwood, which will then increase steadily with the increasing population. Consumption will increase by 8 per cent from 11.06 million tonnes in 2005 to 11.99 million tonnes in 2030.

Under this scenario, manufacturers of fireless cookers (see Annex 3) are expected to manufacture about 400,000 fireless cookers in 2010. This will increase to 3,025,000 cookers by 2030. The cookers will generate Ksh 280 million in 2010 and Ksh 2,118 million in 2030, creating 46,667 and 352,917 jobs in 2010 and 2030, respectively.

Although the Policy proposes to increase planting of trees and energy crops, it has not stated the desired amount. This makes measurement of sustainability progress difficult. It, however, claims that success is found in even a 1 per cent change.

Access to fuelwood is a critical social indicator. With a sustainable wood fuel supply, the wood fuel deficit in year 2000 was estimated at 16.4 million tonnes and is expected to increase to 29 million tonnes by 2020.

The *Business As Usual* scenario will see a deficit of 46.5 metric tonnes in 2030. Using the adequate wood fuel requirement of 1,000 kg per person per year, the proportion of the population with no access to wood fuel would have been 61 per cent in 2004 and will be 76 per cent in 2030. Under *Implementation* and *Win-Win* scenarios however, the proportion of woodless population will decrease to 35 per cent and 17 per cent respectively. This suggests that the latter two policies are socially more favourable.

Consumption of charcoal

The second type of biomass that is consumed in large quantities in urban areas is charcoal. In 2000, the annual consumption of charcoal was estimated at 2.4 million tonnes valued at Ksh 36 billion (Government of Kenya, 2002). The most recent national charcoal survey estimated a lower figure of 1.6 million tonnes valued at Ksh 32 billion (ESDA, 2005). The current Energy Policy has a number of provisions on charcoal such as:

- Increasing the rate of adoption of efficient charcoal stoves from 47 per cent now to 80 per cent by 2010 and 100 per cent in 2020 in urban areas. This translates to an adoption rate of 2 per cent per year or 10 per cent every 5 years. The improved charcoal stove is estimated to reduce consumption of charcoal by 50 per cent.

- Increasing the rate of adoption of efficient charcoal stoves to 40 per cent by 2010 and 60 per cent by 2020 in rural areas.

- Increasing efficiency of the improved charcoal stove from the current 30-35 per cent to 45-50 per cent by 2020. The new stove will also reduce charcoal consumption by another 50 per cent for each user.

- Promoting fuel substitution. It is projected that petroleum fuel consumption will increase by 2 per cent a year, due to growing numbers of consumers. For the purpose of this analysis, it is assumed that 2 per cent of consumers substitute gas and kerosene for charcoal use a year in both urban and rural areas.

Under the *Implementation* scenario, it is assumed that the households currently using charcoal for cooking are not likely to switch to electricity unless the latter is cheaper and electrical cooking devices are more widely available. Since both conditions are unlikely before 2030, electricity is not considered a viable substitute for charcoal in this analysis.

By 2020, a new stove shall be on the market with an efficiency of 45 per cent, increasing current stove efficiencies by half. Since the currently available urban charcoal stove has taken 20 years to reach 47 per cent adoption, it is a good estimate that adoption of the new stove (introduced in 2020) will reach around 25 per cent of the population by 2030.

Under the *Implementation* scenario, charcoal stove manufacturers are expected to produce about 2,268,000 improved charcoal stoves by 2010, which will increase to 4,893,000 stoves by 2030. They will get an income of Ksh 453.6 million and Ksh 978.6 million in 2010 and 2030 respectively (see Annex 3).

Under the *Win-Win* scenario, however, the following conditions are assumed:

- All the provisions in the Energy Policy are implemented.

- Adoption of other energy conservation measures (including energy management information) and technologies, such as fireless cookers at the rate of 2 per cent per year (10 per cent penetration rate by 2010, 30 percent by 2020 and 50 per cent by 2030). This increase energy conservation by 50 per cent.

- Make the use of improved charcoal kilns compulsory in all charcoal producing areas with adoption rates of 10 per cent by 2010, 40 per cent by 2020 and 100 per cent by 2030.

Table 16 shows the projection of charcoal consumption to 2030 under the three scenarios.

Table 16: Charcoal consumption and projections to 2030

Year	2004	2010	2020	2030	% change
Rural charcoal consumption					
Projected rural population (millions)	23.83	26.97	33.17	40.80	
Rural population using charcoal (34%, millions)	8.10	9.17	11.28	13.87	
Business As Usual charcoal consumption (billion tonnes, per capita 143 kg)	1.16	1.31	1.61	1.98	
Implementation charcoal consumption (billion tonnes)	1.16	1.05	1.13	0.99	
- with fuel substitution	1.16	1.03	1.106	0.97	
Win-Win charcoal consumption (billion tonnes)	1.16	0.93	0.77	0.485	
Urban charcoal consumption					
Projected urban population (millions)	8.16	9.30	11.4	14.00	
Urban population using charcoal (87%, millions)	7.1	8.1	9.92	12.18	
Business As Usual charcoal consumption (billion tonnes, per capita 153 kg)	1.09	1.24	1.52	1.86	
Implementation charcoal consumption (billion tonnes)	1.09	0.74	0.76	0.93	
- with fuel substitution	1.09	0.73	0.74	0.91	
Win-Win charcoal consumption (billion tonnes)	1.09	0.66	0.52	0.455	
Total charcoal consumption (rural and urban, billion tonnes)					
Business as Usual	2.25			3.84	+71
Implementation	2.25			1.92	-15
- with fuel substitution	2.25			1.88	-37
Win-Win					

Under the *Win-Win* scenario, manufacturers of fireless cookers (see Annex 3) are expected to manufacture about 352,000 fireless cookers in 2010. This will increase to 2,676,000 cookers by 2030. The cookers will generate Ksh 284.1 million in 2010 and Ksh 2.143 billion in 2030, creating 16,182 and 121,800 jobs in both years respectively.

The use of biomass fuels has adverse effects on health. The smoke produced as a result, when not vented out of the cooking space, causes the most adverse effects from biomass combustion. The emissions contain suspended particulate matter, polycyclic organic matter which includes a number of carcinogens, especially benzo-a-pyrene, and gaseous pollutants such as carbon monoxide and formaldehyde. The effects on health can range from chronic obstructive pulmonary disease to nasopharyngeal cancer. When infants and children are exposed, acute bronchitis and pneumonia occur because their respiratory defences are impaired. This will cause many deaths among infants and children. If the emissions contain high concentrations of carcinogens, nasopharyngeal cancer is common among young adults who have been exposed to the emissions since infancy. In addition, besides its effects on the heart and nervous system, carbon monoxide exposure by pregnant women can result in birth defects. In countries like India where people are exposed to this type of pollution, chronic obstructive pulmonary disease is the most frequent result.

In a study conducted (ITDG, 2001), measurement of particulates level after installing smoke hoods in Kajiado and Western Kenya showed an average reduction of 76 per cent for Kajiado (82 per cent and 70 per cent for 2.5 feet and 4 feet height hoods, respectively). Other interventions like installations of windows, eaves and improved (Upesi) stoves in kitchens did not help. For this analysis, the change in particulate emissions is assumed to be proportionate to changes in respiratory disease incidence. Fireless cookers were not included in this particular experiment but they are known to reduce the time exposed to smoke or the cooking environment by half.

The percentage of people with respiratory diseases attributed to indoor air pollution is another important social indicator. Under the *Business As Usual* scenario, there are no interventions to reduce health risks. In the *Implementation* scenario, there are no specific energy-related intervention for health improvement. In the *Win-Win* scenario, it is assumed that both smoke hoods and fireless cookers are adopted by rural households at an average rate of 2 per cent per year. Community health records show that 25 per cent of cases of respiratory diseases (e.g. chest illness, coughs, phlegm and wheezing), could be associated with indoor air pollution (ITDG, 2001). People affected by these diseases will increase from 5.3 million in 2004 to 9.08 million by 2030 for *Business As Usual*; increase to 7.262 million for *Implementation*; and decrease to 1.09 million for *Win-Win* in the rural population. As for the urban population, the cases will rise/fall from 122,400 people in 2004, to 210,000, 168,000 and 25,200 by 2030 in the three scenarios respectively (see Table 17). This implies an increase of between 37 per cent to 71 per cent for the first two scenarios and a fall by 80 per cent for *Win-Win* scenario by 2030.

Table 17: Projected fuelwood use and health impacts to 2030

	2004	2030	% change
Projected national population (millions)	31.99	54.81	
Rural population (millions)	23.83	40.80	
Numbers using fuelwood (89%)	21.21	36.31	
Business as Usual – Numbers of respiratory diseases (25%)	5.30	9.08	
Implementation (20%)	5.30	7.262	
Win-Win (with smoke hoods and fireless cookers)	5.30	1.0893	
Urban population (millions)	8.16	14	
Numbers using fuelwood (6%)	0.49	0.84	
Business as Usual – Numbers of respiratory diseases (25%)	0.1224	0.21	
Implementation (20%)	0.1224	0.168	
Win-Win (with smoke hoods and fireless cookers)	0.1224	0.0252	
Total (rural plus urban)			
Business As Usual	5.4224	9.2900	+71
Implementation	5.4224	7.4300	+37
Win-Win	5.4224	1.1145	-80

The differences between *Business As Usual* and *Implementation* scenarios are slight because there is no direct health safety provision in the current policy. Although increased access to modern energy services will automatically lead to a decline in indoor air pollution and a fall in energy related respiratory diseases, this is not expected to be dramatic.

Access to modern forms of energy are incidentally a very good social indicator. About 15 per cent of the population in Kenya have access to electricity, or 46 per cent in urban areas and 3.8 per cent in rural areas. A goal of KPLC is to have an additional 150,000 connections per year to domestic consumers. It is therefore expected that 10 per cent, 20 per cent and 40 per cent of the people in the rural areas will have access to electricity by 2007, 2015 and 2025, respectively. Under the *Win-Win* scenario, this percentage is likely to rise even further. Table 18 presents the possible impacts from more electricity connections in rural and urban areas.

Table 18: Possible impacts from more electricity connections

Electricity for	Impacts
Lighting	Positive on education due to better light for studying Positive on health since no polluting emissions from kerosene lamps
Radio	Positive because of reduced expenditure on dry cells Positive because of increased exposure to information
TV	Positive because of increased communication Negative because of likely erosion of cultural values and morals Negative because of more time spend watching TV instead of doing productive work
Service industry like tailoring, hairdressing	Positive because of increased jobs
Manufacturing - carpentry, welding, agro-processing	Positive on job creation leading to increased employment in rural areas, reduced rural-urban migration and reduced urban crime
Powering equipment like computers	Positive on increased use of technologies like computers leading to increased knowledge hence development

Access to LPG gas meanwhile is 7.8 per cent nationally. This translates to 23 per cent for urban areas and 1.8 per cent for rural areas. This percentage is expected to rise in the *Implementation* and *Win-Win* scenarios. Sustained use of LPG for cooking will depend more on rising incomes than interventions.

4.7 Summary and conclusions

The implementation of the provisions relevant to household energy will lead to significant environmental gains (see Table 19) including mitigation of climate change, lower altitude ozone toxicity, and low incidences of acute respiratory infections. It will also potentially lead to significant resource conservation (land, fuelwood and income).

Table 19: Summary of environmental gains

	Resources conserved		Emissions avoided (Gg/yr)				
	Woodlands (ha)	Wood (mill. t)	CO_2	CH_4	N_2O	PM	CO
BAU	Nil	Nil	256,143.8	423.5	12.8	245.4	5,039.1
Implementation	76,000	8.1	314,319.2	424.4	15.6	255.0	5,316.4
Win-win	100,000	14	354,386.0	299.2	17.5	200.7	4,371.2

In the case of fuelwood, for the *Business As Usual* scenario, household fuelwood consumption will increase by 38 per cent from 11.06 million tonnes in 2005 to 15.25 million tonnes in 2020. For *Implementation* and *Win-Win* scenarios, consumption is expected to increase respectively to 11.62 million tonnes and 11.99 million tonnes by 2030.

Under *Implementation*, fuelwood stove manufacturers are expected to produce about 372,600 improved stoves in 2010, which will increase to 2,879,600 by 2030. They will get an income of Ksh 168 million and Ksh 1,296 million respectively in 2010 and 2030. For the *Win-Win* scenario, manufacturers of fireless cookers are expected to manufacture about 400,000 fireless cookers in 2010, increasing to 3,025,000 cookers by 2030. The cookers will generate Ksh 280 million in 2010 and Ksh 2,118 million in 2030, and create 46,667 and 352,917 jobs in 2010 and 2030 respectively. About 39 per cent of the fuelwood-using population had access to adequate supply of wood fuel in 2004 and the proportion will decrease to 24 per cent by 2030 for *Business as Usual*. The other two scenarios will see adequate fuelwood for 65 per cent and 83 per cent respectively.

Annual consumption of charcoal is expected to rise in the rural areas from 1.16 million tonnes in 2004 to 1.98 million tonnes in 2030 under the *Business As Usual* scenario but decrease to 0.99 million tonnes and 0.485 million tonnes under *Implementation* and *Win-Win* scenarios respectively. In urban areas, consumption of charcoal will rise from 1.09 million tonnes in 2004 to 1.86 million tonnes in 2030 under *Business As Usual* but decrease to 0.93 million tonnes and 0.455 million tonnes under Implementation and *Win-Win* respectively.

Under *Implementation*, charcoal stove manufacturers are expected to produce about 2,268,000 improved stoves in 2010, which will increase to 4,893,000 by 2030. They will get an income of Ksh 453.6 million and Ksh 978.6 million in 2010 and 2030, respectively. Under the *Win-Win* scenario, manufacturers of fireless cookers are expected to manufacture about 352,000 fireless cookers in 2010, increasing to 2,676,000 cookers by 2030. The cookers will generate Ksh 284.1 million in 2010 and Ksh 2,143 million in 2030, creating 16,182 and 121,800 jobs in 2010 and 2030 respectively.

Energy-related respiratory diseases will increase for the rural population from 5.3 million people in 2004 to 9.08 million people by 2030 for *Business As Usual*, and increase to 7.262 million for *Implementation*. However, a reduction to 1.09 million people in 2030 is expected for the *Win-Win* scenario. As for the urban population, the 2030 figures are 210,000, 168,000 and 25,200 respectively for the three scenarios, compared to 122,400 people in 2004.

5. Conclusions, lessons learned and recommendations

5.1 Conclusions

There are shortcomings in the way energy planning is done in the country. The gaps include a process that is generally not very systematic or well organized, inadequate stakeholder consultation, lack of continuity in representation, inadequate integration of social and environmental issues, inadequate or lack of integration with policies in related sectors, and weak data systems, among others.

The assessment confirmed the potential of provisions of the Energy Policy to protect human health, safeguard the environment and conserve resources. Effective implementation of these provisions under the modest assumptions made will lead, by 2030, to the reduction of 36.6 Tg/yr of CO_2, conservation of 76,000 ha of woodlands (mainly in marginal areas of Kenya), and conservation of 8.1 million tonnes of woody biomass, the equivalent of firewood or charcoal consumed yearly by 2030 under the *Business As Usual* scenario. An 86 per cent reduction in soil lead is also projected, as are significant reductions in CO, PM, CH_4 and N_2O.

The analysis also finds that global warming, desertification, corrosion and property damage effects that could be mitigated if an improved Energy Policy is put forward for implementation. The wide-ranging effects necessitate coordination by different government agencies and consideration of documents such as the UNFCCC.

Access to fuelwood, biomass consumption, incomes, job creation and health impacts had been identified as key social indicators. The analysis showed that the proportion of the population with access to adequate wood fuel will increase from 24 per cent under *Business As Usual* scenario to 65 per cent and 83 per cent under the *Implementation* and *Win-win* scenarios respectively. The pattern is the same for income generation and job creation. The assessment therefore showed that the current Energy Policy has enormous social benefits if implemented, provided that all the necessary institutions and structures are in place along with the required financial and human resources. In addition, adequate effort and funding are needed to generate regular and accurate data for improved policy formulation.

The transport subsector will yield more gains if energy efficiency and aspects of the traffic legislation as well as other laws are harmonized. On the other hand, the household subsector will better benefit if:

- Policy provisions on stove and kiln quality standards are incorporated.
- Micro-credit access for households and micro-entrepreneurs is improved.
- Biomass energy profile is raised on the national political agenda.
- Community capacity in farm forestry is created.
- Land tenure policy is adjusted to favour private land ownership.

The results of this assessment pointed to the need to restructure the existing energy policymaking process to a sustainability-sensitive one. Clear policy guidelines, complete with the main elements of a sustainability-driven policy, need to be developed and adopted for future policy development, not only for the energy sector but all economic sectors.

5.2 Lessons learned

A number of useful lessons are appreciable from the pilot IAP project in Kenya. These include:

- **Lack of capacity.** There is a lack of human and institutional capacity to handle environmental, social and economic problems in an integrated manner in Kenya. For instance, NEMA does not have an adequate number of environmental lawyers, auditors, technologists and engineers. NEMA is therefore unable to be represented at all stages of the planning process and in various Ministries such as planning, tourism, trade and finance. These capacity problems are linked to inadequate funding.

  Other institutions in the environment and energy sectors face similar problems. The ability to engage in effective policy analysis within the Ministries is constrained by poor conditions of service and high staff turnover. The increasing ability of independent research institutes to perform this work is not a perfect substitute, in part because the Ministries still require high calibre staff to interpret and utilize research generated by external organizations and also because it is important to retain a strong "institutional memory".

- **Data availability.** Empirical studies at the country level are needed to define and categorize current forms of government support and assess their environmental, social and economic impacts. This needs considerable data, which is not available in the form and adequacy needed. Lack of quality, timely and regular data/information usually leads to poor planning, monitoring and evaluation. In addition, environmental sustainability indicators need to be established. These are highly data intensive. There is therefore a need to overcome these shortfalls by increasing budgets, establishing links and capacity building.

  Along with data availability, there is an associated problem of data storage. Some of the national data centres have inadequate physical facilities and obsolete systems, and use incompatible data formats. Other issues include reliable and fast storage, duplication of effort in data collection and generation, and weak links between data institutions and users.

  There is also paucity of data on aggregate and sectoral energy needs. This has been aggravated by the use of energy planning models that not only rely on questionable data, but were also developed for countries with very different energy dynamics. Kenya has historically failed to undertake comprehensive energy planning. It is only in the past few years that energy has received the attention it deserves in national planning, but poor quality data is still being used. There is a need to authenticate the information and also the tools to be used.

- **Legal and regulatory framework.** Until the Environmental Management and Coordination Act (EMCA) was enacted in 1999, Kenya lacked a coordinated legal and regulatory framework for taking into account environmental issues in development planning. Even with EMCA, environmental issues were not considered from the beginning of the planning process. The draft Energy Bill, which makes provisions for integrated planning in energy, has not been enacted yet.

- **Institutional arrangements.** The institutional arrangements of MOPND and other Ministries are a major source of weakness. It was noted that there had been institutional alignments, as well as periodic mergers and separations for MOPND and MOF, usually on the basis of political considerations and other expediencies. This trend had reduced ability to conduct national policy development, management and implementation. Weak linkages between MOPND and the line Ministries, as well as with its field officers at the provincial and district level, constituted another source of weakness.

- **Weaknesses in the budgetary process.** Although improvements are being proposed and implemented in the budgetary process, the budget process is still dominated by MOF. Budgetary estimates are debated and finally approved without meaningful debate, in part due to the lack of technical skills. Ministries in Kenya even have the liberty to spend beyond the approved figures, and need only seek parliamentary approval retrospectively.

- **Problems of inter-ministerial coordination.** There is the problem of inter-ministerial coordination. The task of formulating and implementing an integrated policy may be more difficult since a number of Ministries and NEMA will be involved. The Ministries currently have their own policy agendas.

- **Personality driven processes.** A persistent weakness of the policy process has been the lack of institutionalization leading to the pursuit of self-interest.

- **Large players' vested interests.** There are some "large players" in both the public and private sector that have undue influence on the policy process, in part to control rent creation and extraction. The interests of small players and the vulnerable members of the society are inadequately considered.

- **Other issues.** IAP requires political will, broad and adequate understanding of the key sustainability issues and analytical tools appropriate for attaining this purpose. There is the "growth and poverty reduction first" argument, which is voiced in many line Ministries. There is a limited understanding and knowledge of the environment and how it relates to, for example, poverty, economics and economic policies, and health. Furthermore, many of the environmental, social and economic links and issues are complex, and the prevailing tools perceived to be difficult to grasp. Access to useful sustainability indicators is very poor. Consequently, IAP analysis and support for high-quality development planning is hampered.

Another issue of concern is awareness of environmental, economic and social issues. Public awareness of all important issues is needed to gain the support of a well-informed public for the planning process. Finally, IAP requires a longer time period for assessment using more rigorous analytical methods. As a result, decision making takes much longer as public participation and consultation become necessary. It is costly. Costs could possibly be reduced through the help of NGOs that represent the marginalized and the vulnerable groups, in part to build capacity for participation.

The process of policymaking can be improved through a number of measures. Some of these include raising the effectiveness of public participation, inter-ministerial coordination and multidisciplinary collaboration. The participation of affected communities, including the poor and the marginalized groups, is equally important. The private sector is also crucial, as it has a unique role in economic development and environmental degradation. There is also the need for transparency, accountability and easy access to information. Other measures include more frequent reviews, surveys, participatory appraisals, and the development of a comprehensive databank to facilitate regular assessments.

There is also the need to build coalitions. The formation of alliances between interest groups can greatly increase their influence in policy processes. However, in most cases change agents in Kenya have acted independently of each other. To effectively and specifically improve the participatory process of decision-making, planners and policy makers should also ensure that policy outcomes reflect the desires expressed by stakeholders. In that way, people will see the benefits of participation and will know that their views are being taken into account. The country may also require assistance with policy, legal and institutional reforms to establish the basic conditions. In addition, the following should be considered for successful implementation of IAP:

1. Need to raise awareness and popularity of the IAP process, by clearly explaining its benefits to unfamiliar stakeholders
2. Capacity development to aid assessment
3. Urgent need to demonstrate the benefits of IAP over conventional planning
4. Adequate resources to conduct rigorous assessment
5. Enactment of the draft Energy Bill 2004 to empower energy planning, promote investment in the energy sector, and conserve the environment
6. Need for legal backing for the planning process and public participation.

5.3 Recommendations

Given the implications of the assessment, there is a need to develop policy recommendations to address harmful economic, social and environmental impacts in addition to enhancing the positive effects. These recommendations may use market-based instruments such as subsidies as well as command and control policies, such as:

- **Targeted income subsidies.** With the rise in the price of energy, subsidies to the most affected such as the poor and SMEs may be considered. To be successful, there must be mechanisms to identify these groups. Also, policies geared to provide incentives for agro-forestry and village woodlots should be launched. Taxation can be reduced on goods commonly consumed by the poor and the SMEs. One important policy measure that the Kenya government has been pursuing is the elimination of value added tax on kerosene, cooking gas, maize flour and milk, all staples of the poor.

- **Differential taxation.** Such taxation involves exceptions or rebates, and can sometimes be used to encourage or discourage the production and use of certain fuels. In this case, there is the need to deepen the reforms associated with zero-rating of kerosene and cooking gas. However, it is clear that there are problems as there will be weak incentive for consumers to use energy efficiently and minimize environmental damage. One positive effect however is the likely reduction of deforestation as households consume more of these fuels instead of fuelwood. Even though zero-rating of LPG may not reduce the consumption of fuelwood especially in the rural areas, increased urban LPG use will relieve deforestation pressures and fuelwood scarcity in rural areas.

In order for the recommendations to be realized, the government is expected to pass the draft Energy Bill 2004 into law. This should be done before the end of 2006. There is in addition a need to establish an institution to ensure consistent implementation and setting of targets for wood energy policies. Donors can also be helpful by availing funds for stakeholder participation, data generation and capacity building. The research community should also assist by identifying and developing innovative and cost effective methods of assessment. This should be done as soon as possible. Private sector organizations such as the Kenya Association of Manufacturers (KAM) and NGOs can also spearhead energy conservation and efficiency education to reduce waste.

The immediate next step is the dissemination of the results of IAP through workshops, website, brochures and flyers. The project Steering Committee should also review the findings of the project and plan to implement those parts that do not need changes. Given that the Steering Committee was composed of permanent secretaries in major Government Ministries, recommendations that do not require bureaucratic or cumbersome procedures, or heavy investment of human and financial resources, should be implemented since they will not face much opposition.

To effectively improve the participatory process of decision making beyond rhetoric, planners and policymakers should ensure that policy outcomes reflect the desires expressed by stakeholders. In this way, the people will see the benefits of participation and know that their views are being taken into account. There are prevailing opportunities always emerging, which should be formalized and nurtured through legislation. These include increasing transparency and room for debate, increasing representation through parliamentary committees, improved budgetary process, donor coordination and support, increased capacity for policy analysis, creation of local ownership and commitment to policy and budgetary process, strengthening the voice of the hitherto marginalized groups, and emergence of various stakeholder groups.

An important strategy is the development of a civic culture and empowered citizenry that engage actively in social, economic and environmental issues. Therefore, interventions should empower vulnerable groups including women, the urban and rural poor, the disabled, pastoralists, etc. Furthermore, support is needed for civic education initiatives to build awareness of rights and responsibilities. There is a need to encourage the formation of local community groups with common policy interests. This may be one method of engaging more people in the policy formulation process.

In addition, the following should be formalized and nurtured:

- **Increasing transparency and room for debate.** There appears to be much more openness surrounding debates relating to many policy processes in the country.

- **Encouraging opinions and consensus.** Strengthening of the parliamentary system through parliamentary committees and caucuses is engaging parliamentarians on many policy issues.

- **Strengthening different voices.** The foundations are in place for strengthening different viewpoints across society. The need now is to build the capacity of existing organizations, strengthen their institutional arrangements and develop new institutions where required. Doing this effectively requires a clear identification of short and medium-term needs and well-defined and adequately resourced programmes.

- **Emergence of new viewpoints.** These include various stakeholder groups and umbrella organizations within civil society and the private sector.

- **Improved budgetary processes.** The development of the Medium Term Expenditure Framework (MTEF) and Public Expenditure Review (PER) framework for the government fiscal expenditure provides an opportunity for harmonization of the policy and budgetary processes and thus a more transparent and rational method of allocating resources. The MTEF is an outcome-based planning and budgeting process that seeks to establish an explicit link between policy planning and budgeting by encouraging communication between the different Ministries. The budget process will be strengthened if parliamentarians and advocacy organizations become better trained in analysing and discussing budgetary issues and claim a stake in formulating budget proposals.

- **Increased capacity for policy analysis**. The development of several independent or autonomous research institutes with apparent capacity to undertake policy-related research provides the opportunity for the generation of evidence-based research and more informed policy debates and decisions.

- **Donor coordination and support**. There are several ways in which the donor community, through cooperative efforts, can play a supportive role by providing finance and possibly suitable training. There are opportunities for donor coordination either through basket funding of groups of activities or allocating specific areas of support to various donors to avoid duplication of efforts.

- **Creating local ownership**. Policy and budgetary processes should be more development oriented to meet the needs of the society. Reorientation, communication and training involving a wide range of stakeholders working in partnership needs to continue on a long-term basis. Equally, briefing and training programmes, demonstrating to the executive, bureaucrats and a wider range of stakeholders the importance of budgetary discipline, are likely to achieve much.

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Annex 1. Integrated assessment of the Energy Policy with other sectors

Table A1: Integration of Energy Policy with policies of related sectors

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
Forestry (Sessional Paper No. 9 of 2005 on Forest Policy)	Supplies energy, consumes energy and sequestrates carbon	Takes cognisance of energy policy	- Promotion of dry land forestry for supply of wood fuel - Sustainable commercial production of charcoal - Promotion of efficient wood energy technologies and use of alternative forms of energy - Regulation of production and marketing of charcoal	- Promotion of farm forestry and forestry extension - Soil and water conservation	Acknowledges that forests provide 45 per cent of biomass energy	- Promotion of fast maturing trees for energy production - Promotion of commercial woodlots and peri-urban plantations - Promotion of tree planting	- Considerable integration between energy and forestry policies - More integration needed so that pursuits of energy objectives do not lead to deforestation - Need for incentives and private sector in general to invest in energy production
Water (Sessional Paper No. 1 of 1999 on National Policy on Water Resources Management and Development)	Supplies energy, consumes energy, and absorbs wastes from energy systems	Takes cognisance of needs of energy sector	- Provision of water for generation of electricity	- Protection of water catchment areas - Preservation and conservation of water resources	- Little recognition of needs of the water sector energy	- Support of water lifting and pumping using renewable energy technologies	- Little integration between energy and water policies - Considerable integration is required in payment for environmental services (KenGen to pay for management of water resources)

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
Industry (Sessional Paper No. 2 of 1996 on Industrial Transformation to the Year 2020)	Consumes energy	Recognizes energy as very crucial to industrialization	- Provides for exploration of fossil fuel minerals - Establishment of statutory power authority - Reorganization of generation, transmission and distribution of power - Promotion of new and renewable sources of energy - Legislation for private sector participation and limited monopoly of KPLC	- Allocation of resources to technology development and management	- Acknowledges the needs of the industrial sector	- Provision of technical assistance, demonstration projects, management training programmes and fiscal incentives for industry to conserve energy	- Moderate integration between energy and industrial policy - Provisions need to go beyond energy efficiency and conservation - Need for provisions on reducing the cost of power
Environment (Sessional Paper No. 6 of 1999 on Environment and Development)	Absorbs wastes from energy systems. Source of renewable forms of energy such as solar and wind	- Recognizes energy as an essential input in the economy - Recognizes also that energy is a contributor to environmental degradation	- Provides for development of energy policy and legislation - EIA for all energy projects - Adoption of energy efficient technologies - Incentives for energy conservation and private sector investments - Encourage research in energy conservation and end use technologies	- Water catchment protection - Soil and water conservation	- Recognizes the need to protect and conserve the environment	- Ensure environmental rehabilitation on completion of energy projects - Ensure fossil fuel fired plants meet environmental standards - Environmental health and safety policy framework established by ERB	- Considerable integration between energy and environmental policy - More integration needed so that pursuit of energy objectives does not lead to environmental degradation

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
Agriculture (Strategy for Revitalising Agriculture 2004-2014)	Consumes energy, supplies energy	No direct mention of energy as an objective or constraint	No provisions are made	Soil and water conservation as per Cap 318	Recognizes energy needs of agriculture	No provisions are made	- No integration between energy and agricultural policies - Energy needs for agriculture should be factored in as the sector is critical for economic development - Need to promote joint production of agriculture and energy (biomass fuels)
Small and Micro Enterprises – SMEs (Sessional Paper No. 2 of 2005 on Development of Micro and Small Enterprises for Wealth and Employment Creation	Consumes energy	No attention to the role of energy	No provisions made	None	Recognizes jua kali sector	Provides for training of jua kali artisans for manufacture, installation and maintenance of renewable technologies such as cooking stoves	- Integration between energy and SMEs policies - No provision for energy requirements of SMEs yet they are the main source of job creation - Energy policy needs to state how SMEs will be provided with cheap power
Transportation (Integrated National Transport Policy, Moving a Working Nation,	Consumes energy	Does not take cognisance of energy policy	No provisions are made	- Indirectly through the promotion of use of high quality and environmentally	- Recognizes energy needs of transport sector	- No provisions are made except those relating to energy efficiency and conservation - Provisions for	- Integration between energy and transportation policies is inadequate - Considerable integration is

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
Ministry of Transport and Communication)				friendly fuels - For rail transport, energy needs will be considered, but no provisions		developing and enforcing fuel standards - Enforcing speed limits	needed especially on investments on a transport system that reduces fuel consumption and uses electricity and natural gas.
Health (The National Health Sector Strategic Plan: 1999-2004)	Consumes energy	Does not take cognisance of the role of energy	No provisions are made	None	- Recognises needs of heath but only with respect to energy conservation and health concerns	- Increase the rate of adoption of efficient fuel wood stoves - Increase the efficiency of the of the improved charcoal stoves	- Inadequate integration between the energy and health polices -Integration is therefore needed. This includes investments in energy forms that have less health hazards. Investments in health should also incorporate investments in energy systems
Wildlife	Consumes energy	Does not take cognisance of energy policy	No provisions are made	Power plants located in national parks and game reserves	Does not recognize needs of wildlife	No provisions made	- Hardly any integration between energy and wildlife policies - Provisions for energy supply to animal sanctuaries required - Investments in wildlife sector to incorporate investments in energy systems

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
Fisheries (draft policy)	Consumes energy	- Recognizes the role of cold storage infrastructure in fisheries sector - Also recognizes the contribution of wood fuel in fish processing	- Cold storage infrastructure establishment	None	Little recognition of fisheries needs	No provisions made	- There is a draft fishery policy - Integration is therefore required. Energy Policy to make provisions for energy supply to fish landing places.
Tourism (draft policy)	Consumes energy	Does not recognize the energy sector	No provisions are made	- Indirectly through the general conservation of environmental resources	Tourism not acknowledged in the policy	However, the general increase of electricity supply is expected to benefit the tourism sector substantially	- No integration between the two policies - Provisions needed in both sector policies - Need for lower cost of power to attract investment in the tourism
Trade (Scattered in several documents, development plans and ERS)	Supplies and consumes energy	Does not take cognisance of energy policy	No provisions are made	- Domestic industry protection (Oil Refinery) - Trade liberalization	- Recognizes the importance of trade in the provision of energy	-Provisions for extending oil pipeline to neighbouring countries; strategic reserves; incentives to attract investments in new refinery; intention to tap power from the southern Africa power pool; development of standards and codes	- There is some integration, though largely emanating from the Energy Policy - Crucial for the Ministry of Trade and Industry to develop a sessional paper on trade policy that is comprehensive

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
						of practice; allowing duty free importation of renewable energy hardware; construction of LPG import handling; storage and distribution facilities; re-introduction of power alcohol as a motor fuel; removal of non-tariff barriers to market entry on crude processing; minimisation of international energy trade barriers; and energy sector cooperation frameworks and protocols.	

Policy/sector	Generic relationship to energy	Whether policy considers the energy sector	Specific provisions on energy	Provisions that have indirect effects on energy	What Energy Policy says about the sector	Provisions of Energy Policy about the sector	Remarks and Recommendations
Poverty reduction strategy (Poverty Reduction Strategy Paper for the Period 2001-2004)	Energy is a critical determinant of poverty	Recognizes the role of energy in poverty alleviation	Strengthening and expanding the Rural Electrification Programme; increasing private sector participation; tapping from southern Africa power pool; implementation of planned generating plants; explore use of alternative sources of energy	Expansion of forestry plantations; improving legal and regulatory framework of forests; improving natural forest conservation to conserve water catchments; supply of water	- Recognizes poverty alleviation	- Promotion of renewable energy systems such as solar photovoltaics - Dissemination of energy efficiency and conservation information to consumers - Promotion of agro-forestry - Licensing of charcoal traders	- There is considerable integration between PRSP and the energy policy. It is noted that meeting the objective of Energy Policy goes along way into poverty alleviation. The vice-versa is also true. - Need for provisions to reduce the cost of modern forms of energy especially to the poor

Annex 2 Project members and stakeholder contact details

Table A2: List of project members

Name	Organization	Position	Contact details
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Table A3: Members of the original taskforce group

Name	Discipline	Organization
Don Riaro	Geologist	Ministry of Energy
Kirimi	Economist	Ministry of Energy
Ng'anga' Munyu	Science	Ministry of Energy
Wangari Githii	Journalist	Public relations, Ministry of Energy
Paul Ngatia		Petroleum Institute of East Africa
Julius Riungu	Engineer	Advisor, World Bank
Jane Akumu		Petroleum Institute of East Africa
Rodney Sultani	Economist	Advisor, World Bank
Dr. Frederick Nyang	Economist	Power Economist, ERB
Patrick Nyoike	Consultant	World Bank
Mary Mukindia	Commerce	National Oil Corporation of Kenya
Daniel Theuri	Environmentalist	Ministry of Energy

Table A4: Members of the second taskforce group

Name	Discipline	Organization
Mrs Benedict Nzioki		Ministry of Energy
Henry Ogoye	Economist	KENGEN
Amoko	Economist	Ministry of Planning & National Development
Albert Mugo	Engineer	KPLC
David Mwangi	Engineer	KPLC
Wangari Githii	Journalist/Public Relations Officer	Public Relations, Ministry of Energy
Dr. Frederick Nyang	Economist	Power Economist, ERB

Table A5: Consultants hired by UNDP

Name	Discipline	Organization
Dr. Arungu-Olende	Engineer	Queconsult
Mr. Theuri	Engineer	ITDG
Steven Mutimba	Energy and Environment Specialist	Energy for Sustainable Development (ESDA)
Laban Kariuki	Electrical Engineer	

Annex 3. Energy Policy and fuelwood and charcoal use in the household sector

Table A6: Summary of benefits from new fuelwood stoves and Energy Policy (Implementation scenario)

Year	2004	2010	2020	2030
Projected total population (millions)	31.99	36.22	44.56	54.81
Projected rural population (millions)	23.83	26.97	33.17	40.80
Projected urban population (millions)	8.16	9.30	11.4	14.00
Rural population using fuelwood (at 89 per cent; millions)	21.21	24	29.52	36.31
No. of households (millions)	3.66	4.14	5.09	6.26
Proportion of households with improved fuel wood stoves	5%	9%	30%	46%
No. of stoves manufactured assuming only one stove per household.	183,000	372,600	1,527,000	2,879,600
Amount of wood saved (based on 3 tonnes/stove/year; million tonnes)	0.549	1.12	4.581	8.64
Income from stoves for manufacturers (based on Ksh 100/stove; millions Ksh)	54.9	112	458.1	864
Income from stoves for manufacturers (based on Ksh 50/stove; millions Ksh)	27.45	56	229.05	432
Total income (Millions Ksh)	82.35	168	687.15	1296
Monthly jobs created in the rural areas (based on pay of Ksh 3000)	27450	56000	229050	432000

Table A7: Summary of benefits from new fuelwood stoves and Energy Policy (Win-Win scenario)

Year	2004	2010	2020	2030
Total population (millions)	31.99	36.22	44.56	54.81
Rural Population (millions)	23.83	26.97	33.17	40.8
Urban population (millions)	8.16	9.30	11.4	14.00
Rural population using fuelwood (at 89 per cent; millions)	21.21	24	29.52	36.31
No. of rural households (millions)	3.535	4	4.92	6.05
Proportion of population with fireless cookers	3%	10%	30%	50%
No. of households with cookers (millions)	0.106	0.4	1.476	3.025
Wood fuel saved (based on 2.4 tonnes/hh; million tonnes)	0.254	0.96	3.54	7.26
Rural fireless cooker revenues (millions)	74.235	280	1033.2	2117.5
Monthly rural jobs created (based on Ksh 6,000 per month)	12372.5	4666.67	172200	352917
Rural population using fuelwood (at 6 per cent; millions)	0.4896	0.558	0.684	0.84
No. of urban households (millions)	0.1224	0.1395	0.171	0.21
Proportion of population with fireless cookers	5%	10%	30%	50%
No. of households with cookers (millions)	0.00612	0.01395	0.0513	0.105
Wood fuel saved (based on 2.4 tonnes/hh; million tonnes	0.014688	0.03348	0.l2312	0.252
Rural fireless cooker revenues (millions)	4.896	11.16	41.04	84
Monthly rural jobs created (based on Ksh 10,000 per month)	490	111	4104	8400
Rural and urban wood fuel saved (million tonnes)	0.269	0.993	3.666	7.512
Rural and urban fireless cooker revenues (millions Ksh)	79.131	291.16	1074.24	2201.5
Rural and urban fireless cooker jobs (fulltime)	12862	47783	176304	361317

Table A8: Summary of benefits from new charcoal stoves and Energy Policy (Implementation scenario)

Year	2004	2010	2020	2030
Projected total population (millions)	31.99	36.22	44.56	54.81
Projected rural population (millions)	23.83	26.97	33.17	40.80
Projected urban population (millions)	8.16	9.30	11.4	14.00
Rural population using charcoal (at 34%, millions)	8.10	9.17	11.28	13.87
Number of households using charcoal (millions)	1.35	1.62	1.88	2.31
Proportion of rural households using improved charcoal stoves	20%	40%	60%	80%
Number of households using improved stoves (based on one per household, millions)	0.27	0.648	1.128	1.848
Wood fuel saved (based on 3 tonnes/stove/year; million tonnes)	0.81	1.944	3.384	5.544
Revenues from charcoal stoves (millions)	54	129.6	225.6	369.6
Monthly jobs created (based on pay of Ksh 3,000/month)	18000	43200	75200	123200
Urban population using charcoal (at 87%, millions)	7.1	8.1	9.92	12.18
Number of households using charcoal (millions)	1.775	2.025	2.48	3.045
Proportion of rural households using improved charcoal stoves	60%	80%	100%	100%
Number of households using improved stoves (based on one per household, millions)	1.065	1.62	2.48	3.045
Number of households using 2020-introduced improved stoves (based on one per household, millions)	-	-	-	20% (0.6 million households)
Wood fuel saved (based on 3 tonnes/stove/year; million tonnes)	3.195	4.86	7.44	10.935
Revenues from charcoal stoves (millions)	213	324	496	609
Monthly jobs created (based on pay of Ksh 10,000/month)	21300	32400	49600	60900
Rural and urban wood fuel saved (million tonnes)	4.005	6.804	10.824	16.479
Rural and urban charcoal stoves revenues (millions Ksh)	267	453.6	721.6	978.6
Rural and urban charcoal stove jobs (fulltime)	39,300	75,600	124,800	184,100

Table A9: Summary of benefits from new charcoal stoves and Energy Policy (Win-Win scenario)

Year	2004	2010	2020	2030
Projected total population (millions)	31.99	36.22	44.56	54.81
Projected rural population (millions)	23.83	26.97	33.17	40.80
Rural population using charcoal (at 34%, millions)	8.10	9.17	11.28	13.87
Number of households using charcoal (millions)	1.35	1.53	1.88	13.87
Proportion of rural households using improved charcoal stoves	3%	10%	30%	50%
Number of households using improved charcoal stoves (millions)	0.0405	0.152	0.56	1.156
Wood fuel saved (based on 2.4 tonnes/hh; million tonnes)	0.097	0.367	1.353	2.77
Revenues from charcoal stoves (millions)	32.41	122.26	451.11	924.8
Monthly jobs created (based on pay of Ksh 3,000/month)	0.003	0.012	0.045	0.045
Projected urban population (millions)	8.16	9.30	11.4	14.00
Urban population using charcoal (at 87%, millions)	7.10	8.091	9.918	12.18
Number of households using charcoal (millions)	1.77	2.022	2.5	3.045
Proportion of urban households using improved charcoal stoves	3%	10%	30%	50%
Number of households using improved charcoal stoves (millions)	0.05	0.20	0.74	1.52
Wood fuel saved (based on 2.4 tonnes/hh; million tonnes)	0.1238	0.485	1.785	3.65
Revenues from charcoal stoves (millions)	42.60	161.82	595.08	1218
Monthly jobs created (based on pay of Ksh 10,000/month)	4260	16182	59508	121800
Rural and urban wood fuel saved (million tonnes)	0.225	0.852	3.14	6.43
Rural and urban charcoal stoves revenues (millions Ksh)	75.004	284.084	1046.192	2142.80
Rural and urban charcoal stove jobs (fulltime)	4260	16182	59508	121800

Annex 4: Other indicators for economic assessment of the Energy Policy

Other indicators that may be of interest are GDP and demand quantities for various energy sources. The contribution of the energy sector to overall tax revenue is about 20 per cent, which is equivalent to 4 per cent of GDP. Currently the energy sector provides direct and indirect employment to an estimated 160,000 people.

This study assumes a 2 per cent annual growth rate of population[81] (see Table A10 in Annex 4).

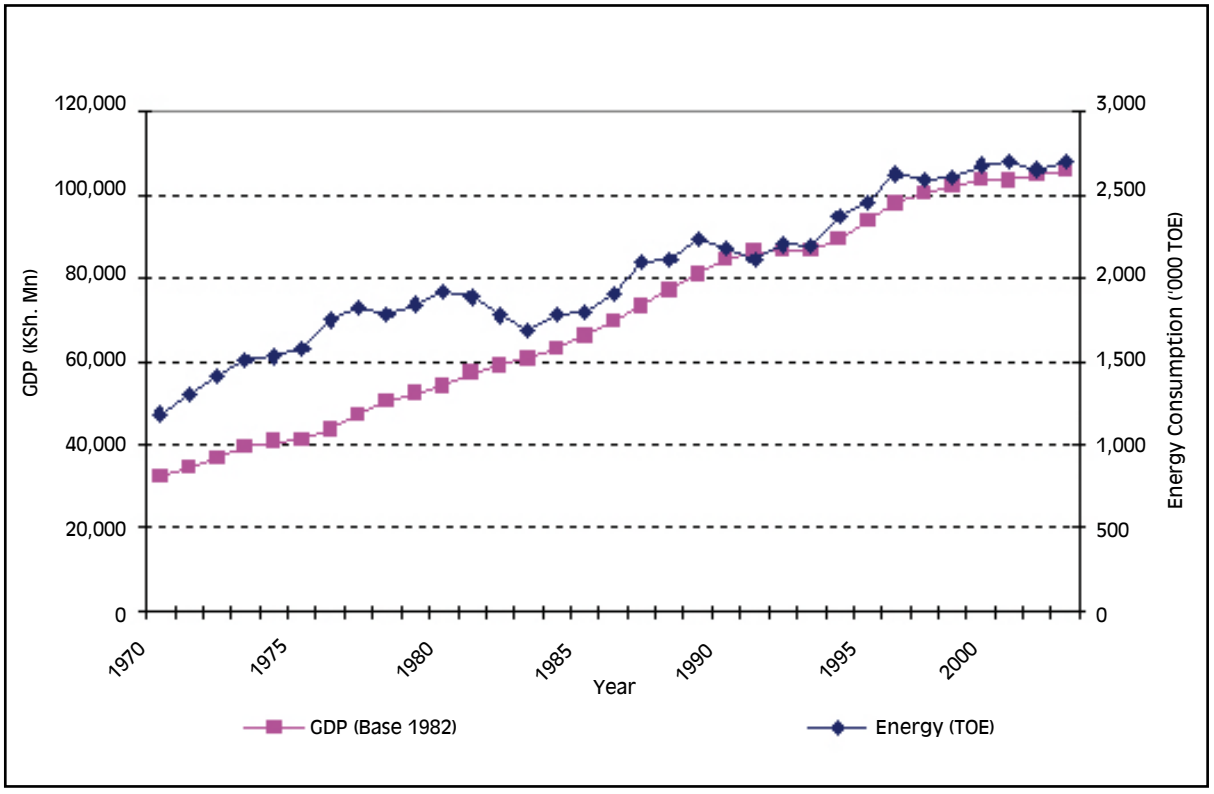
Table A10: Forecasts of population growth in Kenya

Dimensions/Scenarios	Growth rate		Projections			
		2004	2007	2015	2025	2030
Total	2 per cent	31,9920,614	34,796,302	40,769,413	49,697,687	54,870,263

Real GDP

This was chosen as an indicator due to the close link between commercial energy consumption and economic growth (see Figure A1). It is well known that energy provides the stimulus, drive and momentum to all economic activities due to its "hidden multiplier effect". Access to clean, appropriate and sustainable energy is thus an essential step towards the achievement of Kenya's development goals.

Figure A1: GDP and energy consumption in Kenya



[81] The Long Range Planning Unit at MOPND assumes a rate of 2.5 per cent while World Bank uses a rate of 3.6 per cent. However, these do not take into account the effects of the HIV virus.

Under the three scenarios, the GDP growth rates for Kenya for the period 2004 to 2030 are 3, 4, and 5 per cent respectively.[82] These growth rates are based on trends in IP-ERS targets between 2002-2007. Under the *Win-Win* strategy, a 5 per cent GDP growth rate annually robust growth in demand for energy. Therefore, economic targets cannot be achieved without sustainable, affordable and appropriate energy. With the *Business As Usual* scenario, the GDP growth rate is low as energy supply continues to be constrained; while with the *Implementation* scenario, energy demand will be higher due to higher growth of 4 per cent (see Table A11).

Table A11: Real GDP under the three scenarios

Scenarios	Growth rate (%)		Projections (Million Ksh)			
2004	2007	2015	2025	2030		
Business As Usual	3	112326.2*	122741.9	155485.7	208959.8	242241.7
Implementation	4	112326.2	128817	176295	260959.6	317497.3
Win-Win	5	112326.2	135130.4	199649.1	325207.4	415056.2

*Actual figure

The implications are that higher quantities of energy will be required to sustain higher real economic growth rates. It is unlikely that all forms of energy will be met through local production. Already, petroleum imports impose a serious burden on Kenyans through high fuel prices, transport costs and erosion of purchasing power, a trend that is likely to continue. This import dependence is likely to extend to such energy forms as electricity. Currently, electricity consumers face the burden of paying for higher electricity tariffs resulting from thermal generation of power.

Energy demand indicators

The demand for commercial energy in Kenya has been low and declining over the last three decades. This is attributable to failing economic growth performance. Due to the close relationship between GDP and energy demand, total energy demand will grow proportionately under the three scenarios to 2030 (see Table A12). The implications of these projections are a higher quantity of energy supply to sustain higher real economic growth rates.

[82] These assumptions however are very conservative. Vision 2030 sees an annual growth rate for GDP of 10 per cent as feasible.

Table A12: Energy demand indicators

Indicators/ Scenarios	BAU 2004	Imple. 2004	Win-Win 2004	BAU 2015	Imple. 2015	Win-Win 2015	BAU 2030	Imple. 2030	Win-Win 2030
Total Demand for energy (oil equivalent) ('000 tonnes)	2871.96*	2871.96*	2871.96*	3975.5	4507.5	4797.5	6193.65	8117.79	9284.54
Growth rate (per cent)	3	4	5	3	4	5	3	4	5
Petroleum demand for industry ('000 tonnes)	348.32*	348.32*	348.32*	661.21	516.17	584.55	1584.62	929.59	1215.24
Growth rate (per cent)	6	4	5	6	4	5	6	4	5
Petroleum fuels ('000 tonnes)	2590.90*	2590.90*	2590.90*	4918.32	3839.49	4348.12	11787.04	6914.71	9039.43
Growth rate (per cent)	6	4	5	6	4	5	6	4	5
LPG cooking gas ('000 tonnes)	41.72*	41.72*	41.72*	51.87	65.48	92.11	69.81	117.93	254.15
Growth rate (per cent)	2	4	7	2	4	7	2	4	7
Coal (oil equivalent) ('000 tonnes)	94.25*	94.25*	94.25*	117.19	105.15	111.02	157.72	122.08	138.80
Growth rate (per cent)	2	1	1.5	2	1	1.5	2	1	1.5
Electric power (million KWh)	3959.49*	3959.49*	3959.49*	6095.45	7660.83	6837.18	10977.56	18359.64	14214.01
Growth rate (per cent)	4	6	5	4	6	5	4	6	5

*Actual figure ('000 tonnes)

Petroleum accounts for 20 per cent of total primary energy consumed in the country. The overall demand for petroleum is projected to rise by 2 per cent per annum to reach 2.93 million tonnes by the year 2010. However, with improved economic performance as a result of both macro and structural policies being pursued by the Government to stimulate recovery and growth, consumption of petroleum fuels is expected to surpass this projected level of demand. The rates of growth of demand are 6, 4 and 5 per cent, respectively (see Tables A12). The rates are lower for *Implementation* and *Win-Win* scenarios due to energy efficiency and conservation. Increases in energy taxes (for environmental and fiscal reasons), and the substitution of alternative fuels will tend to moderate the growth in petroleum demand. We expect the trend towards lighter products to continue with most of the growth occurring in lighter transport fuels. The *Win-Win* scenario is expected to see higher growth due to higher GDP growth rates.

Petroleum demand in Kenya is expected to continue its strong growth due to economic growth, increasing population, and increasing transport needs. However, it will be partially offset by expected improvements in energy efficiency, higher consumer energy prices and financial constraints that restrict consumption in parts of the country. Much of the growth in petroleum demand is likely to be in transport fuels but increases for the household sector are also expected as the transition from traditional fuels to oil (e.g. kerosene and LPG) accelerates with urbanization and improved incomes.

Demand for LPG has been rather low in the last 30 years. However, with the implementation of the Energy Policy, and the zero-rating of imported duty, significant shifts are likely to occur.

Interventions such as standardization of gas valves and regulators; and retailing in smaller quantities are likely to trigger increases in LPG consumption in Kenya and will increasingly make LPG an attractive alternative to fuelwood and kerosene in rural areas. LPG demand is likely to continue to rise rapidly in the future due to modernization and lack of clean alternatives.

Coal energy is currently used by Bamburi Portland Cement Company, where it complements heavy fuel oil for process heat. The consumption of coal has averaged 130,000 metric tonnes per annum over the last five years. Coal utilization has remained low in Kenya despite stable international prices over the years relative to petroleum.

In the Energy Policy, interventions in coal consumption are efforts to promote coal as an alternative source of energy for commercial and industrial use. Some of the major problems limiting higher coal consumption include inadequate import handling and storage facilities (imported coal arrives at Mbaraki terminal and is stored in the open); high conversion costs in industry; and lack of fiscal incentives to encourage companies to convert their liquid fuel fired systems to dual fuel. Coal consumption is expected to increase markedly, since there has been a steep rise in the cost of fuel oil.

The demand for electric power is also expected to increase under the three scenarios (see Table A12). The price of electricity for both domestic and industrial customers is on an upward trend, not the least as a result of liberalization. This trend is likely to continue due to the absence of competitive factors, a surge in consumer demand, and lack of low cost investment opportunities. There has been a lack of response from power producers to take advantage of increasing prices. This is a negative economic development since it implies a greater need for investment in energy efficiency and alternative energy sources.