WATER, FOOD AND ENERGY NEXUS:
The Kenyan context

Workshop Report
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FOREWORD

Water, food and energy form a basic requirement for human existence and must be available in adequate quality and quantities to all populations. However, due to continued demographic changes, rising incomes and associated consumption patterns, climate change, persistent poverty and inconsistent policies and governance, there has been excess pressure on these resources leading to challenges in their sustainability. This has also contributed to continued rising of prices of these resources, making them out of adequate reach for the majority pure especially in the developing world. For instance, globally the food prices are expected to double by 2030. In Kenya, about 25% of the population (10 million) are considered to be food insecure, meaning they cannot afford a decent three meals a day and this number could go up if timely drastic measures are not taken. Well thought-out policy and management interventions are required in order to reverse this situation.

Food security is closely related to water and energy security. Food growing and processing need water and energy; water supply and circulation requires energy and likewise some energy production processes require water. The agricultural sector also supplies biomass for renewable energy production. Despite this linkage among the three resources, the planning and management within the sectors handling them continues to be done in isolation. Policy intervention required then will be integration of the policies and management of the three sectors. This will require trade-offs among the three, enhancement of potential synergies and most of all, continued exchange and collaboration to make sure development of one of the sectors does not pose a threat or conflict to another.

LIST OF ABBREVIATIONS

UNDP United Nations Development Program

HEP Hydro Electric Power

MDG Millenium Development Goals

ASAL Arid and Semi-Arid Lands

KARI Kenya Agricultural Research Institute

SWAP-bfz Strengthening water Association Partnership

IWRM Integrated Water Resources Management

PV Photo Voltaic

MW Megawatts

kWh Kilowatt Hour

VAT Value Added Tax

IDF Import Declaration Fee

USD United States Dollar

LNG Liquefied Natural Gas

GDC Geothermal Development Company

JKUAT Jomo Kenyatta University and Agriculture and Technology

kVA Kilovolt Amps

KENDBIP Kenya Domestic Biogas Programme

KIRDI Kenya Industrial Research and Development Institute

DFID Department For International Development

KIPPRA Kenya Institute Of Public Policy Research and Analysis

WEF Water Energy Food

UNCED United Nations Conference on Environment and Development

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EXECUTIVE SUMMARY

Water, food and energy form a basic requirement for human existence. As populations continue to grow and economies keep enlarging, the consumption patterns for the three resources become more intensive. The demand for water, food and energy is expected to grow by 30% - 50% in the next two decades. To effectively meet this demand, there is a global need for well-coordinated and timely management of the three resources and any other interrelated resource or aspect. It is imperative that there is comprehensive understanding of the three sectors, all factors contributing to their enhancement, all risks that challenge their sustainable supply and how these risks are being responded to and managed globally.

The NEXUS workshop was part of a 4-day event, in Nairobi Kenya, targeting key stakeholders and decision makers in the Kenyan Water, Agricultural (food) and Energy sectors. The overall objective of the event was to enhance the understanding of how the 3 sectors interrelate, to identify gaps for example in terms of knowledge and integrated management and to come to some recommendations on how to achieve a more integrated approach. For the workshop the participants were split into 3 working groups, which worked on one nexus respectively: Energy-Water, Water–Food, Food-Energy. This was by Assessment of trade-offs and synergies, identification of barriers/challenges and possible approaches to overcome these barriers and identification of activities for mitigating selected trade-offs and/or for exploiting more the potential synergies. Each working group had representatives of the two relevant sectors, e.g. the working group on energy-water had representatives from both the energy and the water sector. The results of each discussion group were presented and discussed by all participants. Generally, the workshop was very interactive. The representatives of the sectors showed strong commitment and were very engaged.

Some of the trade-offs identified are; obstruction to water access points by farmers, unsustainable agricultural practices, Hydroelectric power (HEP), land use for energy crop/ mining while some of the synergies identified included; use of energy-efficient pumps, using residuals from crops for biogas and use of micro-irrigation technologies (drip and sprinkler). Some of the recommendations arrived at included responsible governance and policy harmonization, increased awareness creation among key stake holders and planners in the three sectors about the need for the nexus approach, continually addressing the drivers of the resources' scarcity, scaling up of technical approaches, financing and information sharing to enhance the nexus.

INTRODUCTION

Background

Water, food and energy form a basic requirement for human existence. As populations continue to grow and economies keep enlarging, the consumption patterns for the three resources become more intensive. The demand for water, food and energy is expected to grow by 30% - 50% in the next two decades. To effectively meet this demand, there is a global need for well-coordinated and timely management of the three resources and any other interrelated resource or aspect. It is imperative that there is comprehensive understanding of the three sectors, all factors contributing to their enhancement, all risks that challenge their sustainable supply and how these risks are being responded to and managed globally.

The promotion of food security has been adopted as policy in many countries and regions, and while increasing area under irrigated agriculture is clearly encouraged as a means to achieving food security, it is often forgotten that water and several times sustainable energy are also critical for food security. In Kenya, like in many other countries water is critical for energy security; at the same time there are areas where water for irrigated agriculture won't be available without energy for pumped supply. Energy production requires massive quantities of water and most water distribution processes use large amounts of energy. Management of rainwater contributes to food security. A report by the Kenya Food Security Steering Group (KFSSG), 2010, cites cumulative poor rains in the country as a major cause of food and water insecurity. This situation is particularly worse for the urban poor who dwell in slums. About 45% of slum dwellers have no access to safe drinking water and food. Due to failing rains, 2.4 million Kenyan pastoralists, agro-pastoralists and marginal farm households are food and water insecure often leading to recurring conflict. These regions are also energy poor. Overall, about 1/3 of Kenya's population is food insecure.

Appreciating the link between the water availability to food security and mitigating by water harvesting and good management of the water will result to both water and food security. Additionally, appreciating that water, food and energy are inextricably linked, and that actions in one area more often than not have impacts in one or both of the others, will necessitate a common approach to their management. A report on an integrated assessment of the energy

policy (2006) revealed that in spite of the projected increase in demand of energy by 2030, there was little synergy in policy planning between the energy sector and other sectors that may affect or contribute towards energy supply. Yet, electricity generation in Kenya (electricity accounts for about 9% of Kenya's energy mix) is predominantly hydro (of the total electricity generated 49% is hydro), hence highly interlinked to the water sector.

Globally, Kenya is classified as a water scarce country with only 647cubic meters of renewable fresh water per capita. According to JMP 2011/2012, Kenya has the highest unserved population. Challenges in the water sector include harmonizing with other laws and water service provision sustainability (revenue collection, tariffs). With the prevailing changes in climatic conditions (declining rainfalls and prolonged drought conditions), growing populations and degraded catchments, it's crucial that the available water resources are well managed and this includes analysis and mitigation of all factors impacting on the resources.

Research is therefore needed to show the interdependency of water, food and energy in order to inform policy makers so as to integrate their management. The information upon which to base effective strategies, plans and decisions, including leading-edge input from the science-research community, must be available to the right persons at the right time and used to raise capacity of institutions so as to make sound decision and encourage participation of all stakeholders, including the private sector, and this way the resulting infrastructure may deliver benefits which will lead to sustainable and equitable distribution of the three resources.

Justification

Achieving energy and food security for all in an increasingly water stressed world is intimately linked to water security. While food demand may increase by up to 70 percent by 2050, the global demand for energy may increase by up to 40 percent. Agriculture accounts for some 70 percent of the world's freshwater withdrawals for food, feed and fiber, as well as for production of biofuels. Energy production in some parts of the world accounts for up to 45 percent of all water withdrawals. Satisfying these demands, while maintaining ecosystems, livelihoods, fisheries and biodiversity, is a challenge. While energy production carries a heavy water bill, a significant energy bill is associated with pumping, treatment of water. The "footprints" work both ways. Hence water, food and energy security needs to be addressed in an integrated way.

One of the strategies of Kenya's economic development blueprint, vision 2030, aims at expanding access to electricity (energy) and safe water to all Kenyans and an integrated approach of these sectors will contribute towards achieving this.

A review of the Kenyan Food security policy gives some of the factors contributing to food insecurity as weak governance and planning capacity, inadequate information and information sharing, weak dialogue with the private sector and weak social participation and system responsiveness. This can be addressed by creating a forum that will not only address the insecurity issue but will also provide a mechanism of discussing and proposing possible multi-sectoral inclusions and trade-offs that will help decision makers draft policies that will mitigate the insecurities.

- What are the key issues we should be looking at within the water, energy and food security nexus? And what are the main challenges or potential tradeoffs between water, energy and food security?
- What are your recommendations in terms of what is needed from government, business and civil society to address water, energy and food security in a more integrated way?
- What is needed in terms of regulation, other enabling conditions or incentives?
- What roles can a) policy, b) finance and c) technology play?

To effectively meet the growing demand for water, food and energy, there is need for well coordinated and timely management of the three resources and any other interrelated resource or aspect. It is imperative that there is comprehensive understanding of the three resources, all factors contributing to their enhancement, all risks that challenge their sustainable supply and how these risks are being responded to and managed nationally and globally. This requires an integrated effort for the three sectors in terms of strategy and policy planning and implementation.

Aim and target of the Workshop

This training workshop targeted policy makers, researchers and practitioners in the three sectors, who need to work together towards an efficient and sustainable supply and use of water, food and energy.

Specifically, the workshop addressed the tradeoffs in the water-food-energy sector for better informed decision-making and to maximize synergies, including multi-purpose infrastructure to manage large and small scale changes that affect the resources availability, explore good

examples of successful investment and institutional arrangements for efficient and mutually beneficial arrangement for water, food and energy and finally it addressed the essential capacity and information required and how its development can be facilitated.

Overall Objective

To enhance integrated management of water, food and energy resources so as to improve their productivity, sustainability and equitable access.

Objectives

- To enhance understanding of how the 3 sectors(water, energy and food) inter-relate and inter-depend
- To review the collaboration and coordination between water, energy and food sectors for sustainability
- To identify capacity and gaps related to knowledge, technology, integrated planning and the implementation of water, energy and food sustainable supply, processing and use, for further research and capacity building
- To initiate formation of a continuing platform for linkages, networking and capacity building for the three sectors
- To publish a policy brief paper.
- To expose the participants to already existing successful projects using an integrated approach

Output

The expected outputs of the project included:

- Awareness created amongst key decision makers and stakeholders in the water, food and energy sector
- Platform to dialogue and encourage open discussion with stakeholders including those with potentially conflicting views in the water-food-energy sectors
- Research and capacity gaps identified for action
- A policy brief paper

- Workshop report

Expected impact

- Improved efficiency in use of water, food and energy resources
- A more harmonized policy development process for water, food and energy sectors
- Stronger link between the academia and industry
- Improved quality of life for the public

BRIEF SUMMARY OF THE PRESENTATIONS AT THE WFE NEXUS WORKSHOP

Following the Water, Food and Energy Nexus workshop, these are summaries of the presentations from invited participants.

Presentation 1: Water Consumption Patterns in Kenya by Dr. Nzula Kitaka, an Aquatic Scientist from Egerton University

The above mentioned presentation mainly covered the topic on water and its relation to the two nexus topics; food and energy. The presenter gave a brief on sectors mainly involved in the consumption of water and these are:

- Household/domestic
- Industrial (e.g. HEP generation)
- Agricultural sector (irrigation farming)
- Ecosystem /environment (environmental flows)
- Others diversion projects

Kenya is a water scarce country, with < 1000m^3 per capita of renewable freshwater supplies and >80% of Kenya is made up of Arid & semi-arid lands. Rainfall variability coupled with high populations growth rate have resulted to limited Socio-Economic opportunities.

Most of the water comes from Ewaso Nyiro system in Northern region of Kenya with 36.3 % coverage followed by Tana river basin with 21.7 % coverage and a variety of other sources like Athi River contributing 11.5 %, Lake Victoria 8% and Rift Valley and Inland lakes contributing 22.5%.

Majority of the water sources are highly polluted due to poor hygiene (poor sites of toilets-distance) and therefore not available for use.

By the year 2006 (after water act 2002), 57% of Kenyans out of 36.6 million people had access to improved drinking water while 42% had access to improved sanitation facilities.

It's important to note that almost 35% of rural water supply systems in most cases are not operating, though a third of the rural populations (20+million persons) have access to improved

water supply through piped or Point systems. UNDP estimated that Kenya piped system has more than 740,000 connections, though most of these were experiencing poor maintenance hence hindering the water availability and consequently consumption.

By 2008, Kenya was classified in the category of PROGRESS BUT INSUFFICIENT compared to other countries which were categorized as ON TRACK (only 26 countries in Africa out of 54) e.g. South Africa, towards achievements of MDGs on improved water target by 2015. But Kenya lies in the countries NOT ON TRACK on sanitation MDG targets.

The challenges facing water consumption in Kenya include:

Meeting the growing water demand due to high cost of water provision, geographical isolation and, exploding peri-urban and slums (typical scenario for developing and countries on transition particularly in Africa)

Kenya also faces the challenge of provision of water for food security. Like other countries in Africa, agriculture is the greatest consumer of water in Kenya thus facing inadequate water for sustainable food production.

New challenges like climate change are expected to exacerbate the rainfall pattern variability and make the scenario worse if opportunities for the constraints are not tackled i.e. improve financing & encourage privatization in the water sector.

Therefore it's in order to conclude that water consumption in Kenya is determined by

- Its availability and
- The buying power
- Increase in access to safe domestic water sources and sanitation facilities are not keeping pace with population growth, food production demand, environmental integrity sustainability and other new external pressures

Case study indicates that Lake Naivasha expresses an example of how water demand influences priorities in water consumption cascading within the environment and the society.

Presentation 2: Production/Consumption Patterns of Food in Kenya by Matolo Nyamai from Kenya Agricultural Research Institute

Agriculture is the mainstay of the Kenyan economy and currently represents 24% of GDP. It accounts for 18% of total formal employment and provides livelihood for 70% of the population. Agriculture is dominated by more than 5 million smallholder farmers. There are smallholders faced with many constraints (high cost of inputs, over- dependence on rain-fed agriculture, lack of markets, limited extension services etc.)

Water Food Energy Nexus

- Demand and Supply affects increasing competition for scarce water resources. Therefore, there is need to balance between Equity and sustainability.
- Production patterns of food in Kenya - Arable land is about 46%, which means not much room for expansion of agriculture.
- Opportunities include improvement of water use efficiency in present irrigated agriculture, expansion of irrigated agricultural lands and Research, Technology and Innovation.

The following table summarizes consumption patterns.

Table 1. Consumption of Primary Staples (kgs per adult equivalent) per month, Nairobi

Income Quintile	Maize Products		Wheat Products		Rice		Cooking Bananas		Total	
	2003 [a_1]	1995 [b_1]	2003[a_2]	1995[b_2]	2003[a_3]	1995[b_3]	2003[a_4]	1995[b_4]	2003 [c]	1995 [d]
1	5.90	8.95	2.25	2.11	1.16	1.45	0.75	0.34	10.06	12.85
2	5.61	8.39	3.08	2.66	1.55	1.56	1.19	0.12	11.43	12.73
3	5.74	7.90	3.47	3.73	1.38	1.82	1.88	0.23	12.47	13.68
4	4.32	6.97	4.76	3.56	1.79	1.86	1.81	0.63	12.68	13.02
5	5.47	5.78	5.58	4.06	2.01	2.13	1.52	0.28	14.58	12.25
Total	**5.67**	**7.48**	**3.83**	**3.27**	**1.58**	**1.78**	**1.43**	**0.33**	**12.51**	**12.86**

Source: Tegemeo/MSU Urban Consumer Survey, 1995 and 2003

Presentation 3:

Water & Energy use Efficiency in the Agro-Industry by Gathogo Victor, Environment/Cleaner Production expert at Kenya National Cleaner Production Centre

Poor governance of water resources including poor financing and tariff policies, large unaccounted-for losses, inefficient technologies, lack of demand management, ineffective management of water sheds, inadequate pollution control, deteriorating hydro-meteorological services, and neglected demands for stream flow requirements impose a major additional constraint on an already stressed resources base, threatening its long term sustainability.

Water can be used efficiently in agro industries through

i. Total Site Water Management, which entails:
    - Optimization - (Water consumption/ production unit-need to benchmark the volumes of product produced per m^3 of water used.
    - Internal Reuse – (e. g process water reuse)
    - Alternative Water Sources – (e.g. Rain water harvesting)
    - Site Wastewater Reuse – recovery of condensate water, Use dry cleaning method instead of hoses to wash the floors

ii. Energy efficiency in agro industries
    - The key challenge facing Kenya is not to increase energy consumption per se, but to ensure access to cleaner energy services, preferably through energy efficiency and renewable energy thus promoting sustainable consumption.
    - Unlike most industrialized countries which progressed from traditional energy to unsustainable conventional energy consumption patterns and which are now struggling to move to a sustainable energy path, Kenya could, in a number of sectors, leapfrog directly from current traditional energy consumption patterns to sustainable energy options. Consequently, the careful examination of energy

consumption patterns and trends in Kenya (and Africa at large) should be of interest to the sustainable development community.

Overview of Kenya's Energy Sector

Kenya's energy supply mix consists of:

- Biomass - 68%
- Petroleum - 22%
- Electricity - 9%
- Others (Coal and coke) - 1%

High dependency on biomass is a big challenge due to environmental degradation while volatility of oil prices impacts negatively on the agro-sector. Meanwhile, electricity access is low at about 18%.

We need to use our energy efficiently:

- To minimize energy costs / waste without affecting production & quality
- To minimize environmental effects

Present scenario on inefficient Energy use agro industries in Kenya is due to:

- Lack of management awareness
    - Production is more important
    - Lack of investment capital
    - Limited policies/systems/processes
    - Limited knowledge and information
    - Few meters for electricity, water etc.
    - Lack of monitoring equipment
    - Information held by different people
    - Lack of communication
    - Multiple sets of data
    - Limited data from contractors

- Lack of financing
    - Long payback period
    - High investment
    - Unable to get a loan
    - Uneasy about taking loans
- Limited policies and enforcement
    - Lack of effective policies
    - Focus on command-control policies (legislation) energy regulations act 2011

Presentation 4: Brief Analysis of Kenyan Water Policy by Alec Kimathi, SWAP-bfz

In order to realign the water sector operations with the Constitution of Kenya 2010, the Ministry of Water & Irrigation in consultation with the stakeholders have drafted:

- The Water Bill 2012,which seeks to repeal the Water Act of 2002 and the Legal Notice No. 208 of 1988 that established the NWCPC in order to align it to COK 2010

Currently, the formulation of the National Water Policy, National Irrigation Policy and National Land Reclamation Policy and their respective Bills (all 2012) are complete.

Challenges in Water Policy include:

- Climate Change, Disaster Management and Environmental Degradation (e.g. erosion risks) not taken on board sufficiently;
- Rapid growth in urbanization, industrial production, hydropower generation, tourism and recreation services, agricultural and livestock production, among others;
- Missing sector basket as national sector financing mechanisms offering comprehensive implementation concepts and investment plans that attracts more donor support and support solid capacity building;

The following are the Guiding Principles in Water Policy formulation

- Fresh water is a finite and vulnerable resource which is essential to sustain life, development and the environment
- Wise management of water resources linked to livelihoods along natural catchment/basin boundaries following the IWRM approach
- Water is a cultural, social and economic good
- Separation of regulatory functions from implementation / operations
- Building effective partnerships among the public, private and civil society through a participatory approach involving users, planners and policy makers
- Treatment of effluents and re-use/recycling
- Water-related disaster preparedness
- Open awareness creation, communication and reporting to public.

Policy Statements

- Ensure increased per capita water availability above the international benchmark of 1000 m^3 by 2030
- Ensure progressive restoration of ecological systems and biodiversity in strategic water catchments
- Maximize use of trans-boundary water resources in coordination with other riparian countries
- Enhance rainwater harvesting and storm water management
- Enhance inter-basin water transfer as a strategic intervention supporting national development goals and IWRM and development
- Enhance water quality and pollution control
- Establish sound research and development in the water sector
- Adhere to regulation in WRM
- Treat effluent waters and recycle for use
- Ensure sustainable groundwater resources for present and future generations
- Avail sufficient funds and ensure progress in sustainable development and management of water resources
- Resolve conflicting mandates by better cross-sectoral coordination

- Develop a water management system which protects environment and ensures ecological integrity and protection of biodiversity

Presentation 5: Energy policy and programs in Kenya by Faith Odongo, Assistant director of renewable energy ministry of energy

Policy instruments

The government of Kenya through the ministry of energy has put into place energy policies that include;

- The energy policy of 2004 and the energy act of 2006 which are still under review
- The feed-in tariffs policy of 2008 and 2010 is under review to bring it in line with change in cost of equipment and borrowing and to standardize approval mechanisms and instruments.
- The solar PV regulation which seeks to streamline operations on solar PV installation through licensing and registering of solar PV operators
- Solar water heating regulations which makes it mandatory for all premises using over 100 Litres of hot water per day to install hot water systems
- Energy management regulations ensures that owners of designated facilities develop energy management policies and appoint energy officers who are responsible for development and implementation of energy efficiency and conservation programs
- Blending E10 mandate (ethanol blending mandate) for Western Kenya (gazetted in May 2010) and the energy efficiency accord which is monitored by Kenya Association of Manufacturers through the Centre for Energy Efficiency and Conservation and seeks to reduce energy consumption by 15% in one year

Feed-In-Tariff (FiT) policy

The FiT policy covers geothermal, wind, small hydro, solar and biomass forms of energy. This policy review includes introduction of solar PV tariff for grid connection for plants 0.5- 10 MW

i.e. for off-grid connection between 0.5MW – 1MW the unit price is 20 US cents per MW and 12US cents foe grid connection of between 0.5MW – 10MW. The current applicable rates for the different forms of energy are shown in the table below:

Technology	**Plant Capacity (MW)**	**Maximum Tariff ($/kWh)**	
		Firm power	**Non-firm power**
Geothermal	Up to 75	0.085	-
Wind	0.5- 100	0.12	0.12
Biomass	0.5- 100	0.08	0.06
Small-hydro	0.5- 0.99	0.12	0.10
Small-hydro	1- 5	0.10	0.06
Biogas	0.5- 100	0.08	0.06
Solar for off-grid	0.5- 10	0.2	0.1

Resource assessment

Resource assessment and feasibility studies have been availed to investors through a bidding process. Wind resource atlas was first developed in 2003 and upgraded to a high resolution solar & wind resource atlas in March, 2008. The government is currently undertaking wind data logging in high potential areas to obtain actual wind data and mapping out small-hydro power resources to produce an atlas for investors. Between the years 2008 to 2011, 26 feasibility studies were done including: Cogeneration feasibility studies, geothermal resource assessment, petroleum exploration and coal exploration.

Policy and fiscal incentives

These include VAT (value added tax) and IDF (import declaration form) fees waiver on renewable energy plants and equipment. The government has also offered letters of comfort to independent power producers. Small-hydro power schemes less than 1MW do not require licensing.

Overview of electrical power situation

Hydro contributes about 45% but varies considerably depending on variation in hydrology. Additional 332 MW thermal plants are being installed as insurance against the uncertainty of supply from hydro and to meet growing energy.

Green energy projects under development will provide 809MW i.e. Geothermal 332MW, wind power 384MW and hydro 93MW. The power demand is projected to rise to 15,000 MW by year 2030 while the projected generation to meet this demand is 17,500 MW out of which; geothermal is 5000MW, wind is 1500MW and hydro is 2000MW the approximate cost being USD 18billion, USD 3.5billion and USD 1.2 billion respectively. The remainder will be supplied from LNG, Coal and Nuclear**.**

Ongoing green energy initiatives

SITE	TYPE	MW	Cost US$	COMMISSIONING DATE
Olkaria I & IV	Geothermal	280	1.37 billion	2014
Olkaria III	Geothermal	52	220 million	2014
L. Turkana	Wind	300	700 million	2013
Aeolus	Wind	60	132 million	2013
KenGenNgong II	Wind	24	40 million	2013
Sangoro	Hydro	21	78 million	2013
Kindaruma upgrade	Hydro	32	75 million	2013
Total added capacity by 2014		769	2.6 billion	

Development of geothermal resources

The potential for geothermal resource located in the Rift Valley in Kenya is over 10,000 MW and out of this only 205 MW has been developed for electricity generation while another 332 MW is scheduled for commissioning in the year 2014. The development of 5000MW of geothermal power by the year 2030 has been proposed since it is the least cost option for Kenya. Out of this, GDC has commenced the development of the 1600 MW Menengai field. This will be followed by the development of the Bogoria-Silale geothermal power plant of 5000MW.

Out of the USD18 billion required for geothermal development, the critical amount is USD 5 billion for resource assessment and development. The rest can be raised through private investors.

A total of 2600 Km of transmission lines at an estimated cost of over USD 1 billion are under construction. The majority of these lines will facilitate transmission of green energy to the grid. Key among these will be the 427 km Loyangalani- Suswa transmission lines at a cost of EUR 137 million. This will transmit the 300 MW of wind power from Lake Turkana Power plant.

Wind power

In the least cost plan it is proposed to develop a 1500 MW of wind power which is estimated to cost USD 3.5billion. 70 wind data loggers will be installed for collecting wind data to be used in establishing wind regimes in identified high potential areas.

Small Hydropower enables communities to develop small hydropower. Currently, the ministry of energy is collaborating with the Numerical Machining Complex to manufacture a turbine locally.

On the Biogas technology, piloting of sewage based biogas plants in institutions of higher learning is ongoing. At JKUAT, a 385 m^3 digester with gas production capacity of 50m^3 has been constructed to run a 45 kVA generator and be used for cooking. Domestic biogas plants are under installation by KENDBIP which is supported by the Netherlands government and the target is 8000 plants in four and a half years (2009-2013). There is promotion of improved cook stoves for domestic and institutional use. A facility of blending ethanol and petrol is being set up at Kisumu KPC depot

Presentation 6: Nyongara Biogas Pilot Plant: A Public Private Partnership Program Producing Energy from Slaughterhouse Waste by Willis B. Makokha KIRDI (Energy Division)

The growing population in the Nairobi Rivers catchment areas and river banks is resulting in increased demand for more food, water, and energy hence putting considerable pressure on the environmental resource base i.e. There is a population of 25,000 people in approximately 5000

homes around the abattoirs and there are 4,000 persons living within one km radius of the abattoirs. The area is said to be supporting a floating population of nearly 10,000 persons.

Biogas production in an increasingly decentralized fashion and its utilization through state-of-the-art technologies, present an optimal way of mitigating this pressure and combating climate change.

Major Processes in Biogas Production include:

i. Feeding process: The main feedstock for the biogas digester is waste water and solid waste from the slaughter house.
ii. Anaerobic process: Anaerobic digestion is a series of processes in which microorganism break down organic material in the absence of oxygen.
iii. Hydrolysis: Is the process by which complex carbon chains in the organic materials are decomposed into simple organic compounds.
iv. Digester: The digester is an *airtight* system in which the methanogen bacteria have the best living environment i.e. without light and oxygen and 37°C.
v. Overflow: From the overflow, anaerobically digested effluent which is a highly nutritive *organic fertilizer* can be packaged.

Parameters for the Nyongara biogas plant;

Water use per day	5000litres
Blood in the waste stream per day (some is dried)	480litres
Solid waste generated per day	2000Kg
Feedstock per day	500Kg
Biogas Volume per day	94m^3
Expected methane content	60%
Energy production per day	563 kWh
Annual electricity production	61685 kWh
Annual income (As per feed-in-tariffs policy, GoK)	KES 321,260*

*Using US cents 7 per kWh, and given plant operation is steady throughout the year.

Presentation 7: The place of the media in water, energy and food security *by Mr.Aghan Daniel*

As journalists have the skills and capacity to investigate feasible options to challenges at the local level and have the platform to present the various solutions in a clear and understandable way, educating media professionals is key in opening up information channels especially for the marginalized communities experiencing poverty and malnutrition. Informing the public is the first step in tapping into the strengths of the local community so that they can collectively take action. AmetoAkpe, a print reporter played an investigative role in the water sector. She investigated Nigeria's water emergency in the context of the oil-rich country's opaque financial management structure and policies. She found out that ordinary Nigerians suffer the impact of a faulty water system while their leaders, often a stone's throw away, enjoy benefits that could be available to all.

Journalist also play the role of setting agendas during their investigations and reporting as seen by a Multimedia journalist Selay Kouassi who assessed Ivory Coast's efforts to move beyond the post-election violence of spring 2011. He reported on communities in the western part of the country that have put political and ethnic differences aside to ensure access to safe drinking water despite lack of support from a faltering government-led reconciliation initiative.

In Liberia, radio reporter Tecee Boley played a watch dog role by taking issue with President Ellen Johnson Sirleaf, the Nobel laureate who has served as the Goodwill Ambassador for Water, Sanitation and Hygiene in Africa since 2009. Local news reports praised the government for bringing water to previously thirsty slums, but visits to these neighbourhoods found that residents were still waiting.

Samuel Agyemang, national TV anchor for Metro TV in Ghana, took his camera to a long-established community in the capital, Accra, which had been without water for two decades and only now receives intermittent service. The director of the water company claims he is raising capital "like nobody's business," but most neighbourhoods aren't seeing change, raising questions about Ghana's status as a darling of donor groups.

To solve the water corruption dilemma, journalists also need to have a good understanding of the water sector and the roles of the actors in the sector to better report on the topic. Moreover, integrity is a complex concept that requires some unpacking.

The news media can still play a more informative and insightful pro-active role in educating readers and audiences on the vital issues at stake. Nothing can bring out the social responsibility role of the media than the challenge of covering mass deprivation and building a public agenda to overcome massive social deficits on the energy, food and nutrition fronts; lack of choice when it comes to energy and poor policies on water and its quality.

The reality indicates that in the current changing world journalists and scientists who have never been known to be activists take up the role of activism/activist. Efforts aimed at promoting coverage of water and sanitation, food and energy issues in the local and national media so as to have a positive influence on decision-makers, the private sector, the civil society as well as individuals and households should be encouraged. The news media can still play a more informative and insightful pro-active role in educating readers and audiences on the vital issues at stake. Nothing can bring out the social responsibility role of the media than the challenge of covering mass deprivation and building a public agenda to overcome massive social deficits on the energy, food and nutrition fronts; lack of choice when it comes to energy and poor policies on water and its quality.

Journalists can help in improving integrity in their countries while also increasing participation and transparency in water- and sanitation-related debates and discussions. To solve the corruption dilemma, journalists also need to have a good understanding of the sectors and the roles of the actors in the sector to better report on the topic. Moreover, integrity is a complex concept that requires some unpacking

Presentation 8: Energy consumption patterns in Kenya by KIPPRA

The output based on KIPPRA Survey was carried out in 2009. The findings were conclusive, since all energy types were captured. A total of 5534 consumers categorized as: Households-3600, establishments (enterprises in various classified sectors)-1534were captured. The samples were distributed in all 8 former provinces.

The method used to collect data for the energy consumption in Kenya was through interview schedules administered by trained enumerators. From the study, it was observed that Fuel popularity differs across income groups and locations (urban vs rural). Kerosene is more popular with the urban low income group while Liquid Petroleum Gas (LPG) is popular with high income groups, and even more popular with urban population. Some energy types are rarely used due to lack of information, technical know-how and cost implications. There is evidence of fuel stacking behavior so that businessmen can shield themselves from high cost of fuels.

Fuel popularity VS income groups

Energy source	<10000		> 10000	
	Rural	Urban	Rural	Urban
Material residues (e.g. cow dung, maize stalks, etc.)	152	6	103	8
Fuel wood	969	52	887	88
Charcoal	587	224	733	646
Kerosene	1162	276	950	551
LPG	40	38	189	483
Biogas	1	0	5	0
Electricity	117	150	310	770
Solar	23	3	73	9
Lubricants	1	0	13	15
Wind energy	1	0	2	1
Other petroleum products (MSP, MSR, etc)	4	0	23	37
Candles	29	11	21	16

Energy sources

Energy Type	Energy sources		
	Collected free of charge	**Own production**	**Purchases**
Material residues (e.g. cow dung, maize stalks, etc.)	194	29	39
Fuel wood	1171	259	585
Charcoal	47	365	1776
Kerosene	-	-	2974
LPG	-	-	756
Biogas	1	5	1
Electricity	-	-	1340
Solar	23	46	29
Lubricants	-	-	35
Wind energy	1	-	2
Other petroleum products (MSP, MSR, etc)	-	-	59
Candles	**-**	**7**	**35**

Reasons for not using energy types

Fuel/energy type	Material Residue	Fuel wood	Charcoal	Kerosene	LPG	Biogas	Electricity	Solar	Lubricants	Wind Energy	Other Petroleum Products	Candles
Unavailability/physical access	1391	344	124	16	154	**2082**	785	1140	447	**1926**	328	3
Dirty, Bulky, inconvenient	**1005**	**942**	437	200	13	56	3	11	151	11	84	
Unreliable/insecure	611	207	152	131	85	305	38	519	327	471	240	5
Cost/expensive (economic access)	44	74	743	316	**2544**	834	1517	**1701**	**1066**	721	**1433**	5
Dangerous poor quality	76	46	33	33	57	87	21	90	756	135	734	1
lack of technological know how	43	6	3	1	20	116	1	31	90	155	50	1
No space/not allowed	3	10	2	8	23	78	9	1	340	111	283	1
plans underway/S	49	14	8			2		28				
slow in cooking	13		10	1	1			2				
bad food taste/smells	2	2		6								

Responsiveness of fuel budget share to price movements

	Fuel wood	Kerosene	Charcoal	LPG	Electricity	MSP	AGO	Lubricants
Fuel wood	-0.814							
Kerosene	0.175*	-0.547						
Charcoal	0.275*	0.282*	-0.718					
LPG	0.169*	0.265*	0.337*	-0.634				
Electricity	0.165*	0.36*	0.256*	0.359*	-0.64			
MSP						-1.055		
AGO						0.740*	-0.975	

*substitute goods (multiple fuel use at hh level)

Enterprises(firm use)

	Kerosene	LPG	Lubricants	MSP	AGO	Candles
Agriculture	**0.1925**	0.0019	0.0137	0.0039	0.0016	0.0013
Manufacturing	**0.0565**	**0.0453**	0.0689	**0.0276**	0.0070	0.4002
Electricity &water	0.0000	0.0183	0.0050	**0.7387**	0.0000	
Trade	0.0103	**0.0800**	0.0127	**0.1133**	0.0002	0.4181
Transport & Communication	0.0013	0.0005	0.4846	**0.6032**	**0.5266**	0.0940
Community & Social Institutions	**0.5376**	**0.0782**	0.0133	**0.2212**	0.0023	0.0071

Own price elasticities for the enterprises

	Agriculture	Manufacturing	Trade	Social Inst.	Electricity & Water	Transport and communications
Fuel wood	0.45	1.89	-0.13	0.28		
Charcoal	0.87	-0.34	0.074	0.42		
LPG	-1.49	-3.03	0.64	0.4		
Kerosene	2.11	0.835	-0.047	0.133		
Electricity	0.23	0.302	0.02	0.526	0.724	-0.492
MSP	0.24	1.31	0.005	-0.025	-0.062	0.007
AGO	-0.48	-0.02	-1.552	-0.067	-0.24	2.88
Lubricants	0.79	0.35	0.25	0.772		1.87

Outstanding conclusions

- Income categories and changes in the same determine fuel choice and demand (expenditure shares)
- There is fuel stacking behavior
- General lack of knowledge on available renewable resources

Presentation 9: Knowledge, data and information for water, food and energy by *WangaiNdirangu, WaterCap*

Water knowledge management entails knowledge generation and management, dissemination and access to information and methods and technologies. It also involves whole processes that govern leveraging of knowledge to fulfil the policy and management objectives.

The Fundamentals of Knowledge management include:

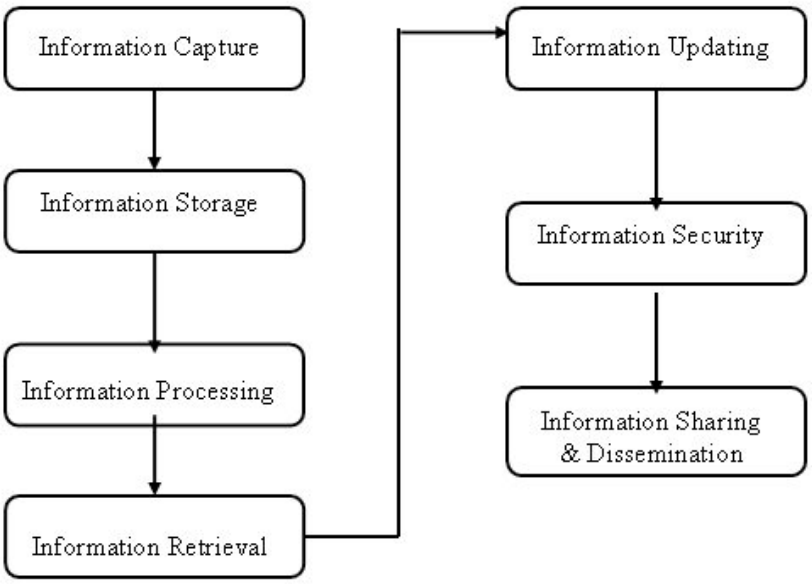
- Knowledge management Objectives. (Why information has to be managed.)
- Information Management Process
- Information Management Tools
- Information Management Outputs
- Indicators of Outputs for Information Management Function

Knowledge management objective is "To ensure that essential information are managed and disseminated to policymakers, managers and stakeholders to support management decision and gain commitment and support for the decisions made."

Generic information types & their characteristics

- Static Info - e.g. river name, river length, basin size
- Dynamic Info - e.g. river flow data, rainfall data, water quality data
- Raw Data - from measuring equipmentor survey
- Processed Info - Information that meets a defined need and is processed from raw data
- Report Type Info - Combination of text, figures and tables, organised within a set of narrative text
- Spatial Type Info - Information stored in the form of maps and is geo-referenced to a map

Information Management Process



Tools for Knowledge Management

- Knowledge networks/ Communities of practices / learning alliances
- Tacit knowledge sharing programs e.g. mentoring, apprenticeship
- Web information
- Best practices studies
- e-learning programs
- Forums for knowledge and information sharing (e.g workshops)
- Research
- Publications / Documentation
- Chat groups
- Video conferencing
- News (for broadcasting)
- Map and search
- Access to archives / libraries
- Access to tools (modelling systems, monitoring systems, etc)

- Help desk

The necessary steps taken towards Knowledge management Include:

- Strategy - defining the direction to be taken
- People - the 'knower' and 'managers' who make the processes effective and productive
- Technology - the enabling tools that facilitate storage, handling and sharing of data and information
- Implementation plan
- Monitoring and evaluation - assessment / judging the success of the process

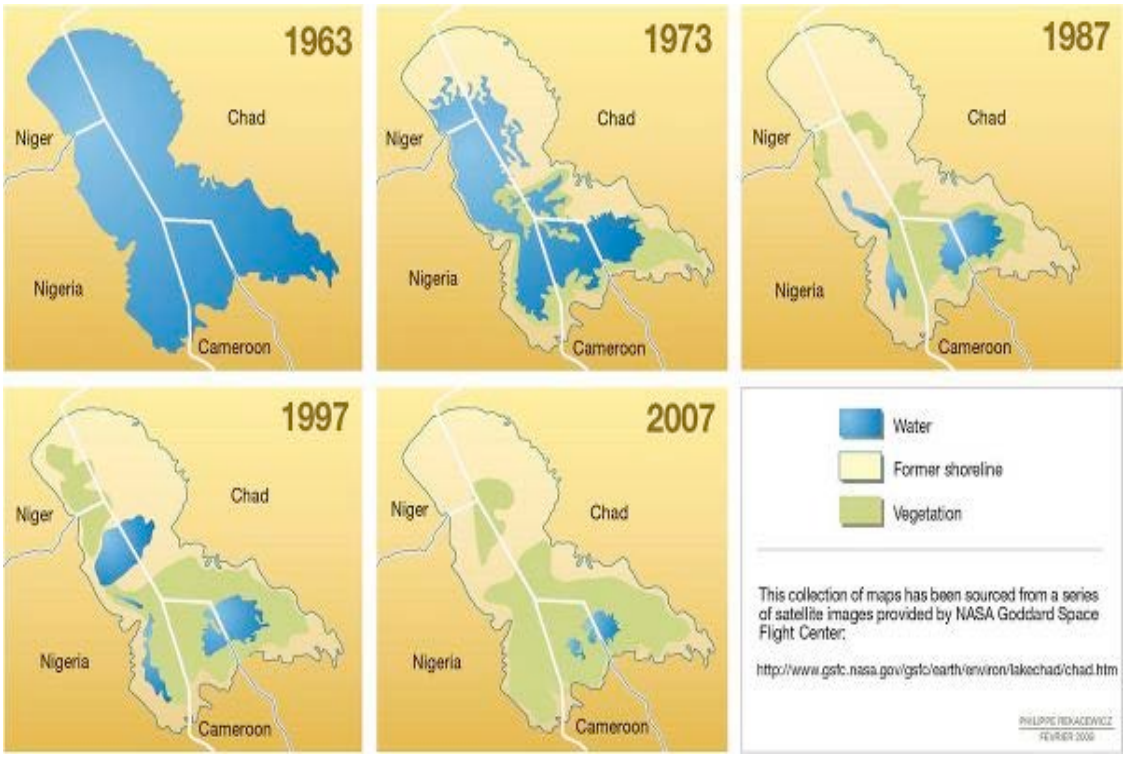
Presentation 10: Gender aspects on water *by Ms.Annabelle Waituti*

Water is the basis for human life (water for life; water is life). It is indispensable for life and human growth (also essential for survival of all living things). It is also fundamental, inalienable human right based on human dignity. Water is crucial for sustainable development and a pre-requisite for meeting all the MDGs, and vision 2030 (its pillars are dependent on water). It plays a key role in achieving gender equality

Kenya is a water stressed country. Water is inequitably distributed in space and time but also among women and men. Today the highest proportions of those without safe water are the poor and marginalized groups. Unless drastic measures are taken, water availability is getting worse by day expected to reach 247m^3/capita/ by 2020.

Lake Chad (bordering Chad, Niger and Cameroon) offers the best example of shrinking freshwater resources. Since 1963, the lake has shrunk to nearly a twentieth of its original size, due both to climatic changes and to high demands for agricultural water. Decrease in surface area of the Lake is from approximately 25,000 km^2 to 1,350 km^2 (Scientific American, 2001).

The changes in the lake have contributed to local lack of water, crop failures, livestock deaths, collapsed fisheries, soil salinity, and increasing poverty throughout the region.



Some of the Kenyan shrinking fresh water sources include

- Lake Victoria
- Lake Naivasha
- rivers and wetlands

An example of a dry riverbed

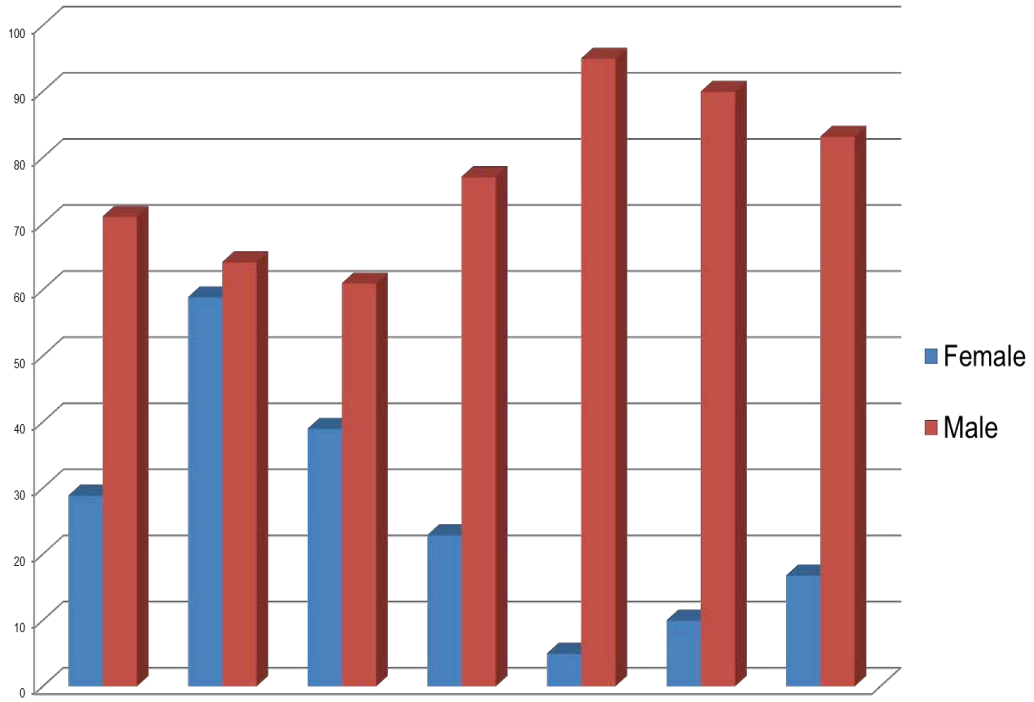
Consequences of shrinking water sources

- Growing competition

- Growing water conflicts
- Widening access gap between the rich and the poor
- Gender inequalities

Relationship between gender and water

The growing water scarcity will impact women and men differently. Decrease in water availability and deteriorating water quality will reduce access to drinking water and negatively affect the health of the poor, and decrease agricultural and livestock production hence resulting to food insecurity.



Gender Concerns

Women and men access and use water differently. Inadequate participation of women in water decisions affects their uses. Access to and the control over water resources determines the productive and physical security of women and their families, and ultimately their survival -

obstacles. Inequitable access to paid labour is related to water and sanitation. Women's traditional roles require adequate access to water services e.g. they are the food producers.

Agricultural production in Kenya relies mainly on rainfall for irrigation. Production is increasingly getting compromised in many parts of the country with shorter growing seasons, lower yields and increased dependence on irrigation. A majority of Kenyans live in rural areas, where income and employment depend almost entirely on rain-fed agriculture. Agricultural activities and water production, irrigation are highly dependent on energy. The related technologies require energy for operation hence the need for women to have access and capacity to operate these technologies. For the women to acquire these technologies they will need financial assistance through credit facilities and other financial resources. Additionally, time consumed in collecting water has socio-economic development implications

Integrated Water Resource Management (IWRM)

IWRM is defined by the Global Water Partnership as "a process which promotes the coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (UNEP Water Policy 2007)

Dublin 1992 and Chapter 18 of Agenda 21 (UNCED Rio de Janeiro 1992) states that:

- IWRM is a crosssectoral holistic approach to water management as response to the competing demands. It ensures the coordinated development of water, land and related resources so as to optimize economic and social welfare without compromising the sustainability of environmental systems

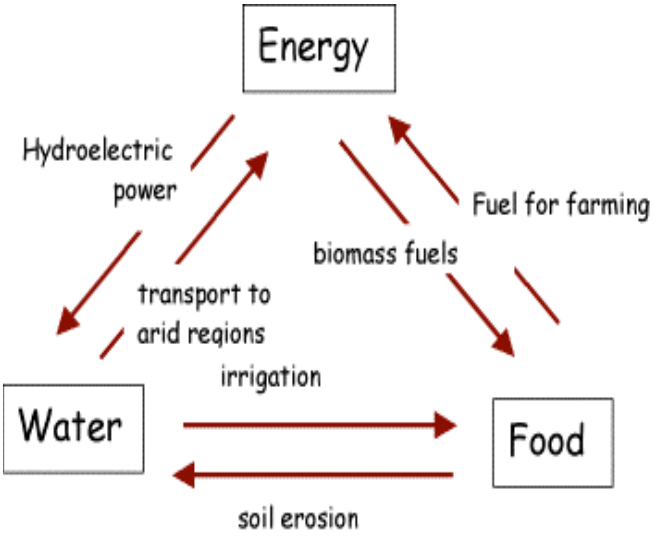
The application of IWRM as a philosophy, policy, and implementation guideline can assist in addressing the:

- Gender and social disparities in terms of equitable access to and control over resources, benefits, costs, and decision making between women and men.
- Need for sustainable water resources development as a key to poverty eradication.

For successful gender mainstreaming into water policies, capacity should be developed for:

- Collection of sex and gender disaggregated data
- Gender analysis
- Monitoring mechanisms i.e. gender sensitive indicators
- Gender sensitive evaluation tools

Presentation 11: Gender aspects on energy and food security by *Anastasia Muiti*



Water, food and energy form a basic requirement for human existence. The food, water and energy inputs are both crucial and interlinked. Making water of acceptable quality available for food production carries a heavy energy bill. Energy production is associated with significant water consumption. Increased consciousness about water and energy linkages will be a cornerstone of future food, water and energy security. The food-energy linkages are about costs. Higher energy prices affect the cost of agricultural inputs and water, and consequently food prices. The high prices also increase the incentive for growing crops for fuel rather than food.

The volatility of energy prices is hence transferred to the price of food contributing to increased food security risks.

Gender Definition

- Gender- Refers to socially constructed differences between men and women
- Gender relations refer to the power relations between men and women due to which women occupy a secondary status in society

Gender inequalities are shown in the following five mechanisms and can arise in any context.

- Differences in power
- Differences in income and economic resources
- Gender-bound patterns in the division of labour
- Other cultural patterns and social roles
- Biological differences

These five mechanisms largely overlap in all aspects.

Food Security

Food security refers to the physical, social and economic access to sufficient, safe and nutritious food by all at all times to meet their dietary and food preferences for an active and healthy life. It comprises three key elements: food resource availability, access to those resources to ensure sufficient consumption of food, and appropriate utilisation in a sanitary and nutritious manner.

Gender lens is required to examine questions of food security and energy to provide a more integrated understanding of their gendered nature. Some of the issues to be examined include:

- Ownership of and control over assets, especially arable land;
- Access to employment and other income-earning means;
- Access to communal resources such as village commons and forests;
- Access to traditional social support systems such as of patronage, kinship, caste groupings, etc.;
-

Gender and Energy

Women and men have different energy needs due to their differing household roles, responses to crises and coping mechanisms. A gender-sensitive energy policy aims at offering energy technologies and services that match those needs. Such a policy involves more than the creation of a gender-sensitive set of energy-related goals.

Gender mainstreaming should take place at the actual policy formulation and implementation stages. Increased participation of women in the energy sector and improvement of their status can help to incorporate gender as an integral part of energy policies and practices.

Availability and use of disaggregated data by sex would facilitate the energy policy process in defining the issues, examining policy alternatives, making policy choices, implementing policies and evaluating results.

With the prices of electricity and fuel constantly rising, women will suffer more than men from the deepening of "fuel (energy) poverty". Women and girls spend a huge amount of time collecting wood and carrying water leading to loss of time for schooling and revenue generating activities.

Indoor air pollution from low quality solid cooking fuels (wood, charcoal, dung, waste) imposes a major health burden on those who spend their days close to the cooking area i.e., women and girls. The solutions are available and often cost little - provide a small amount of energy to pump water for cooking and agriculture; provide improved fuels and appropriate stoves.

The political aspect of energy policy relates to the way in which the production, transportation and distribution of energy products and services are organized and secure access to energy is ensured.

The environmental sustainability of energy policies needs to recognize that in many cases women and men are affected differently by health problems related to energy use and production. Energy policy can offer distinctive solutions based on women's and men's differing roles and experience.

Energy policy has a social aspect. Improved access to energy services can reduce inequalities between women and men, rich and poor and other population groups. Energy services can also contribute to women's empowerment.

The goals of gender mainstreaming for energy

- To ensure that women and men have equal representation in decision-making with regards to policy and policy instruments aiming at changing the established patterns of energy production and consumption.
- To ensure that corrective measures intended to mitigate negative effects of energy production and consumption take into consideration gendered impacts to avoid undermining the opportunities to improve the lives of targeted women and men.
- To identify new possibilities of improving income and employment for both women and men that could be brought about by new sources of energy and/or new energy efficient methods and technologies.
- To ensure that men and women have equal opportunity for learning and information acquisition regarding the links between energy production and consumption, environmental degradation and feasible solutions of existing problems.

Issues and key questions that could be addressed in energy sector

- Number of women and men at top level decision-makers in the area of energy
- Women and men awareness of the links between environmental degradation and energy production and consumption
- Ways and means to improve energy efficiency
- New technologies and home appliances that could improve energy efficiency both at the work place and home
- Accessible and affordability of clean energy to men and women
- Energy consumption levels of women and men
- Men and women equal participation equally in decision-making in energy management

ASSESSMENT OF TRADE-OFFS AND SYNERGIES

In the first session, the participants were requested to identify the trade-offs and synergies by considering the nexus in *both* directions. That means, that the working group discussed for example how the energy production affects the water resources but also to what extent the water sector requires energy. With regard to potential synergies, the participants discussed possibilities, how to get mutually beneficial responses, e.g. wind and PV power production facilities do not need water compared to thermal power plants. The participants could discuss the trade-offs and synergies generally, but **were requested to prioritize** them in consideration of the specific challenges in Kenya *(issues of highest priority are marked yellow).*

NEXUS Water - Energy

TRADE-OFFs	SYNERGIES
NEXUS Energy for Water	
➢ Pumping ➢ Irrigation ➢ Waste water treatment, drinking water treatment ➢ Extraction & transmission	➢ Solar-run pumps ➢ Mini-hydro ➢ Gravity design ➢ Channeling drip
NEXUS Water for Energy	
➢ Thermal power plants ➢ Hydroelectric power (HEP) ➢ Extraction & refining (e.g. coal, oil), geothermal power plants ➢ Fuel production (ethanol, hydrogen) ➢ Thermoelectric cooling	➢ Water storage harvesting ➢ Efficient water use in power production ➢ Exploiting alternative energy sources ➢ Reduced tariffs for WSPs (??) ➢ Wet, dry & hybrid cooling and intake structure technologies ➢ Develop and/ or apply technologies to recover and reuse water from power plants, e.g. coal dewatering ➢ Air-cooled condensers directly condense exhaust steam from steam turbine and return condensate to boiler without water loss

NEXUS Food - Water

TRADE-OFFs	SYNERGIES
➢ Use of chemicals in farms that leads to water pollution (e.g. Lake Naivasha) ➢ Unsustainable agricultural practices ➢ Failure by institution to inform & mobilize the local communities on farms in efficient use e.g. drip irrigation, storage use ➢ Usage of high water intensive trees/crops e.g. eucalyptus trees, French beans ➢ On farms: over abstraction leading to depletion of water sources ➢ Encroachment of wetlands / riparian land ➢ Obstruction to water access points by farmers ➢ Conflict between the water supplier and farmers (competition for water)	➢ Using organic fertilizer ➢ Efficient water use systems, e.g. drip irrigation ➢ Water harvesting storage ➢ Treatment of waste-water for agriculture ➢ Less water-intensive crops, e.g. cowpeas, pulses, dryland maize (KDVs, KCBs), Nerica rice etc. ➢ Malkas: Opening access routes for pastoralists to access water along farming land

NEXUS Energy – Food

TRADE-OFFs	SYNERGIES
➢ Land use for energy crop/ mining ➢ Water to irrigate energy crop ➢ Crop rotation ➢ Use of more water for commercial beef production	➢ Energy development triggers agro-industry ➢ Energy crop for soil conservation ➢ Utilization of agricultural waste for energy ➢ Use of animal waste for energy production ➢ Solar farms in arid areas ➢ Agroforestry practice increases fuel-wood production & enriches soil fertility

(2) Barriers/ challenges & possible approaches

For the discussion of approaches the facilitator gave some input. As key interventions information and awareness raising as well as policy integration were mentioned. On basis of the input, the working groups selected the trade-offs and/or synergies of highest priority and discussed the challenges and possible approaches respectively.

NEXUS Water – Energy

BARRIERS/ CHALLENGES	APPROACHES
Case a) Pumping	
➢ High electric power costs ➢ Inconsistent power supply ➢ Insufficient efficiency of pumps ➢ Distance & gradient to consumer ➢ Low water quality	➢ Government sets standards and enforces pump specifications ➢ Encourage private power producers ➢ Applying innovations in energy efficiency and renewable energies ➢ Tax waivers on such innovations ➢ Urban design & development
Case b) Hydro Electric Power (HEP)	
➢ Water scarcity per capita, > 647 m3 ➢ Population growth & demand dynamics ➢ Human activities in water catchments (e.g. siltation) ➢ Concentration on large HEP plants ➢ Demand for same water for: Tourism, Agriculture, pastoralism, industry	➢ Water storage during El Nino & long rains ➢ Conglomeration of land & urbanization of rural areas ➢ Catchment areas protection ➢ Rainwater harvesting & implementation of the 3 Rs policy ➢ More exploitation of: micro, mini and pico-hydro ➢ Exploitation of alternative sources of energy (off grid)

Beyond the mentioned approaches, it has been highlighted that **research is necessary** especially regarding "energy for water": for lifting ground water, pumping water through canals & pipes, controlling water flows, treating water & waste water, desalinating brackish & sea water.

NEXUS Water - Food

BARRIERS/ CHALLENGES	APPROACHES
Case a) Conflict between the water supplier and farmers (competition for water)	
➢ Inadequate water resources ➢ Population pressure ➢ Climate change (Floods, droughts), unpredictable weather patterns ➢ Lack of political will	➢ Abstraction/ pollution survey (assessing abstraction for what use, amounts, how many beneficiaries, balance of water) ➢ Water allocation plan (WRMA): systematic use + regular review, scope to be widened (ground water, rivers, dams) ➢ Metering of abstractions, piping, canals, control devices (e.g. gates) ➢ Intensify enforcement to ensure compliance, i.e. with permitting conditions ➢ Providing/ enhancing/ clarifying inspection duties, WRMA ➢ Making work force (i.e. inspectors) available ➢ Encouraging farmers to build water reservation, storage & rain water harvesting (soil and water conservation measures) ➢ Stakeholder involvement (inform users about rights, obligations, application of public participation guidelines) ➢ Good political governance
Case b) Encroachment of wetlands/ riparian land	
➢ Lack of political will	➢ Intensify enforcement to ensure compliance, i.e. with permitting conditions ➢ Providing/ enhancing/ clarifying inspection duties, WRMA ➢ Making work force (i.e. inspectors) available ➢ Stakeholder involvement (inform users about rights, obligations, application of

	public participation guidelines) ➢ Good political governance

From all approaches, the good political governance and the stakeholder involvement were considered as the most important approaches.

NEXUS Food-Energy

BARRIERS/ CHALLENGES	APPROACHES
Case a) Land use for energy crop/ mining	
➢ Poverty ➢ Lack of alternative sources for generating income ➢ Unreliable data ➢ Breakdown of communication ➢ Inefficient agricultural production systems ➢ Lack of subsidies of energy crop ➢ Lock of proper pilot projects ➢ Land tenure system	➢ Policy reviews & enforcement ➢ Land use plans ➢ Provide financial instruments, innovative/ sustainable financing schemes (encouraging market forces) ➢ Institutional strengthening, capacity building (county CEC) ➢ Stakeholder involvement (MoA, MoE, MoW&I, landowners, NGOs etc.) ➢ Improve information sharing systems ➢ Advocacy (on basis of common interests) ➢ Social impact assessment
Case b) Energy development triggers agro-industry	
➢ High initial investment costs ➢ Lack of subsidies ➢ Lack of information ➢ Lack of technology and technology transfer ➢ Poor quality standards (e.g. missing for biogas) & enforcement	➢ Same approaches as above ➢ Promote & enhance technology transfer

From all approaches, policy review & enforcement as well as institutional strengthening were considered as the most important approaches. Approaches that cut across the three nexus are summarized as;

Information & Awareness raising

- Improving quality of data + information (science-based…)
- Reporting guidelines
- Developing information dissemination channels
- Information material
- Integrating nexus-issues into curricula

Policy integration *(normative, organizational, procedural)*

- A**: Horizontal** policy integration
- Legislation & regulation (e.g. EIA)
- Inter-ministerial & interdisciplinary expert committees
- Cross-sectoral departments in sector-ministries
- Strategic environmental assessments (SEAs)

B: **Vertical** policy integration

- Adequate allocation of responsibilities to administrative bodies
- Realignment of authority lines, supervision mechanisms
- Policy enforcement: environmental monitoring, supervision + inspection
- Definition of coordination and communication mechanisms in multi-level governance (esp. in consideration of decentralization in Kenya)

Identification of activities

In the third, last session the working groups identified some activities for those approaches, which were considered as the most relevant ones. The facilitator gave some examples:

APPROACH	ACTIVITIES
➢ Horizontal policy integration	➢ Assessment of inter-ministerial coordination ➢ Establishing an independent regular working group/ experts' committee ➢ Developing and introducing scenario + planning tools ➢ Reviewing EIA guidelines, SEA guidelines
➢ Awareness raising/ information disclosure	➢ Conducting scientific-based studies on nexus ➢ Compiling database(s) on good practices ➢ Introducing scenario + planning tools ➢ Developing understandable material for different target groups ➢ Organizing international seminars and conferences ➢ Guidelines for collecting, managing and reporting data & information *(Who should make available which contents to whom at what time?)*

The working groups were requested to define also the roles of the different stakeholders *(governmental bodies, academia, research institutes, associations, corporate sector etc.)* for various activities, as far as possible.

NEXUS Water - Energy

APPROACH	ACTIVITIES
➢ Urban design & development	➢ Stakeholder Consultative Meeting *(lead agencies, technical team, private sector, local community, political leaders)*

	➢ Mapping potential areas *(WRMA, Local authority, LoL, NEMA)* ➢ Zoning & setting setback lines *(WRMA, NEMA, Physical Planning)* ➢ Implementation & enforcement *(MoWI, MoL, Local authority)* ➢ Monitoring & evaluation (WRMA, NEMA, WSBs)
➢ Exploitation of alternative energy sources (off-grid), alternative to (large) HEP	➢ Assessing demand for energy (MoE, WASREB) ➢ Identifying current supply (MoE, KPLC) ➢ Evaluate potential alternative sources (MoWI, MoE, private companies) ➢ Feasibility studies (KAM, consultants, private sector) ➢ Implementation (private sector, MoE, development partners, local community, NEMA, CDF projects, local authorities) ➢ Monitoring & evaluation (NEMA, MoE, KAM)

NEXUS Water - Food

APPROACH	ACTIVITIES
➢ Good political governance	➢ Identifying direct & indirect stakeholders / and their roles and responsibilities ➢ Bringing them together (establishing a forum) on community level and analyze the conflict ➢ Formation of committees, sub-committees and working groups to address specifically identified conflict issues ➢ NEMA investigates a concrete problem through the public complaints committee, making the public complaints committee more effective ➢ Enhancing conflict solving capacities of environmental tribunals ➢ Harmonization of institutional responsibilities for resources (e.g. NEMA, MoW&I, WARMA, KWS, KFS, MoE, MoF, MoL, KARI, KEFI, KEPHIS) ➢ Harmonization of different conflicting acts, e.g. land act and water act

➢ Stakeholder involvement, information sharing	➢ Same activities from above ➢ Training of farmers how to use water more efficiently

NEXUS Food - Energy

Approach	Activity	Additional remarks
Policy reviews & enforcement	1. Identify key stakeholders in key ministries / sectors + county representatives + media 2. Create a platform for engagement 3. Identify gaps and develop recommendations for harmonization 4. Develop a policy brief 5. Create awareness through the media 6. Schedule monitoring and evaluation for enforcement	Engage independent evaluator e.g. coordination of research projects
Institutional strengthening : a) Academia b) Regulatory / Legal bodies c) Civil societies d) Research institutions e) Private sector & NGOs f) Media	Identified institutions will interact with point 1) + 2) from policy review approach, furthermore, their roles/activities should be: For a) develop relevant curriculum For b) enforcement and monitoring of enforcement For a+d+f) Translation of research into practice For c+e+f) knowledge transfer & skills development For a+d) increase funding for implementation of pilot projects For e) develop ppp platform	
Provide financial instruments		

(innovative/sustainable financing scheme – encouraging market forces		

ACTION POINTS

At the close of the workshop the following points were agreed upon on how to take agenda for the nexus forward.

i. Understand the status (study existing systems), the gaps and see how to address them in a new WFE approach
ii. Carry out a technology needs assessment within the three sectors
iii. Appraisal, adaptation of systems and adoption
iv. Incorporation of researchers from the three sectors in specific projects
v. Evaluation of technological options to make the best choice in terms of efficiency, acceptability and cost effectiveness
vi. Design of complete systems – micro-hydros, biogas systems
vii. Do proper planning of projects – do model projects and replicate
viii. Carry out resource mapping
ix. Proper technology management – ensure safe efficient technology
x. Patenting of local technologies
xi. Standardization and codes of system
xii. Information sharing
xiii. Technology management;
    - Study models from other regions on how to implement WFE nexus concept, and try to borrow ideas
    - A national research agenda should be done for the sectors and coordinate the activity to address the national priorities – advocacy
    - Carry out research in strategic areas
    - PPP – support for industry
    - Capacity building of juakali / other institutions
    - Stakeholders analysis

CONCLUSIONS AND RECOMMENDATIONS

The workshop was one of the first opportunities to bring together the stakeholders of all three sectors and to exchange ideas about current conflicts, i.e. negative externalities of one sector on the other. Of course, it was not possible to elaborate comprehensive strategies to address the most relevant trade-offs. However, some important ideas came up and they indicate, that there is a need to

- Harmonize legislation *(e.g. land act, water act with regard to riparian land)* and policy *(e.g. for land use of energy crop)*
- Developing more comprehensive plans *(e.g. water allocation plan, land use plans)*, involving other ministries *(e.g. involving water ministry and water sector institutions in the development & review of off-grid rural electrification plans (on basis of renewable energies)*
- Awareness raising and information about technical (innovative) solutions which have mutual benefits *(e.g. rainwater harvesting, exploitation of alternative sources of energy etc.),* promoting resource efficient solutions, *e.g. drip irrigation as water efficient irrigation system, energy efficient pumping systems etc.*
- Providing more reliable data *(e.g. regarding land use for energy crop, water abstraction survey etc.)*
- Enhancing monitoring, *e.g. monitoring of water abstraction (through metering) and monitoring of enforcement*
- Improving information dissemination/ sharing
- Improving policy enforcement *(e.g. inspection, environmental tribunals)*

It can be concluded, that all working groups (but mainly those on food – water and food-energy) considered **good political governance as very crucial** for getting a more integrated approach, for addressing existing trade-offs and for promoting win-win solutions. In this context, participants identified some important aspects, such as harmonization of legislation & policies and better enforcement of laws, standards and guidelines. **Institutional strengthening and harmonization of institutional responsibilities** were mentioned as **prerequisites** for a better political governance.

Stakeholder involvement, which is very closely linked to good governance, has also been identified as an important approach to mitigate conflicts between the sectors. There are guidelines and mechanisms in place, but it seems that first of all they **can be better**

implemented. Secondly, an effective stakeholder involvement **requires a regular dissemination of information** and, as it has been identified by working groups, a **training of target groups** (e.g. training of farmers on technical alternatives in agriculture such as efficient irrigation system, rain harvesting etc.).

Recommendation(s)

In consideration of the need for good political (environmental) governance it is recommended to choose a **two- stages approach**: As first step, awareness towards nexus issues can be raised through a **high level international experts' dialogue**, which brings together representatives of academia, research institutes of Kenya and Germany/ Europe with political leaders on nexus issues. The dialogue can be hold through workshops, seminars and conferences. In preparation of the workshops, (research) studies can be conducted, so that science-based information about trade-offs and synergies are available and can be presented to political leaders. In addition, studies and working papers can help to submit some recommendations to the GoK.

As second step, such a dialogue can also **function as a kind of "incubator" to identify hot topics and to develop concrete projects**, such as the harmonization of concrete acts from different sectors, strengthening of policy enforcement mechanisms, supporting local authorities to use public participation (guidelines) or research on selected issues. **For developing concrete projects, task forces** can be established by the experts' dialogue. In addition, a **call for proposals** can be launched to get concrete (pilot) projects. In this case, the experts' dialogue should have a secretariat.

The whole dialogue and the development of projects could be **realized with support of international/ bilateral donors.** For instance, the EU runs programmes on environmental governance worldwide.

APPENDIX I