



Ministry of Water, Sanitation and Irrigation



Energy and Mining Sectoral Integration Plan

KENYA WATER SECURITY AND CLIMATE RESILIENCE PROJECT

Implementation Support Consultancy (ISC) to Support
Strengthening of Water Resources Management and
Planning

August 2020



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Energy and Mining Sectoral Integration Plan

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Implementation Support Consultancy (ISC) to Support Strengthening of Water Resources Management and Planning

Prepared for:

Ministry of Water, Sanitation and Irrigation
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Executive Summary

E1. Background, context and objectives

The purpose of this Sectoral Integration Plan with regard to the **energy and mining sectors** in Kenya, is to ensure that the key findings and outputs from the six Basin Plans are properly integrated at sectoral level - in each of the six basins as well as in the country as a whole. The six major river basins of Kenya are Athi, Tana, Lake Victoria South (LVS), Lake Victoria North (LVN), Rift Valley (RV) and Ewaso Ng'iro North (ENN).

E2. Integrated Water Resources Management and Development Plan for the six basins

In order to comprehensively and systematically address the range of water resources related issues and challenges in the six basins and to unlock the value of water as it relates to socio-economic development, ten key strategic areas were formulated for the basins as shown below.

Table E1: Basin Plan - Key Strategic Areas and Objectives

	Key Strategic Area	Strategic Objective
1	Catchment Management	To ensure integrated and sustainable water, land and natural resources management practices
2	Water Resources Protection	To protect and restore the quality and quantity of water resources of the basin using structural and non-structural measures
3	Groundwater Management	The integrated and rational management and development of groundwater resources
4	Water Quality Management	Efficient and effective management of water quality to ensure that water user requirements are protected in order to promote sustainable socio-economic development in the basin
5	Climate Change Adaptation	To implement climate change mitigation measures in the water resources sector and to ensure water resource development and management are adapted and resilient to the effects of climate change.
6	Flood and Drought Management	To establish and guide a structured programme of actions aimed at ensuring the prevention of, mitigation of, timeous response to, and recovery from, the harmful impacts of floods and droughts across the Basin or specific catchment area.
7	Hydromet Monitoring	An operational and well-maintained hydromet network supported by effective and functional data management and information management systems
8	Water Resources Development	To develop water resources as a key driver for sustainable economic and social development
9	Strengthened Institutional frameworks	To achieve an appropriate balance between operational functionality and the need for effective oversight and governance.
10	Enabling environment to support effective institutions	Improved regulatory responses to strengthen catchment based water resources management

The national estimated budget which is required for implementation of integrated water resources management and development activities up to 2040 in all basins and across all KSAs equals about **29 billion USD**. The **energy and mining sectors** are linked to about **4 billion USD** of the National Budget as shown in Table E2, which summarises the proposed implementation budgets from all six Basin Plans up to a planning horizon of 2040, for activities that are relevant to the energy and mining sectors. The KSAs that demands the largest expenditure from an energy and mining sector perspective are KSA8: Water Resources Development and KSA4: Water quality management.

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Table E2 Summarised IWRM budget for implementation activities linked to energy and mining sectors under specific Key Strategic Areas

Key Strategic Areas and Themes		Budget (USD Million)				
		2020-2022	2022-2025	2025-2030	2030-2040	Total
KSA 1	Catchment management					
	Promote improved and sustainable catchment management					
	Sustainable water and land use and management practices	21	214	185	144	563
	Natural resources management for protection & sustainable use Rehabilitation of degraded environments					
KSA 2	Water resources protection					
	Classification of water resources					
	Reserve determination	2	5	11	11	28
	Determine Resource Quality Objectives Conserve and protect ecological infrastructure					
KSA 3	Groundwater management and development					
	Groundwater resource assessment, allocation and regulation					
	Groundwater development	26	90	60	64	240
	Groundwater asset management Conservation and protection of groundwater					
KSA 4	Water quality management					
	Effective data collection, information generation, dissemination, knowledge management	6	154	470	623	1 253
	Promote sound water quality management governance Efficient and effective management of point and nonpoint sources of water pollution					
KSA 5	Climate change adaptation and preparedness					
	Understand impacts on water resources at appropriate spatial scales Climate change mitigation	21	70	72	46	210

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Key Strategic Areas and Themes		Budget (USD Million)				
		2020-2022	2022-2025	2025-2030	2030-2040	Total
	Climate change adaptation					
KSA 6	Flood and drought management					
	Flood management Drought management	42	212	22	39	314
KSA 7	Hydromet monitoring					
	Improved monitoring network Improved information management	9	77	53	33	172
KSA 8	Water resources development					
	Groundwater development Hydropower development	4	58	739	464	1 265
KSA 10	Strengthen enabling environment to support institutions					
	Develop institutional capacities to support improved IWRM&D	28	48	22	30	129
Total		159	928	1 634	1 454	4 174

E3. Roadmap for sector integration

In order to ensure the successful implementation of the strategies and actions from the six Basin Plans and National Plan as they relate to energy and mining activities, a Roadmap for Implementation is proposed. This Roadmap proposes that before any actions identified under the KSA implementation plans are implemented, there are preceding critical activities. These are as follows (Figure E1):

1. Immediate KSA activities
 - a. Strengthening of institutional capacity and coordination;
 - b. Imminent infrastructure feasibility and impact assessments;
 - c. Expand on the basin plan knowledge base
2. Financial Resource Mobilisation for the KSA activities
3. Implementation of the short to long-term KSA activities
4. Monitoring and Evaluation of the KSA activities

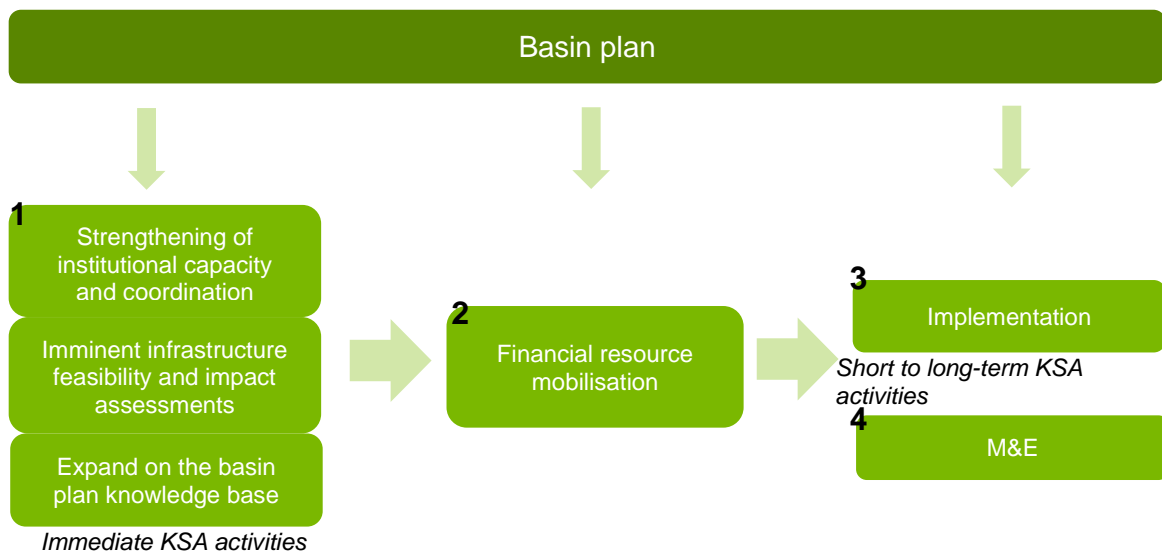


Figure E1: Roadmap for implementation of the Basin Plans

As the strengthening of institutional capacity and coordination is considered an immediate KSA activity, the engagement with role players from various institutions is a priority.

This Sectoral Integration Plan highlights KSAs and themes which are relevant to the **energy and mining sectors** and indicates what immediate actions are required.

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Abbreviations and Acronyms

ASAL	Arid or Semi-Arid Land
ASM	Artisanal and small-scale mining
BWRC	Basin Water Resource Committee
CAAC	Catchment Area Advisory Committee
CDA	Coast Development Authority
CFA	Community Forest Association
CG	County Government
CIDP	County Integrated Development Plan
CMS	Catchment Management Strategy
CMU	Catchment Management Unit
CWWDA	Coastal Water Works Development Agency
EMCA	Environmental Management and Coordination Act
EPRA	Energy and Petroleum Regulatory Authority
ERC	Energy Regulatory Commission
FEWS NET	Famine Early Warning Systems Network
FIT	Feed-in-Tariff
FRF	Flood Response Forum
GCA	Groundwater Conservation Area
GDC	Geothermal Development Company
GDE	Groundwater dependent ecosystem
GDP	Gross Domestic Product
GoK	Government of Kenya
IEA	International Energy Agency
IDP	Integrated Development Plan
IPP	Independent Power Project
IRENA	(International Energy Agency (IEA) & International Renewable Energy Agency
IWRM	Integrated Water Resource Management
KenGen	Kenyan Electricity Generating Company
KETRACO	Kenyan Electricity Transmission Company
KFS	Kenya Forest Service
KMD	Kenya Meteorological Department
KNCPC	Kenya National Cleaner Production Centre
KPC	Kenya Pipeline Company
KPLC	Kenyan Power and Lighting Company
KPRL	Kenya Petroleum Refineries Limited
KSA	Key Strategic Area
KWSCRIP	Kenya Water Security and Climate Resilience Project
KWTA	Kenya Water Towers Agency
Ksh	Kenyan Shilling
MoALF	Ministry of Agriculture, Livestock and Fisheries
MoE	Ministry of Energy

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MoEF	Ministry of Environment and Forestry
MoLPP	Ministry of Lands and Physical Planning
MoPM	Ministry of Petroleum and Mining
MoWSI	Ministry of Water, Sanitation and Irrigation
NAP	National Adaptation Plan
NCCAP	National Climate Change Adaptation Plan
NEMA	National Environment Management Authority
NEP	National Environment Policy
NET	National Environmental Tribunal
NGO	Non-Governmental Organisation
NIB	National Irrigation Board
NLC	National Land Commission
NOCK	National Oil Corporation of Kenya
NWHSA	National Water Harvesting and Storage Authority
NWMP	National Water Master Plan
NWQMS	National Water Quality Management Strategy
PDB	Permit Database
PPA	Power Purchase Agreements
PV	Photovoltaic
REA	Rural Electrification Agency
REREC	Rural Electrification and Renewable Energy Corporation
RO	Regional Office
RQOs	Resource Quality Objectives
SANBI	South African National Biodiversity Institute
SCMP	Sub-Catchment Management Plan
SME	Small and Medium Enterprise
SOPs	Standard operating procedures
SRO	Sub-Regional Office
TARDA	Tana and Athi River Development Authority
USAID	United States Agency for International Development
WASREB	Water Services Regulatory Board
WRA	Water Resources Authority
WRM	Water resources management (also integrated WRM)
WRMA	Water Resources Management Authority
WRUA	Water Resource User Association
WSP	Water Service Provider
WWDA	Water Works Development Agency

1 Introduction

1.1 Background and context

Kenya is a water-scarce country and its water resources are currently threatened by various issues. Addressing these issues demand capacity for comprehensive water resources management and planning, coupled with extensive investment in climate resilient water infrastructure. To address these challenges, and to give effect to the constitutional requirement for devolution of functions from National to County level, the Government of Kenya has embarked on a wide-ranging water sector reform programme. As part of this programme, the Government of Kenya received financing from the World Bank toward the cost of implementing the Kenya Water Security and Climate Resilience Project (KWSCR-1), to be implemented through the Ministry of Water, Sanitation and Irrigation (MoWSI).

This Sectoral Integration Plan constitutes one of the deliverables under Sub-component 2.2 of the KWSCR-1. This sub-component aims to strengthen the capacity of the Water Resources Authority (WRA) as it relates to water resource management and planning through the development of tools, skills and infrastructure to deliver on its mandate. The outcome will be a stronger WRA institution that has strengthened capacity to carry out its core functions with regard to integrated basin management and planning in a manner that is based on extensive knowledge-driven analysis and that meets the expectations of key stakeholders.

1.2 Objectives of the Sectoral Integration Plan

Integrated Water Resources Management (IWRM) considers the environmental, social and economic aspects of a river basin, and ensures that these aspects are integrated into an overall management strategy. It aims to achieve a sustainable balance between the utilisation, development and protection of water resources.

The purpose of this Sectoral Integration Plan with regard to the **energy and mining sectors** in Kenya, is to ensure that the key findings and outputs from the six Basin Plans which were developed under KWSCR-1 are properly integrated at sectoral level - in each of the six basins as well as in the country as a whole.

Figure 1-1 displays the 6 major river basins of Kenya viz Athi, Tana, Lake Victoria South (LVS), Lake Victoria North (LVN), Rift Valley (RV) and Ewaso Ng'iro North (ENN).

1.3 Structure of the Sectoral Integration Plan

This report is structured as follows:

Section 2 provides an overview of the energy and mining sectors in Kenya and summarises key issues, challenges and trends in relation to these sectors.

Section 3 presents an institutional overview, from a sectoral and IWRM perspective, in relation to energy and mining in Kenya.

Section 4 presents strategies and themes which relate to the energy and mining sectors in Kenya, under ten key strategic areas

Section 5 summarises key outputs, presents the broader context, and provides high-level budgets and timelines for integration of the Basin Plans with the energy and mining sectors.

Section 6 provides a conclusion.

Section 7 lists references.

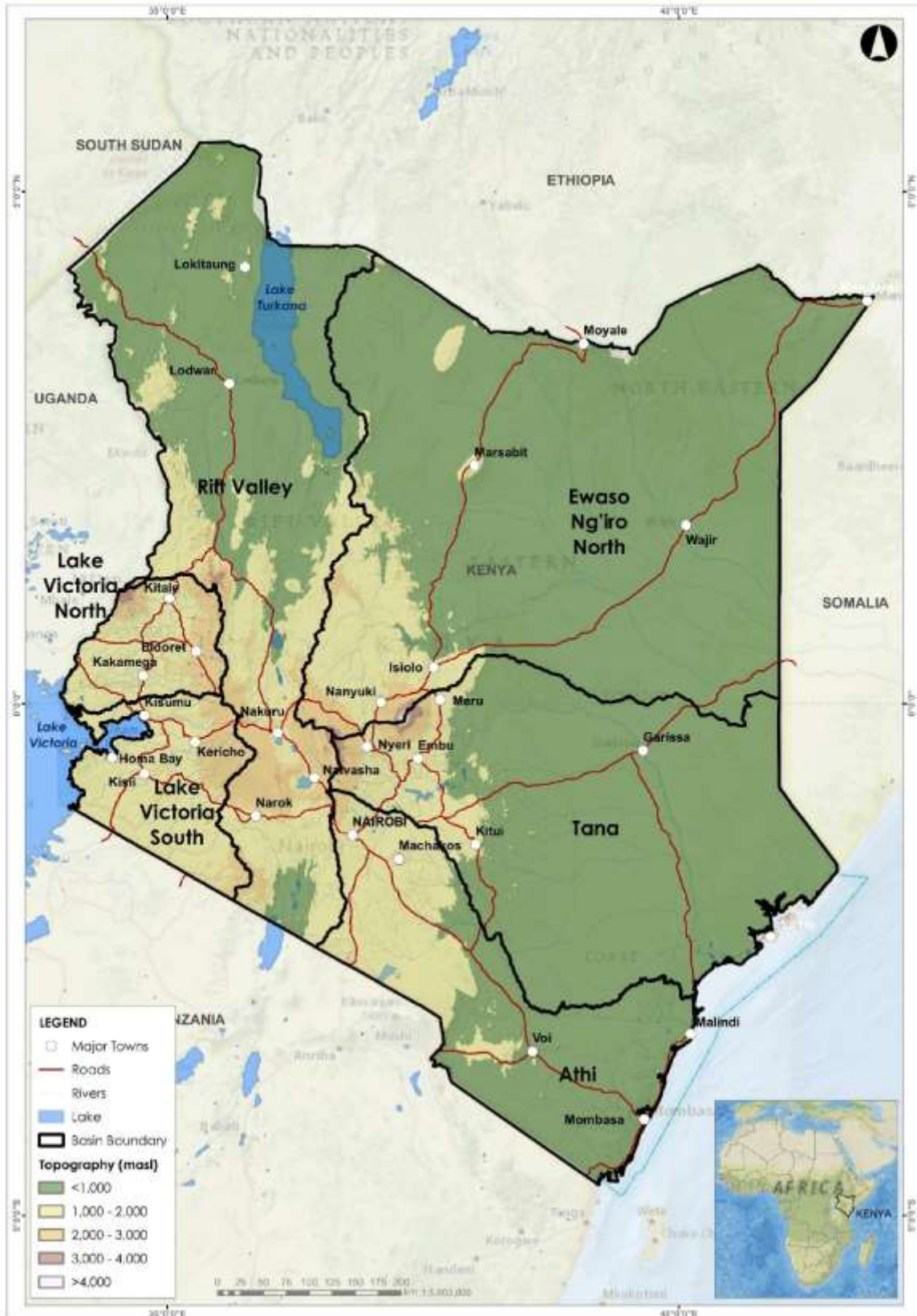


Figure 1-1: Overview map

2 Sectoral overview

2.1 Introduction

Water is crucial for the energy and mining sectors. In fuel production, water is used in resource extraction, irrigation of biofuel crops, fuel refining and processing. Power generation also requires water for cooling processes-related to thermal- and nuclear power plants. Hydropower generation is seen as a non-consumptive water use, but still requires the diversion, damming and controlled release of water.

Mining and energy production can require large volumes of water, impose increased risk of water pollution, and result in the alteration of natural environments and watercourses (IEA, 2012). The 2014 United Nations Report on Water and Energy (UNESCO, 2014) provides useful insights that can be applied as a framework for understanding the relationship between energy and water. Table 2-1 presents key water uses for energy and their associated potential water quality impacts.

Table 2-1: Key water uses for energy and potential water quality impacts

	Uses	Potential water quality impacts
Primary energy production		
Oil and gas	<ul style="list-style-type: none"> Drilling, well completion and hydraulic fracturing. Injection into the reservoir in secondary and enhanced oil recovery. Oil sands mining and in-situ recovery. Upgrading and refining into products. 	Contamination by tailings seepage, fracturing fluids, flowback or produced water (surface and groundwater).
Coal	<ul style="list-style-type: none"> Cutting and dust suppression in mining and hauling. Washing to improve coal quality. Re-vegetation of surface mines. Long-distance transport via coal slurry. 	Contamination by tailings seepage, mine drainage or produced water (surface and groundwater).
Biofuels	<ul style="list-style-type: none"> Irrigation for feedstock crop growth. Wet milling, washing and cooling in the fuel conversion process. 	<ul style="list-style-type: none"> Contamination by runoff containing fertilisers, pesticides and sediments (surface and groundwater). Wastewater produced by refining.
Power generation		
Thermal (fossil fuel, nuclear and bioenergy)	<ul style="list-style-type: none"> Boiler feed, <i>i.e.</i> the water used to generate steam or hot water. Cooling for steam-condensing. Pollutant scrubbing using emissions-control equipment. 	<ul style="list-style-type: none"> Thermal pollution by cooling water discharge (surface water). Impact on aquatic ecosystems. Air emissions that pollute water downwind (surface water). Discharge of boiler blowdown, <i>i.e.</i> boiler feed that contains suspended solids.
Concentrating solar power and geothermal	<ul style="list-style-type: none"> System fluids or boiler feed, <i>i.e.</i> the water used to generate steam or hot water. Cooling for steam-condensing. 	<ul style="list-style-type: none"> Thermal pollution by cooling water discharge (surface water). Impact on aquatic ecosystems.
Hydropower	<ul style="list-style-type: none"> Electricity generation. Storage in a reservoir (for operating hydro-electric dams or energy storage). 	<ul style="list-style-type: none"> Alteration of water temperatures, flow volume/timing and aquatic ecosystems. Evaporative losses from the reservoir.

Source: (IEA, 2012)

At the basis of the water-energy nexus is the realisation that water is a renewable energy resource, that is unique, irreplaceable, and difficult to move beyond the pull of gravity. A further distinction is made between water resources and water services. Water resources management refers to the planning, development and management of water resources in a sustainable way. With regard to water quantity and quality, water services management refers to development and management of infrastructure to capture, treat, transport and deliver water to the end user, while at the same time capturing the waste water for treatment and safe discharge or reuse. Consequently, it can be derived that energy is required for provision of water services, whilst water resources are required in the production of energy. Thus, as the country moves from fossil fuels to renewable energies, there will be implications on both water resources and services management.

Kenya is rich in mineral resources, however most of the country's mineral resources remain unexploited and the mining sector is still greatly underdeveloped. The contribution of the mining sector to the GDP is still low at less than 1%. Exploration activities have indicated that the country is potentially rich in rare earth minerals, and increased exploration is expected to lead to new mineral discoveries. The GoK has recognized the mining sector as a key sector for Vision 2030, and has recently included oil, gas, and other minerals as the seventh priority sector with a high potential of spurring economic growth.

The mining sector in Kenya is a Ksh 23.279 billion (US\$ 0.25 billion) industry, with the highest value production associated with titanium ore and soda ash. Over the last 5 years, quantities of minerals mined have increased, with the exception of gold production, and Fluorspar whose production declined by about 7%. This is mainly attributed to the temporary closures of mining operations and production constraints following low demand and slump in prices since 2013.

This section provides an overview of the **energy and mining sectors** and how they relate to integrated water resources management. Furthermore, a brief overview of existing issues, challenges and trends are discussed.

2.2 Energy

External pressures that drive increasing water demands, also play influential roles in the growing demand for energy. These demands are fundamentally driven by social development, the need for increasing living standards, economic growth and technological development. A key difference between water and energy development, is that market forces tend to play a much more important role with respect to energy sector development, where the development and management of water resources have historically been more of a socio-political duty (UNESCO, 2014).

The energy sector in Kenya relies on three main sources of energy: biomass, petroleum and electricity at 68%, 21% and 9% of total energy consumption. The remaining 2 % consisting of solar and other forms of energy. For an economy that relies heavily on wood fuel and biomass as its largest energy source, the progression to increased use of costlier renewable energy sources can be challenging in the face of oil and coal discoveries that could provide a more readily available energy source.

2.2.1 Renewable Energy

2.2.1.1 Hydropower

The recognition of hydropower as a national resource in Kenya dates to the early 1920s. Early systems were all small hydropower schemes comprising of micro- and mini hydro systems. Most of these power systems were used for maize milling, water pumping and saw milling. Hydropower to date is one of Kenya's most successful and sustainable energy resources with a current installed capacity of 820 MW, approximately 35% percent of the total national capacity (MoEP, 2017c). The majority of hydropower generation originates from 8 large hydropower stations, which all have their own reservoir and have installed generation capacities exceeding 20 MW.

Large hydropower

The Tana River's Seven Forks Falls was identified in 1914 as having high potential for hydropower development. However, the scale and size of the plant would wait for over fifty years to be developed with the Kindaruma Dam and Hydroelectric Power Station, a relatively low head plant commissioned in 1968. The Kindaruma hydropower scheme (74 MW) was followed with the commission of Kamburu (94 MW) in 1973, Gitaru (225 MW) in 1978, Kiambere (165 MW) in 1988, and Turkwel (106 MW) in the Rift Valley Basin in 1991. Since then, limited hydropower development has taken place, with the run-of-the-river Sondu Miriu scheme (60 MW) developed in 2007 and associated downstream tailrace Sangoro hydropower plant (20 MW) in 2013 (MoEP, 2017d). In order to increase generation capacity, the GoK has upgraded a number of existing hydro power plants. These upgrades include Tana (14.4 to 19.6 MW), Kiambere (144 to 165 MW) and Kindaruma (48 to 72 MW). Table 2-2 presents details on the current operational large hydropower plants operated by KenGen.

Table 2-2 Operational KenGen large hydropower plants

Plant	Drainage Basin	River	Year Commissioned	Installed Capacity (MW)
Kindaruma	Tana	Tana	1968	72
Kamburu	Tana	Tana	1973	94
Gitaru	Tana	Tana	1978	225
Masinga	Tana	Tana	1981	40
Kiambere	Tana	Tana	1988	168
Tana 1-6	Tana	Maragua	2009	20
Turkwel	RV	Turkwel	1991	106
Sondu Miriu	LVS	Sondu	2007	60
Sangoro	LVS	Sondu	2013	21
TOTAL				806.2

Source: (KPLC, 2017c; KenGen, 2017f)

Kenya has an estimated hydropower potential (large- and small-scale schemes) of 6 000 MW, which remains mainly unexploited. The economically significant hydropower potential, i.e. which is cost-effective with the current technologies, is estimated at 1 449 MW, of which large projects with a capacity of 30 MW or more account for 1 249 MW. This additional capacity should result in electricity generation of 5,605 GWh per annum and is located in the 5 major drainage basins: Lake Victoria (295 MW), Rift Valley (345 MW), Athi River Basin (84 MW), Tana River Basin (800 MW) and Ewaso Ng'iro North River Basin (146 MW) (MoEP, 2015a; IEA, 2015). Feasibility studies have already been carried out for a number of hydropower related projects and information of proposed development per basin is presented in Table 2-3.

Table 2-3 Proposed hydropower development schemes

Basin	River	Hydropower Scheme	Developer	Installed Capacity (MW)	Comments
LVN	Yala	Nandi Forest Dam	LBDA	50	TA procurement to be reconsidered (2017)
	Nzoia	Nzoia Dam (34B)	WKCDD/FM	16	F/S, ESIA completed (2014)
	Nzoia	Nzoia Dam (42A)	WKCDD/FM	25	F/S, ESIA completed (2014)
Sub-total				91	
LVS	Sondu	Magwagwa Dam	LBDA	115	TA procurement to be reconsidered (2017)
	Kuja	Nyatike Dam	NIB	15	RFP (2017)
Sub-total				130	

Kenya Water Security and Climate Resilience Project

Basin	River	Hydropower Scheme	Developer	Installed Capacity (MW)	Comments
RV	Arror	Arror Dam	KVDA	80	RFP (2015)
	Embobut	Embobut Dam	KVDA	45	RFP (2015)
	Kerio	Kimwarer Dam	KVDA	20	RFP (2015)
	Ewaso Ng'iro South	Oletukat Dam ²	ENSDA	36	F/S, D/D completed (2014)
	Ewaso Ng'iro South	Leshota Dam ²	ENSDA	54	F/S, D/D completed (2014)
	Ewaso Ng'iro South	Oldorka Dam ²	ENSDA	90	F/S, D/D completed (2014)
			Sub-total	325	
Athi	Athi	Munyu Dam	TARDA	40	F/S Stage (2017)
	Athi	Thakwe Dam	TARDA	20	Contractor appointed (2017)
	Mwache	Mwache	MORDA	34	Detail design and main construction contracts procurement (2017)
				Sub-total	94
Tana	Tana	Karura	KenGen	60	F/S completed (2011)
	Tana	High Grand Falls ¹	TARDA	700	ESIA completed (2016)
	Mutonga	Mutungura	MHCL	7.8	AfDB Funding received (2017)
				Sub-total	767.8
TOTAL				1 407.8	

¹ - Phase 1 - 500 MW, additional 200 MW during Phase 2

² - LENSDEP Project (ENSDA, 2017)

Source: (WRMA, 2013; KenGen, 2017f; MoEP, 2015a)

The GoK, through the former Ministry of Regional Development Authorities (MoRDA), commissioned a feasibility study in 2010 for a multi-purpose hydropower project on Tana River, approximately 50 km downstream of the Kiambere hydropower plant. The study was completed in 2012 and reveal hydropower development potential of 500 MW (stage 1) and an additional 200 MW (stage 2) associated with the construction of the High Grand Falls Power Project (Egis, 2017). The proposed 115 m high, 5.7 billion cubic meters capacity, multipurpose High Grand Falls Dam is estimated to cost close to Ksh 200 billion. The project is envisioned to improve living standards of local inhabitants, stimulate economic growth and provide food- and electricity supply security. The Tana and Athi River Development Authority (TARDA) now intends to commission development of this project and a full Environmental and Social Impact Assessment (ESIA) for the project was completed in March 2016 (KenfaceEnconsults (Africa) Ltd, 2016). The objective of this study was to ensure that the potentially adverse environmental and social impacts of the project can be minimized and the positive impacts enhanced.

The dam's construction will start in Marimanti in Tharaka Nithi, which will also be the location of the coordination and site office. It is estimated that construction will be completed over 6 years and an



estimated 1,629 households or 9,194 people in the dam's 165 km² inundation area will need to be relocated (KenfaceEnconsults (Africa) Ltd, 2016). The GoK and TARDA have already engaged in public sensitization and resettlement plans to ensure that local communities are informed on the progress of the project (TARDA, 2017; Construction Business Review, 2017). An additional feasibility study in the same project area also indicated potential for an additional 60 MW power generation at the Karura Hydropower plant.

Source: (Egis, 2017)

Figure 2-1 Rendering of the proposed High Grand Falls Dam

Small Hydropower

Approximately half of the Kenya 6 000 MW hydropower potential stems from small-scale hydropower development. The total estimated potential of small (< 10 MW capacity) hydro systems is 3,000 MW of which about 30 MW has been developed. The development of small-scale hydro is undertaken by both the GoK and private investors. Operational plants have varying ownership structures including private, community or public ownership models. Most of the IPP and Government schemes are operational and generally in good condition, while most of the community schemes are in need of significant refurbishment (UNIDO, 2016; MoEP, 2015a). Details on the operational small hydro plants for KenGen and IPP based plants are presented in Table 2-4 and Table 2-5 respectively.

Table 2-4 Operational KenGen small hydropower plants

Plant	Drainage Basin	River	Year Commissioned	Installed Capacity (MW)
Mesco	Tana	Maragwa	1933	0.38
Ndula	Tana	Thika	1925	2
Sagana Falls	Tana	Sagana	1955	1.5
Wanji	Tana	Maragwa	1952	7.4
Sosiani	LVN	Sosiani	1955	0.4
Gogo Falls	LVS	Gucha	1958	2
TOTAL				13.7

Source: (KenGen, 2017f; UNIDO, 2016)

Table 2-5 Operational IPP small hydropower plants

Plant	Year Commissioned	Developer	Installed Capacity (MW)
James Finlay 1-5	1934-1999	James Finlay	2.21
Brooke Bond 1-4	-	Brooke Bond	0.63
Savani	1927	Eastern Produce	0.24
Diguna	1997	Missionary	0.09
Tenwek	-	Missionary	0.32

Kenya Water Security and Climate Resilience Project

Plant	Year Commissioned	Developer	Installed Capacity (MW)
Mujwa	-	Missionary	0.07
Community MHPs	2002	-	0.02
ReGen-Terem	2017	Idea Power and Gen Pro	5.0
TOTAL			8.58

Source: (WRMA, 2013; UNIDO, 2016; KPLC, 2017c)

Proposed private sector hydropower projects typically entail Feed-in-Tariffs (FiTs) and Power Purchase Agreements (PPAs). There are currently 26 proposed IPP hydropower projects under investigation in Kenya with a combined potential capacity of 136 MW. Four of these projects are proceeding to financial close stage, 8 projects are under PPA negotiations, and the remaining projects (14) are still the subject of feasibility studies. To have been issued with or applying for PPAs means that the projects have proof of land acquisition, access or usage rights, a grid connection plan, a full technical and economic feasibility study, and an approved Environmental Impact Assessment (MoEP, 2015e).

The FITs for hydropower plants of varying installed capacity are presented in Table 2-6. Distinct from other renewable energy FITs, the value of the small hydro FIT is calculated depending on the exact installed capacity ranging from US\$ 0.105/kWh for plants with a capacity of 0.5 MW to US\$ 0.0825/kWh for plants with a capacity of 10 MW. These are regulated tariffs for the sale of generated renewable energy to the national grid by IPPs. For hydro installations with installed capacities larger than a 10 MW, a constant FIT of US\$ 0.0825/kWh is used.

Table 2-6 Feed-in tariffs (FiTs) for renewable hydropower projects connected to the grid

Technology	Capacity category	Installed Capacity (MW)	Standard FiT (US\$/kWh)	% Scalable portion of the Tariff	Min Capacity (MW)	Max Capacity (MW)	Max cumulative capacity (MW)
Hydro	< 10 MW	0.5 - 10	0.105	8%	0.5	10	-
		10	0.0825	-	-	-	-
	> 10 MW	10.1 - 20	0.0825	8%	10.1	20	500

Source: (MoE, 2012)

Note: For values between 0.5 MW and 10 MW, interpolation shall be applied to determine tariff

Kenya Tea Development Agency (KTDA) Power Company (KTPC), a subsidiary of KTDA-Holdings, in conjunction with KTDA, have invested in a number of small hydropower projects to reduce the energy costs associated with factory production by an estimated 30%. KTPC Power has 3 operational small hydro plants (see Table 2-7) and is implementing 12 small hydro projects which are at various stages of project development (see Table 2-8). KTPC intends to sell surplus back to the national grid.

Table 2-7 KTPC operational small hydropower plants

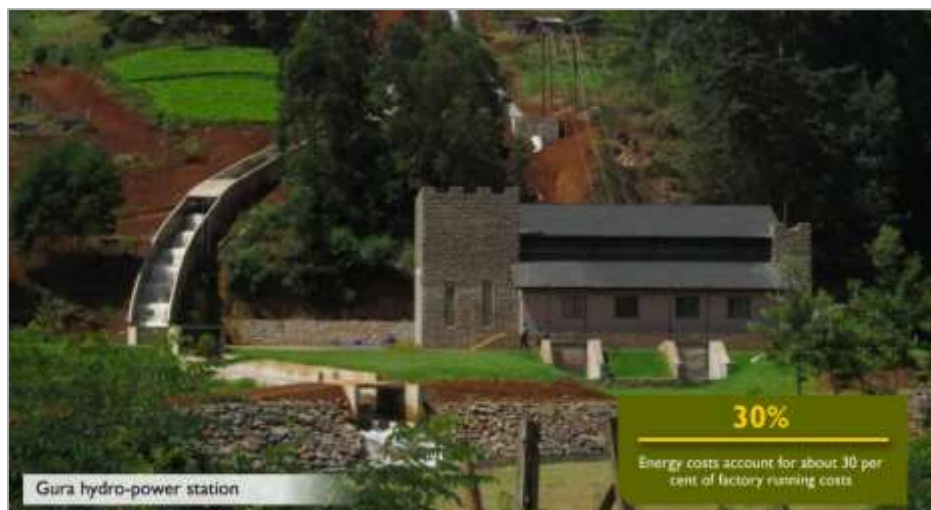
Plant	Year Commissioned	Installed Capacity (MW)	County
Imenti	2008	1	Meru
Gura	2016	5.8	Nyeri
Chania	2016	1	Kiambu

Source: (KTDA, 2017)

Table 2-8 KTPC proposed small hydro development projects and project stage

Plant	Proposed Capacity (MW)	County
1. Construction Stage		
Nyambunde	2	Kisii
Lower Nyamindi	1.8	Kirinyaga
South Mara	2.2	Tharaka Nithi
North Mathioya	5.6	Muranga
Iraru	1.5	Meru
2. Tender Stage		
Chemosit	2.5	Kericho
Kipsnooi	3.6	Bomet
Rupingazi	1.5	Embu
3. Design Stage		
Kiringa	2.5	-
Ura	2.5	-
Kathita	2.5	-
Kiptiget	2.5	-
4. Feasibility Stage		
Nyamasege	1.5	-
Taunet	-	-
Kapolet	-	-

Source: (KTDA, 2016; KTDA, 2017)



Source: (KTDA, 2017)

Figure 2-2 Gura Hydropower station in Nyeri county with installed capacity of 5.8 MW

2.2.1.2 Geothermal Energy

The East African Rift Valley holds a vast amount of geothermal resources, particularly in Kenya and Ethiopia. Geothermal exploration in Kenya started with the drilling of two wells in 1956 at Olkaria to a depth of 950 m. In Kenya, development of geothermal resources is being carried out by the Government, through the Geothermal Development Company (GDC), KenGen and IPPs. Geothermal energy is predominantly used for power generation with the total output into the grid currently estimated at 673 MW (see Table 2-9). In the agriculture sector, geothermal based energy is also used for heating

of greenhouses and drying of cereals and grains. Geothermal energy has also been used for recreational purposes through development of natural spas and steam baths at Olkaria and Lake Bogoria (MoEP, 2013).

Table 2-9 presents a summary of the installed capacity at operational geothermal plants in Kenya.

Table 2-9 Total installed Geothermal Capacity by energy producer

Plant	Installed Capacity (MW)
KenGen	
Olkaria I	45
Olkaria II	105
Olkaria IV	149.8
Olkaria I AU	150.5
Eburru Hill	2.5
Wellhead 37	10.5
Wellhead 43	12.8
Wellhead 914	27.8
Wellhead 915	20.0
Wellhead #	10
Sub-total	534
Ormat Technologies	
Olkaria III	139
Sub-total	139
TOTAL	673

10 MW wellhead development during 2017 (KenGen, 2017a)
Source: (KenGen, 2017c)

Olkaria Geothermal Field

■ **Olkaria I (45 MW)**

The Olkaria I power station was the first geothermal power plant to be built in Africa. The plant was developed in three phases with an increase of electricity generating capacity of 15 MW per unit. The first unit was commissioned in June 1981, the second in November 1982, and the third in March 1985. Since commissioning, the Olkaria I plant has had an average availability factor of over 95 percent.

■ **Olkaria II (105 MW)**

Construction on the 70 MW Olkaria II power station, located in the North-eastern sector of the greater Olkaria geothermal field, began in 2000 after funding was made available. The second phase of Olkaria II was commissioned in 2010, adding an extra 35 MW of power generation capacity.

■ **Geothermal Wellhead units (75.6 MW)**

Through the development of well head condensing technology, KenGen warrants the early development, pending construction, of large scale geothermal power plants. The company has to date implemented a total of 14 well head generation units with a total capacity of 75.6 MW. Construction of the plants started in 2009 and commissioning of all the power plants was completed in December 2016 (KenGen, 2017b).

Additionally, a pilot wellhead plant of 2.5 MW has been commissioned at Eburru Hill. The Oserian Development Company has developed two small scale plants to power their rose farm facilities with a total capacity of 4 MW.

■ **Olkaria III (140 MW)**

The Olkaria III power station developed by Ormat Technologies, was commissioned in 2000 with a generation capacity of 13 MW. An additional 35 MW unit was added to the plant's capacity in 2009, with a later third unit adding an additional 36 MW. The third and fourth generation units, each with capacity of 26 megawatts, was commissioned in 2014 and 2016 respectively, bringing the total capacity of the plant to 139 MW.

■ **Olkaria IV Power Station (280 MW)**

The Olkaria IV plant comprises two developments: the 140 MW Olkaria IV units 1 & 2 and the 140 MW Olkaria I additional units 4 & 5. The two plants were commissioned in October 2014 and February 2015 respectively. The 280 MW plant is the largest single site geothermal plant in the world.

Geothermal Potential

A total of 14 geothermal prospects have been identified across 3 regions in Kenya with energy generation potential ranging between 1,000 MW and 7,000 MW. The Central Rift is estimated to host geothermal capacity of 1,800 MW, South Rift of 2,450 MW and North Rift of 3,450 MW. Geothermal is one of the most promising sources of renewable energy in Kenya as it has limited environmental impact, it's immune to adverse effects of climate change, it has the highest capacity factor (95%) and a significant amount of local research and technical experience has been built up in this sector. Consequently, the GoK through the Geothermal Development Company (GDC) launched a Geothermal Development Plan aimed at installing a geothermal capacity of 1,120 MW by 2018 expanding to 4,060 MW by 2031 (IEA, 2015).

The GDC has also contracted three independent power producers through a competitive international open tender. Each of the three contracted firms will build and operate a 35 MW geothermal power plant in Menengai for 25 years. Once the 105 MW power plants are commissioned, GDC will be earning an estimated additional Kshs 1.7 Billion in annual steam sales revenue (GDC, 2017).

Geothermal projects typically progress through stages of investigation, surface exploration, feasibility studies, exploratory drilling, appraisal drilling, production drilling, steam field development and power plant construction stages (MoEP, 2015a).

2.2.1.3 Biomass

Biomass fuels are the largest source of primary energy in Kenya with wood-fuel (firewood and charcoal) accounting for about 68% of the total primary energy consumption. About 55% of this consumption is derived from farmlands in the form of woody biomass, crop residue and animal waste. The remaining 45% is derived from forests (MoEP, 2015a).

The unsustainable use of wood fuel as primary energy source in rural communities have severe environmental impacts associated with deforestation and land degradation. The national forest cover in 2010 was calculated as 7%. Protected forest areas cover about 3.2% of the total land area, however this does not include the recently gazetted Boni Forest (MENR, 2016).

Wood fuel supply management is crucial to ensure a sustainable supply for a growing energy demand. Degradation of upper basin catchments, due to deforestation, burning and poor agricultural practices (including steep slope cultivation) results in an increase in both the frequency and severity of flash floods. This causes heavy erosion and high siltation of rivers as well as infrastructure breakdown.

The Kenyan Government has promoted agro-forestry and social forestry programmes to increase the stock of woody biomass combat the loss of forest trees as forested areas are converted into agricultural and settlement land. This is a multidisciplinary effort involving the ministries responsible for energy, agriculture and environment and natural resources. Other efforts include developing sustainable plantations of fast growing tree species, integrating wood fuel into the farmland system, improving the

current technologies that use charcoal and improving the legal and regulatory framework (GLI, 2017; KFS, 2015).

2.2.1.4 Biofuels

The conversion of biomass to liquid fuels such as bioethanol and biodiesel, referred to as biofuels, are of particular interest as a substitute for petroleum. The use of an alternative energy source to petroleum would reduce Kenya's current dependency on the importation of oil, resulting in beneficial effects on the economy and local job creation.

Bioethanol

A strategy for introduction of biofuel blends in the market was developed by the Government of Kenya in 2010. Facilities for ethanol-petrol blending have been completed in Kisumu to be followed by Eldoret and Nakuru. Ethanol, also known as ethyl alcohol or grain alcohol, is a liquid fuel that can be produced from a variety of sugars and starch containing crops, such as grains, sugarcane and sweet sorghum (MoEP, 2015a). The main use of ethanol as an energy source is as E10 fuel, a 10% ethanol blend with petrol. The advantage of this low percentage blend is that it does not require any modification of engines to be used as fuel.

The Kenyan ethanol industry comprises two main producers, Muhoroni Agrochemical & Food Company and Spectre International, which, together, have capacity of 125,000 lpd. However, the current supply of molasses, the only feedstock available in Kenya, does not enable more than 60,000 lpd production. Fulfilling the entire capacity would require land to be set aside for production of energy crops as feedstock for biofuels (MoEP, 2015a; IEA, 2015).

Biodiesel

Biodiesel is a very good substitute for petroleum-based diesel. Biodiesel is a liquid substitute for petroleum-based diesel fuel made with vegetable oil derived from a wide variety of oil-bearing plants such as castor, coconut, cottonseed, croton and jatropha. At the rural level, biodiesel can be used to benefit the rural communities, by using community managed bio-diesel electricity generators to provide lighting for households. Vast areas of marginal lands in Kenya also offer an opportunity for growing crops that are well suited to such conditions and to rehabilitate the lands for future use. Specifically, Jatropha which is a drought resistant perennial plant can be adopted as a biodiesel feedstock.

Biodiesel consumption in Kenya is however currently extremely limited, principally because most of the motor vehicles are petrol-powered. There is also a need to diversify rural energy sources by promoting substitution of kerosene with biodiesel and the use of decentralized energy systems (MoE, 2008; MoEP, 2015a).

2.2.1.5 Biogas

Biogas is typically produced through the process of anaerobic digestion of biodegradable materials such as sewage, municipal waste, animal- and plant waste. Even though biogas is not used for large scale energy production, a number of pilot and small commercial biogas facilities for heat and electricity generation have been constructed in Kenya.

According to the feasibility study, 'Promoting Biogas Systems in Kenya', commissioned by Shell Foundation in 2007 (Biogas for Better Life, 2007), a high proportion of the domestic biogas digesters in Kenya either operated below capacity, were dormant, or in complete disuse after construction. The report further indicated that only 30% of the 2,00 biogas plants earlier constructed were fully operational at the time of the study. Currently, it is estimated that the country has 20,000 biogas systems, which is a large improvement although indicated potential is much higher (MoEP, 2017c).

The estimated 20,000 domestic biogas plants in Kenya were constructed under the following programmes:

- i) 17,000 digesters constructed in 36 counties in five years, under the Kenya Biogas Programme supported by the Dutch Government. Phase I of the programme (2009-2013) with Ksh 25,000 subsidy achieved the construction of 12,000 digesters against a target of 8,000. Phase II (2014-2018) without subsidy, has a target of 26,500 biogas plants.
- ii) Approximately 1,000 digesters constructed by MoEP - Energy Centres. An annual average of 50, mainly floating drum types, additional on-site demonstrations and technical support offerings to the clients.
- iii) Approximately 2,000 digesters have been installed by private domestic biogas entrepreneurs, including Takamoto, Sustainable Energy Strategies, Taita Biogas Ltd. and Afrisol.

In 2011, the Ministry of Energy (MoE) initiated pilot projects for electricity generation from cut flower waste in Kiambu and Kajiado counties, with a view to scaling up the generation of electricity from other biogas sources (MoEP, 2015a). A number of large-scale digesters using biogas for power generation have been installed including the Gorge Farm - Biojoule 1 (2 MW) which utilises agro waste and Pine Power Ltd (1.15 MW) at Kilifi using sisal waste and manure. Potential capacity derived from floriculture is estimated to amount to 20 MW and that from sisal industry 10 MW (MoEP, 2015a; MoEP, 2017c).

2.2.1.6 Wind Energy

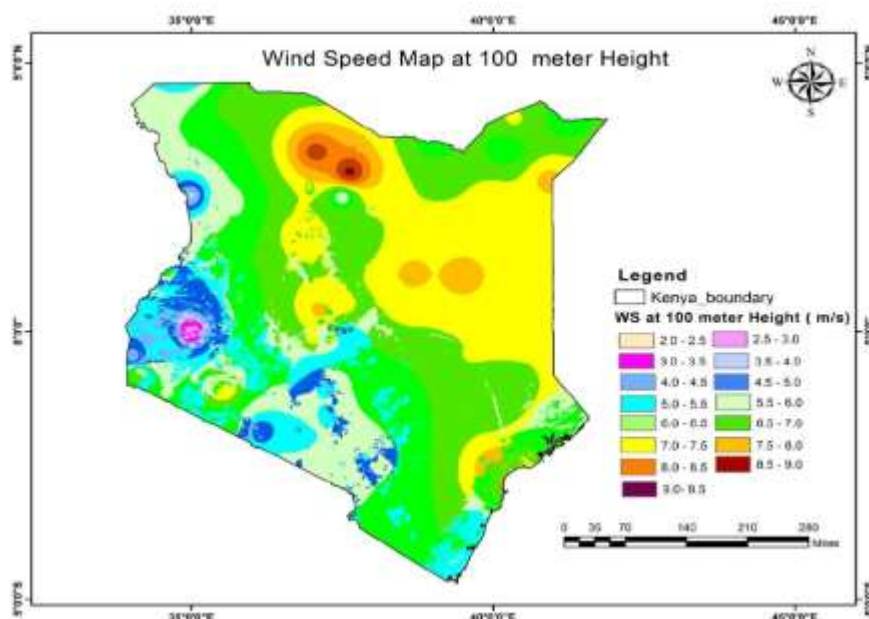
Kenya has a proven wind energy potential of as high as 346 W/m² and speeds of over 6 m/s in parts of Marsabit, Kajiado, Laikipia, Meru, Nyandarua, Kilifi, Lamu, Isiolo, Turkana, Samburu, Uasin Gishu, Narok, Kiambu counties among others. A revised wind atlas of Kenya was completed in 2013 as part of a comprehensive programme on wind speed monitoring across the country, which indicated that Kenya is rich in wind energy resource with large potential for wind energy project development.

The Government of Kenya has ambitious plans to increase the share of renewable energy, especially wind in their electricity mix, as the country is looking to derive 2,036 MW from Wind energy by 2030 (MoE, 2013). Increasing costs associated with oil, has made exploitation of wind energy more attractive. Substitution of thermal generation with wind power plants will reduce the large and increasing costs required to import fossil fuels for the thermal power plants. Implementation of wind energy projects would complement and reduce the dependency on hydropower projects, resulting in a potential long-term solution for reaching renewable energy targets. Attractive policy frameworks have been formulated to provide equity returns to wind energy project investors.

Figure 2-3 presents the wind speed map of Kenya at 100 m height. It is observed that the Marsabit area in Eastern division has the largest potential development area with a maximum mean annual wind speed of 9.27 m/s and minimum of mean annual wind speed of 5.32 m/s, followed by similar wind speeds in Turkana County in Rift Valley province (MoE, 2013). To augment the information contained in the Wind Atlas, MoEP with the assistance of Development Partners, has together with KenGen installed more than 60 wind masts and data loggers at various sites (MoEP, 2015a).

The only wind power plant currently connected to the Kenyan national grid is the Ngong Wind Power station located approximately 30 km south-west of Nairobi power, with an installed capacity of 25.5 MW. The 300 MW Lake Turkana Wind Power project is expected to be connected to the grid soon (ESI Africa, 2017). Other committed projects include the 60 MW wind power plant at Kinangop. The construction of a 400 MW wind power plant in Meru county was however suspended due to land disputes (ESI Africa, 2017).

Local production and marketing of small wind generators have started and some pilot projects are under consideration. However, only a few small and isolated wind generators are currently in operation (MoEP, 2015a; MoEP, 2017d).



Source: (MoE, 2013)

Figure 2-3 Wind speed map of Kenya at 100 m height

Lake Turkana Wind Project

The Lake Turkana Wind Power project, construction completed in June 2017, is located in Loiyangalani District, Marsabit County, Kenya. It comprises of 365 wind turbines, each with a capacity of 850 kW, and a high voltage substation that will be connected to the Kenyan national grid through an associated transmission line, which is currently being constructed by the Kenyan Government (LTWP, 2017). Once operational, the wind farm will provide 310 MW to Kenya’s national grid, approximately 15% of the country’s installed capacity, which will be bought at a fixed price by Kenya Power & Lighting Company Ltd (KPLC) over a 20-year period in accordance with the Power Purchase Agreement (PPA) (LTWP, 2017).

2.2.1.7 Solar Energy

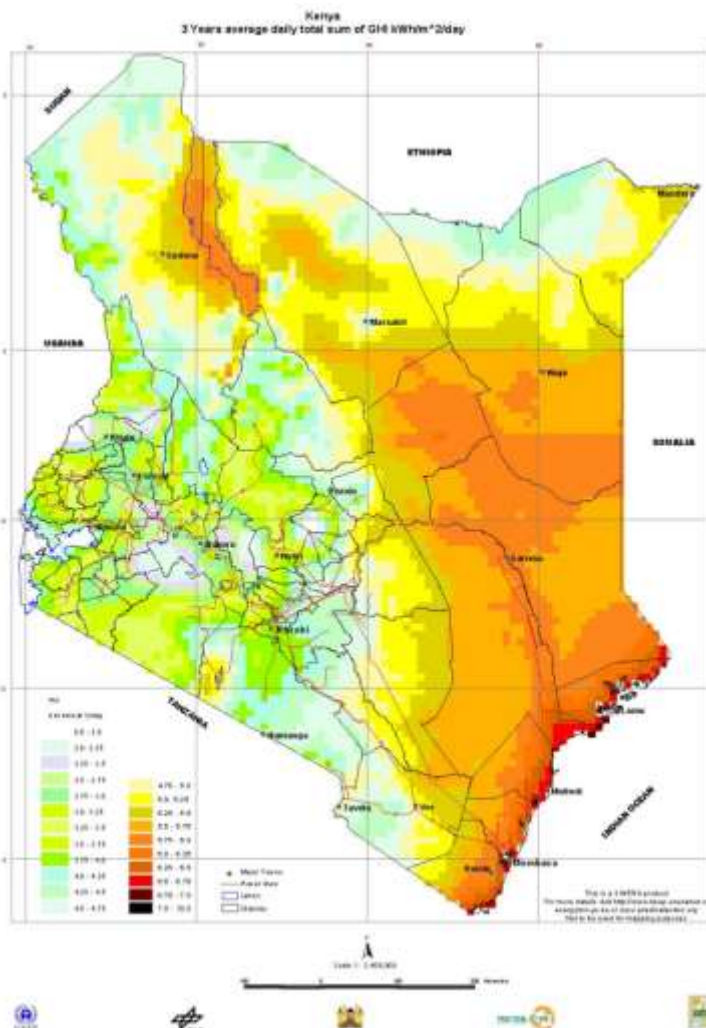
Kenya’s geographical location across the equator provides the country with a unique opportunity for solar energy exploitation. Northern and north-eastern parts of Kenya receive high average annual Global Horizontal Irradiance (GHI) levels of 5.5 to 7 kWh/m²/day, with national average GHI values between 4 and 5 kWh/m²/day (see Figure 2-4). GHI is the total amount of shortwave radiation received from above by a surface horizontal to the ground, and its value is of particular interest to photovoltaic (PV) installations. The main energy uses of solar energy include drying, water heating and electricity generation through small and large-scale PV installations (SWERA, 2008; IEA, 2015).

The amount of solar energy harnessed in Kenya through domestic and commercial purposes is however insignificant to the potential. Approximately 200,000 PV solar systems are installed in Kenya with capacity ranging between 10We and 20We, for a total production of electricity of 9 GWh a year (IEA, 2015). These installations are primarily used for lighting and powering television sets. Over recent years, the number of home systems installed under the Rural Electrification Programme has grown at an average of 20,000 units per annum and the demand is projected to reach 22 GWh annually in the year 2020 (MoEP, 2015a).

Solar water heating systems are mainly used in homes, hospitals and learning institutions. The demand for solar water heating (SWH) is however, projected to grow at a rate of 20% per annum to 800,000 SWH units by 2020 equivalent to 300,000 Tonnes of Oil Equivalent (ToE). The Government of Kenya

has also embarked on a programme to provide solar/wind hybrid generation capacity to off-grid diesel power stations in the range of 10 to 300 kW (MoEP, 2015a).

There are an estimated four million households in rural Kenya alone, thus the potential for photovoltaic solar home systems is virtually untapped. It is therefore expected that with the diversification of rural electrification strategies, the number of installed solar home systems will grow substantially. Aware of the potential of such source of energy, the government issued two bills, the Energy (Solar water heating) Regulation 2012 and the Energy (Solar photovoltaic) Regulation 2012 to provide a clear legal framework to the solar energy sector and thus hastening its development. This comes in addition to the already existing tax incentives of zero import duty and zero VAT on renewable equipment (IEA, 2015; MoEP, 2015a; ERC, 2014).



Source: (SWERA, 2008)

Figure 2-4 Three years (2001-2003) average total daily sum of GHI in kWh/m²/day

Garissa Solar Power Station

The Garissa Solar Power Station is a planned 55 MW solar park approximately 20 km north-west of the town of Garissa. The USD 135.7 million project, originally announced in 2012, is being financed through concessional funding from the Government of the People’s Republic of China. Solar power product manufacturer JinkoSolar Holding announced that it had signed a cooperative agreement with China Jiangxi Corporation for International Economic and Technical Cooperation (CJIC) to provide technical support. The final project designs were to be approved in May 2017 and construction would take approximately one year to complete (Standard Digital, 2017). Construction was however delayed partly

due prolonged talks for the power purchase agreement (PPA) between Rural Electrification Authority (REA) and Kenya Power. In September 2017, REA signed a 25-year PPA with Kenya Power to sell electricity from the solar plant at Sh12 (\$0.12) per kilowatt hour (kWh), approximately Sh8 cheaper than diesel-generated power (Daily Nation, 2017).

2.2.2 Fossil Fuels

2.2.2.1 Oil and Gas

Petroleum in Kenya accounts for approximately 25% of total fossil fuel imports. Petroleum Exploration in Kenya dates back to the early 1950s when the first Oil Exploration License (OEL 1) was granted to BP Shell Development Company to operate in the Lamu Embayment. A significant breakthrough was achieved in March 2012, when oil was discovered in Northern Kenya, leading to a significant increase in interest in the sector and development of additional exploration blocks. In order to fast track petroleum discovery and development in other exploration blocks in the country, the GoK is intensifying primary data acquisition in the available blocks to attract potential investors.

Although oil and gas discoveries are being made in Kenya, extraction and production from its reserves is yet to start, therefore the country currently relies entirely on imports of both crude and refined oil. Over the last decade, the composition of oil imports has transitioned from crude petroleum, to refined petroleum fuels. This transition highlights Kenya's limited refining capacity and the increasing demand for refined petroleum fuels. Consumption of petroleum increased by 3.7% annually over the last decade, to reach 3,638,000 tonnes in 2012, with retail pump outlets being the main consumers with approximately 60% of the total consumption. Production of refined oil from the Mombasa oil refinery has been steadily declining over the last decade, despite of increasing demand (IEA, 2015).

There is thus a need to develop adequate petroleum production capacity in Kenya, as well as supply infrastructure to meet market requirements for the increasing demand of petroleum products. These developments will include the establishment of a new refinery at Lamu, given its strategic location, to increase the affordability of oil and gas products in the region as well as to ensure supply security and stability of supply (MoEP, 2015a).

Petroleum exploration is being undertaken both on-shore and off-shore in the country's four major Sedimentary Basins as shown in **Error! Reference source not found.** The GoK has taken the initiative to lead primary technical data acquisition in the exploration blocks in order to make them attractive to oil and gas exploration companies. By January 2015, there were a total of 70 exploratory wells, approximately 90 000 km of two dimensional (2D)- and more than 6 300 km² of three dimensional (3D) seismic data.

Table 2-10: Summary of Kenya's Sedimentary Basins and number of exploration wells drilled

Basin	Area (km ²)	No. of drilled wells	Average Sediment thickness (m)
Lamu	261 000	19	12 000
Mandera	43 404	2	10 000
Anza	81 319	15	10 000
Tertiary Rift	105 673	34	40 000

Figure 2-5 presents the results of drilled petroleum exploration wells in various basin and exploration blocks in Kenya. After oil discovery at Ngamia-1, 38 wells have been drilled between 2012 and January 2015. The majority of these wells (34), have been drilled by Tullow Oil.

Table 2-11 Well drilling results and hydrocarbon shows per sedimentary basin

Basin	No. of Drilled Wells	Oil & Gas	Oil only	Gas only	No show	Oil Seeps
Anza	15	2	1	1	4	>8
Lamu	20	10	6	6	2	-
Mandera	4	2	1	1	2	2
Tertiary Rift	15	14	8	6	2	2
Total	56	28	16	14	10	>14

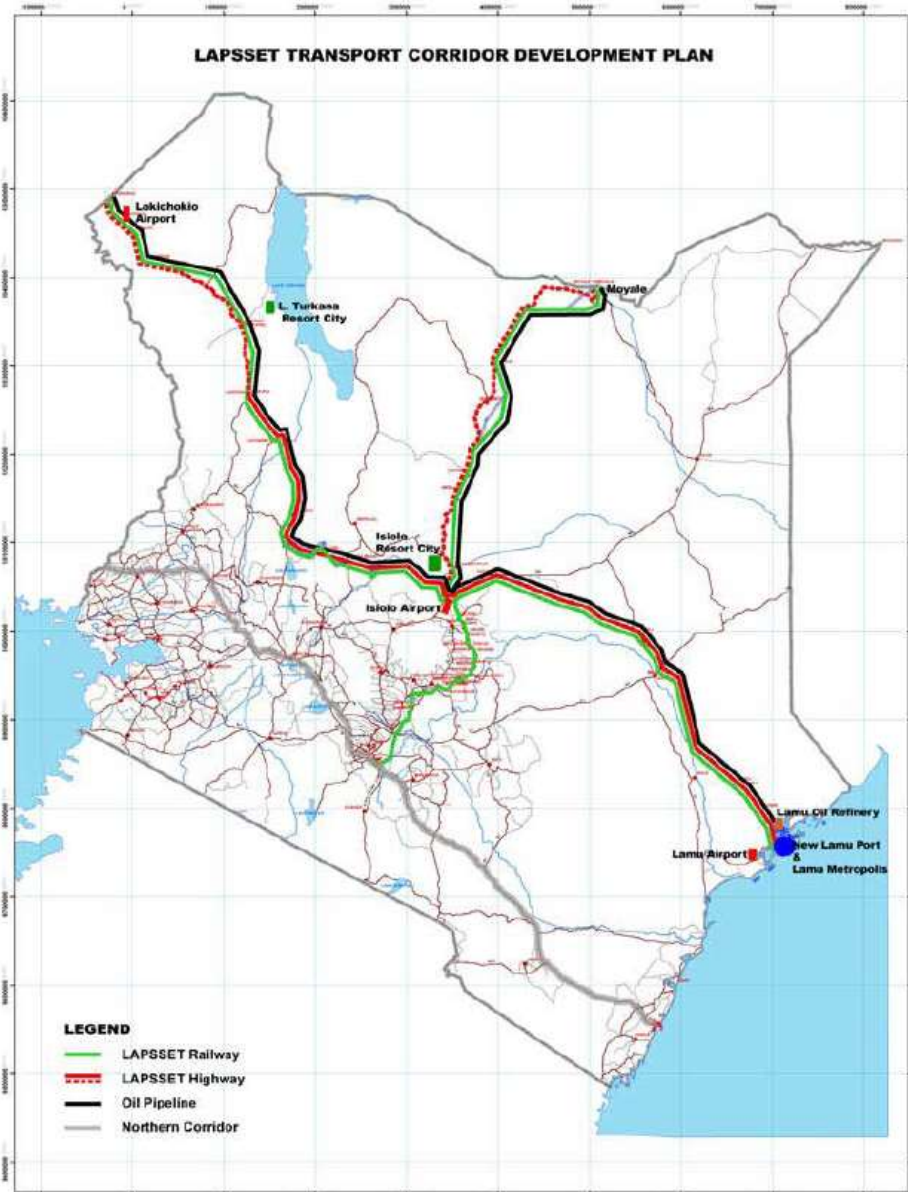
Source: (MoEP, 2017f)

In October 2017, a Development Study Agreement (JDA) was signed between the GoK and Tullow Oil, Africa Oil and Maersk Oil (KJV Partners), to carry out a study for the proposed 820 km Lokichar-Lamu crude oil pipeline. The JDA, which provides a legal framework on the pipeline development, will be followed by studies on the pipeline’s technical requirements as well as its financing and ownership structure. It will allow important studies to commence such as Front-End Engineering Design (FEED), Environmental and Social Impact Assessments (ESIA), as well as studies on pipeline financing and ownership. The aimed completion date for the project is the first quarter of 2021 with an estimated cost of \$2.1 billion (MoEP, 2017g).

In May 2016, the Kenyan national assembly adopted the Petroleum (Exploration, Development and Production) Bill (National Assembly Bill No. 44 of 2015) in an effort to update and align the country’s regulatory frameworks and bring the country closer to production. Amendment of proposed changes to the benefits and sharing formula that had been proposed by Parliament, has resulted in renewed debating on the bill. The bill was tabled, pending national elections in 2017.

LAPSSET

The GoK has started developing the LAPSSET (Lamu Port South Sudan-Ethiopia Transport Corridor) project which includes construction of a crude oil pipeline from Lokichar to Lamu. The construction of a new 32 Berth port at Lamu will be put up to facilitate oil tanker loading and offloading in the high seas. A second pipeline will also be constructed from the Lamu refinery to Addis Ababa, to deliver refined oil products to Ethiopia.



Source: MoEP 2015a
 Figure 2-6 The LAPSSET Corridor

2.2.2.2 Coal

Kenya has not yet integrated coal in its electricity generation strategy, and the current consumption of this energy source that amounted to 498,000 tonnes (Coal and coke) in 2015 (see **Error! Reference source not found.**) corresponds to other uses, predominantly by cement manufacturers to complement heavy fuel oil for process heat.

Economically viable coal deposits were however discovered in Mui Basin. The Basin was divided into four blocks for concession and exploratory works. In 2010, 400 million of tonnes coal reserves were confirmed in Block C. In 2015, the MoEP selected the Consortium of Liketh Investment Kenya and HCIG Energy Investment Company for the concession of both Mui Basin Coal Block A (Zombe-Kabati) and Block B (Mutitu-Ituku) in Kitui County (Reuters, 2017).

The GoK identified coal as one of the indigenous sources of energy that will drive the development of strategic initiatives for Vision 2030. The Government is also carrying out exploration for coal at the Coastal Region in Taru Basin in Kwale and Kilifi Counties as well as extending exploratory activities to

other parts of the country. An additional 31 coal blocks have been established for the purpose of establishing coal potential and delineating the blocks for concession.

Table 2-12 Coal Imports 2004-2013

Year	2010	2011	2012	2013	2014	2015
'000 Tonnes	239.0	337.0	302.0	301.0	470.0	498.0

Source: (KNBS, 2016)

The MoEP is supporting the Development of the Lamu 1,050 MW and Kitui (Mui) 960 MW Coal Fired Power Plants. The department also plans to conduct exploration activities in Mwingi, Kwale and Kilifi counties (MoEP, 2015a).

Amu Power Company Ltd. (APCL) proposed the developed of a 1,050 MW Lamu coal fired power plant in the Kwasasi ara of Hindi/Magogoni sub-county. The power plant will be situated approximately 21 km north of Lamu town. The project forms part of the larger LAPSSET Corridor project, in which a coal fired plant was envisaged as part of the transport corridor project. The need for the project is based on the foreseen increased demand from developing projects such as LAPSSET, the iron and steel smelting industry, resort cities and the standard gauge railway. The ESIA for the Lamu power plant was completed in July 2016. The ESIA study concluded that the proposed 1,050 MW coal fired power plant will have a low impact on the biophysical and social environment (Kurrent Technologies, 2016). A Sh 206 billion agreement between China Power Global and Amu Power was signed in May 2017 and it was estimated that construction of the plant would be completed in two years. But an appeal lodged at the National Environmental Tribunal by Save Lamu, an environmental NGO, and others against the National Environment Management Authority (NEMA) and Amu Power Company Ltd (the project developer) has opposed the EIA Licence issued by NEMA dated September 7, 2016.

2.2.3 Electricity

The Kenyan power sector is organised around four divisions: large power generation is carried out by the Kenyan Electricity Generating Company (KenGen) and a number of private investors; The rural sector electrification is done by Rural Electrification and Renewable Energy Corporation (REREC); the transmission network is operated by the Kenyan Electricity Transmission Company (KETRACO); and distribution falls under the competency of Kenyan Power and Lighting Company (KPLC). REREC has also the mandate of spearheading Kenya's green energy drive, in addition to implementing rural electrification projects.

Approximately 66 % of Kenya's electricity is generated by renewable energy resources, with the remaining 34% generated using fossil fuels. Total installed capacity by year end June 2017 was approximately 2 370 MW.

Around 70% of Kenya's installed capacity is owned and operated by KenGen, which is 70% government owned. The remaining 30% capacity is owned and operated by Independent Power Producers (IPPs).

Based on a reference evaluation scenario, electricity consumption in Kenya is forecasted to grow in the long term by an annual average rate of 7.3% per year. The annual peak load is forecasted to grow at slightly higher rate of 7.5% per annum from 1 600 MW in 2015 to 6 700 MW in 2035. Generation expansion is planned with a focus on renewables, with main base load expansion through geothermal to provide more than half of the annual generated electricity in 2035. In case of high demand developments, base and intermediate load capacity will be supplemented by coal. The second largest share in the long-term energy mix is represented by hydropower, 16% in 2035 in the reference scenario, down from a share of some 40% today. The reduction of hydropower's contribution to the energy mix, is due to its susceptibility to seasonal and long-term climate change effects. Below average rainfall in 2016 affected power production from hydro plants like the Seven Forks Dams on Tana River due to low

dam levels. Increased amounts of electricity generated from thermal plants that use expensive diesel and fuel oil, was injected into the national grid to compensate for hydro generation.

2.2.3.1 Access to electricity and demand

Electricity in Kenya accounts for 9% of the total energy consumption. There is thus a very low per capita consumption of electricity with high disparities between urban and rural areas.

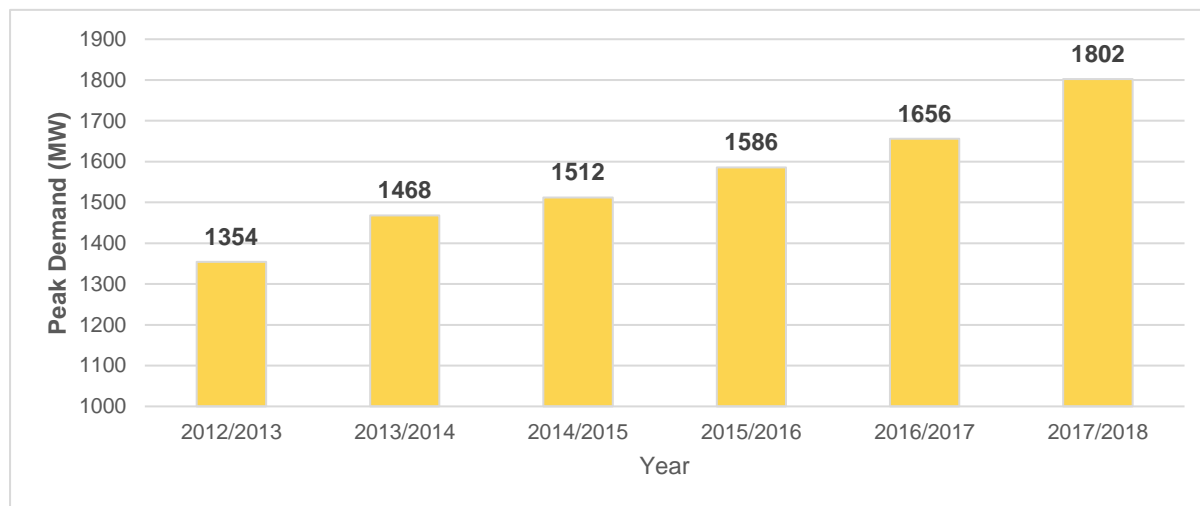
In 2017, an estimated 64% of the population had direct access to electricity (International Energy Agency (IEA) et al., 2018), and in 2018 the population with access to electricity increased to 75%.

Table 2-13: Proportion of the population with access to electricity

Region	National					Urban	Rural
	2000	2005	2010	2015	2018	2018	2018
Kenya	8%	14%	18%	41%	75%	>95%	66%
East Africa	10%	17%	21%	31%	43%	78%	31%
Africa	36%	39%	43%	49%	54%	79%	35%
World	73%	77%	80%	85%	89%	96%	79%

Source: (International Energy Agency (IEA), 2019b)

Peak electricity demand in Kenya grew by 8.8% from 1 656 MW in 2016/2017 to 1802 MW in 2017/2018 as shown below.



Source: (Kenya Power and Lighting Company, 2018)

Figure 2-7 Peak Electricity Demand

2.2.3.2 Power Generation

Power generation in Kenya is carried out by the state-owned KenGen and a number of private investors or IPPs.

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Electricity in Kenya is mainly generated from hydro, thermal and geothermal sources, with a combined installed capacity share of about 97%. Approximately 66 % of Kenya’s electricity is generated by renewable (hydro, wind, solar and geothermal) energy resources, with the remaining 34% generated using fossil fuels (see

Table 2-14 and Figure 2-8).

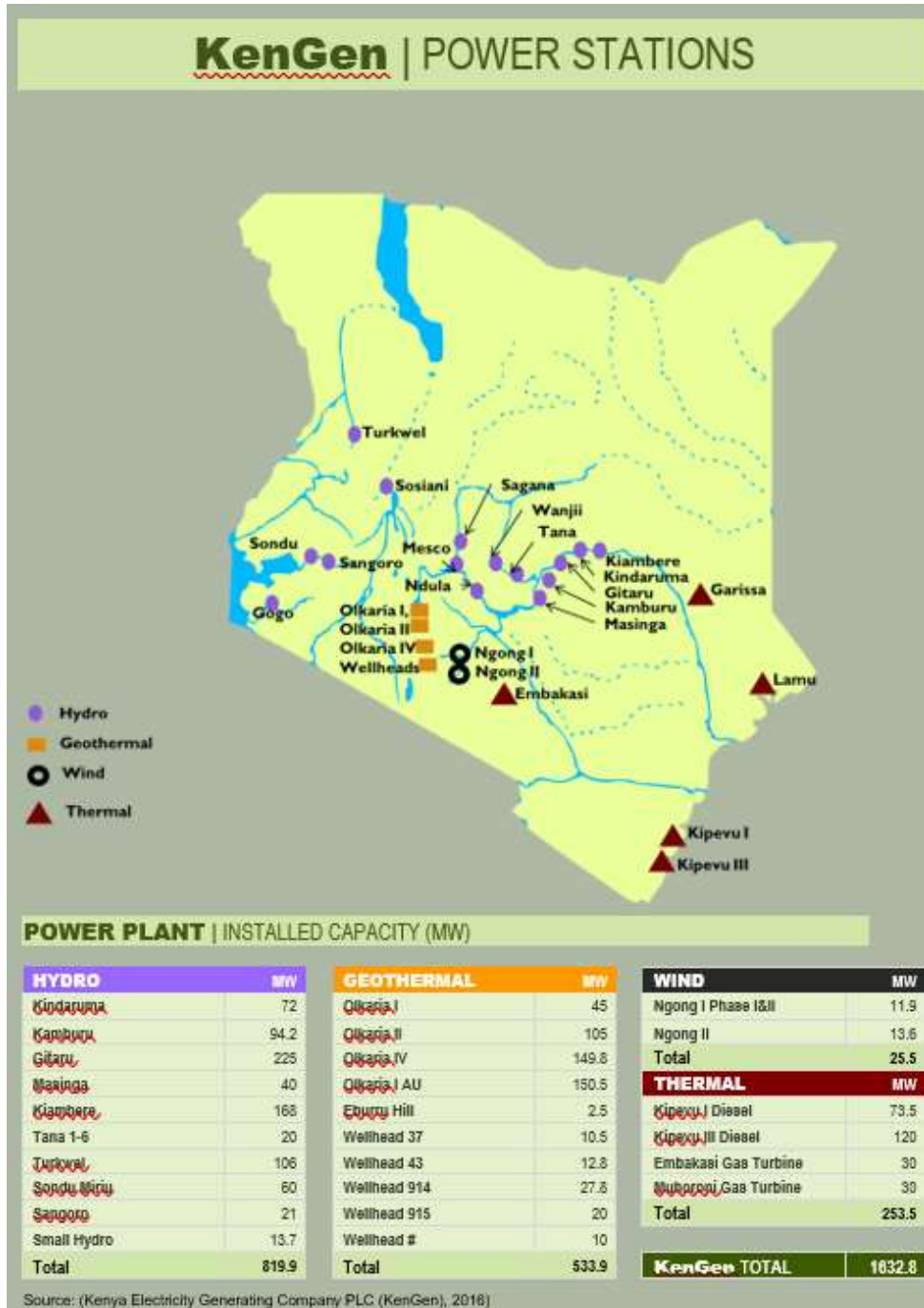


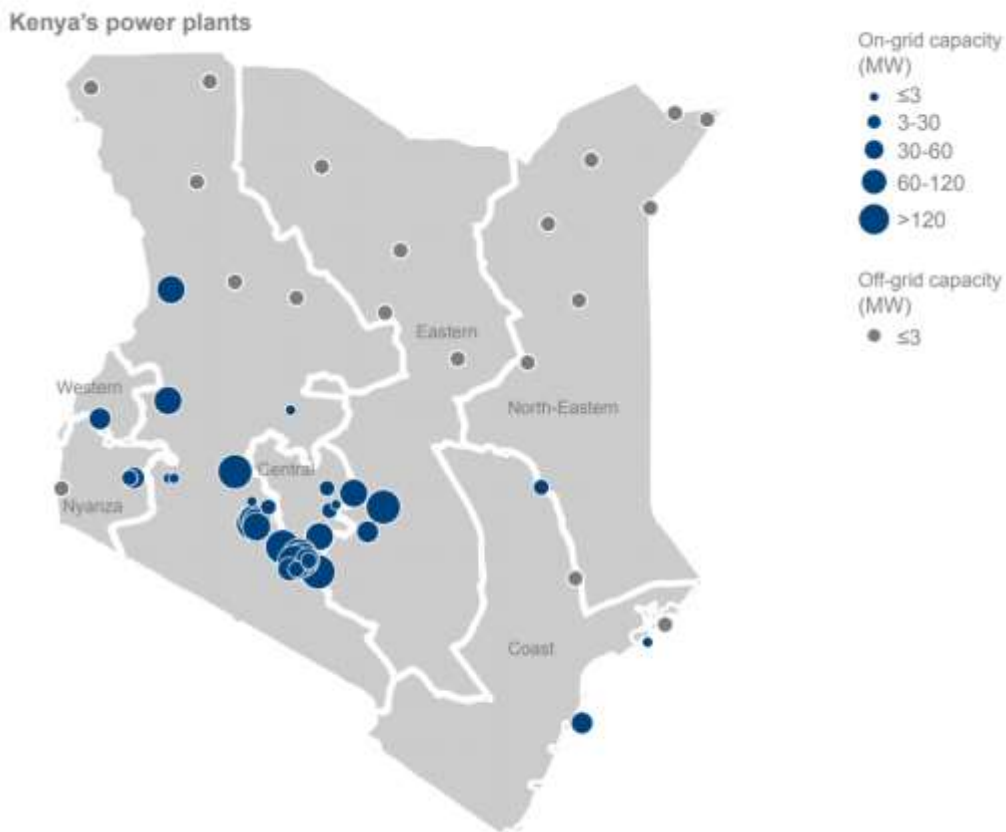
Figure 2-8: Kenya power stations (KenGen, 2016)

Table 2-14 Installed capacity per power generation source

Electricity Source	Installed Capacity (MW)	Percentage of Total
Hydro	829.3	35.0%

Electricity Source	Installed Capacity (MW)	Percentage of Total
Thermal	802.5	33.9%
Geothermal	672.9	28.4%
Wind	26.16	1.1%
Co-generation	38	1.6%
Solar	0.55	0.02%
TOTAL	2369.4	100.0%

The map below shows the spatial distribution of Kenya’s power generation plants. Off-grid installations are common in the less densely populated north- and north-eastern regions of the country.



Source: (Power Africa, 2016)

Figure 2-9 Distribution of Kenya's Power generation plants

Figure 2-10 presents consolidated estimates of water consumption for different power generation technologies employed globally. Water demands are based on actual operations and does not take into demands for fuel mining and processing, which are equally critical. From the figure it can be seen that coal and nuclear power plants have the highest water demand where water is necessary for steam generation and cooling of thermal systems. Gas and diesel generating plants also require water for cooling, combined-cycle systems require more water for steam generation.

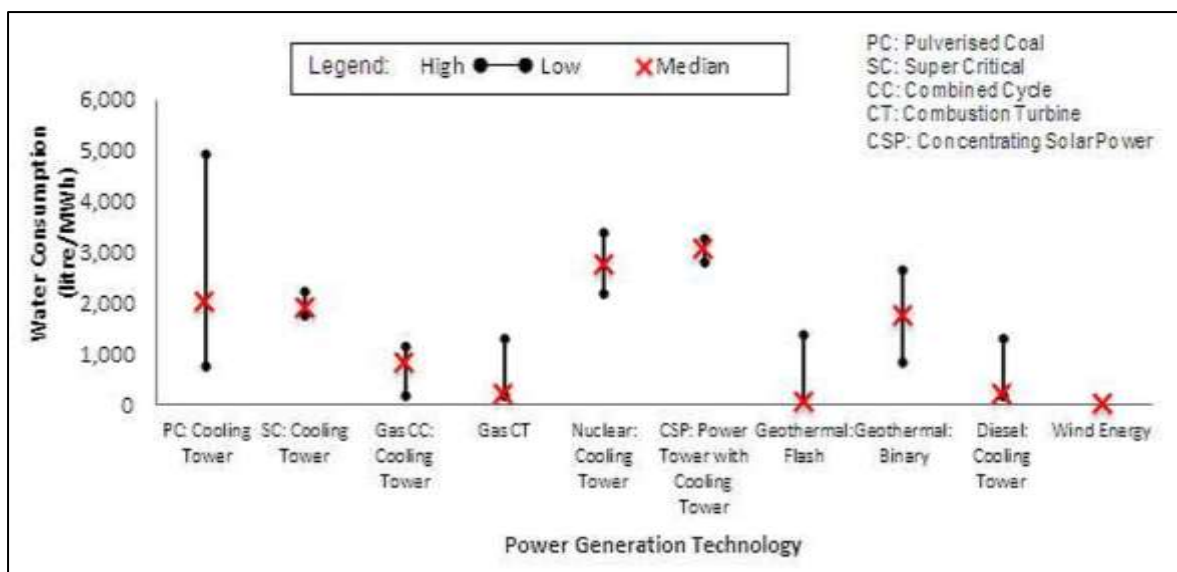


Figure 2-10: Electricity Generation: Water Use by Technology, Global, 2013 (Source: Frost & Sullivan, 2016)

Kenya has in the past heavily relied on hydropower and diesel-based plants to meet its power requirements, with increased expansion of geothermal energy in recent years. Kenya is estimated to have consumed approximately 0.6 million m³ of water for meeting its power needs in 2013/2014 (see Figure 2-11), with 84.5% of the total consumed by diesel systems and 13.8% by geothermal systems (Frost & Sullivan, 2016). Based on the proposed LCPDP strategy, Kenya's electricity demand is projected to increase to 18,000 MW by 2030 with planned generation expansion based on reduced dependence on hydropower and diesel, and increased expansion of geothermal, nuclear, coal, and wind energy. It is estimated that over 38 million cubic metres will be required for energy generation in 2030/31 as shown below (Figure 2-12).

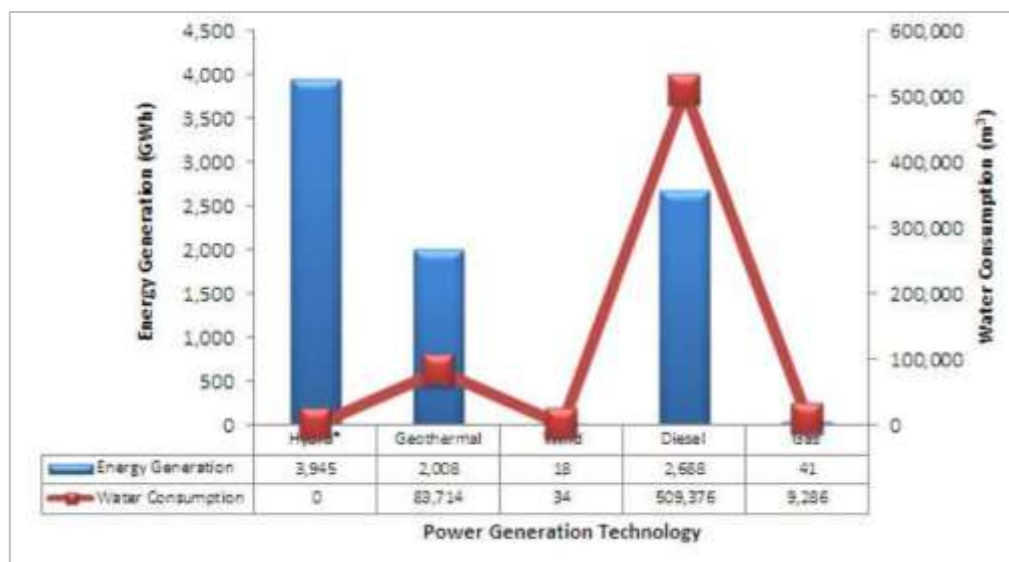


Figure 2-11 Electricity Generation: Water Consumption for Power Plant Operations, Kenya, 2013/14 (Source: Frost & Sullivan, 2016)

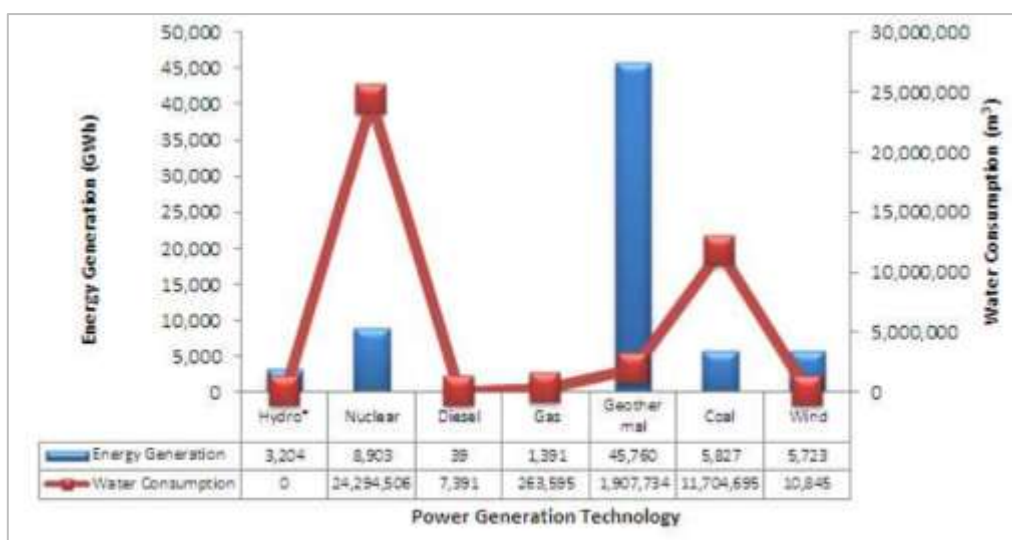


Figure 2-12 Electricity Generation: Projected Water Consumption for Power Plant Operations, Kenya, 2030/31 (Source: Frost & Sullivan, 2016)

Projected sub-basin precipitation and temperature changes under climate change scenario RCP 4.5 were used to assess climate change impacts on the water resources of Kenya as part of the development of the basin plans. It was found that that, even though rainfall is projected to increase in all basins, the expected increase in temperature and associated evapotranspiration will result in a net reduction in surface water runoff in the LVS, LVN and RV basins of up to 9% by 2050. However, in the Athi, Tana and ENN basins surface water runoff is expected to increase by up to 9% by 2050.

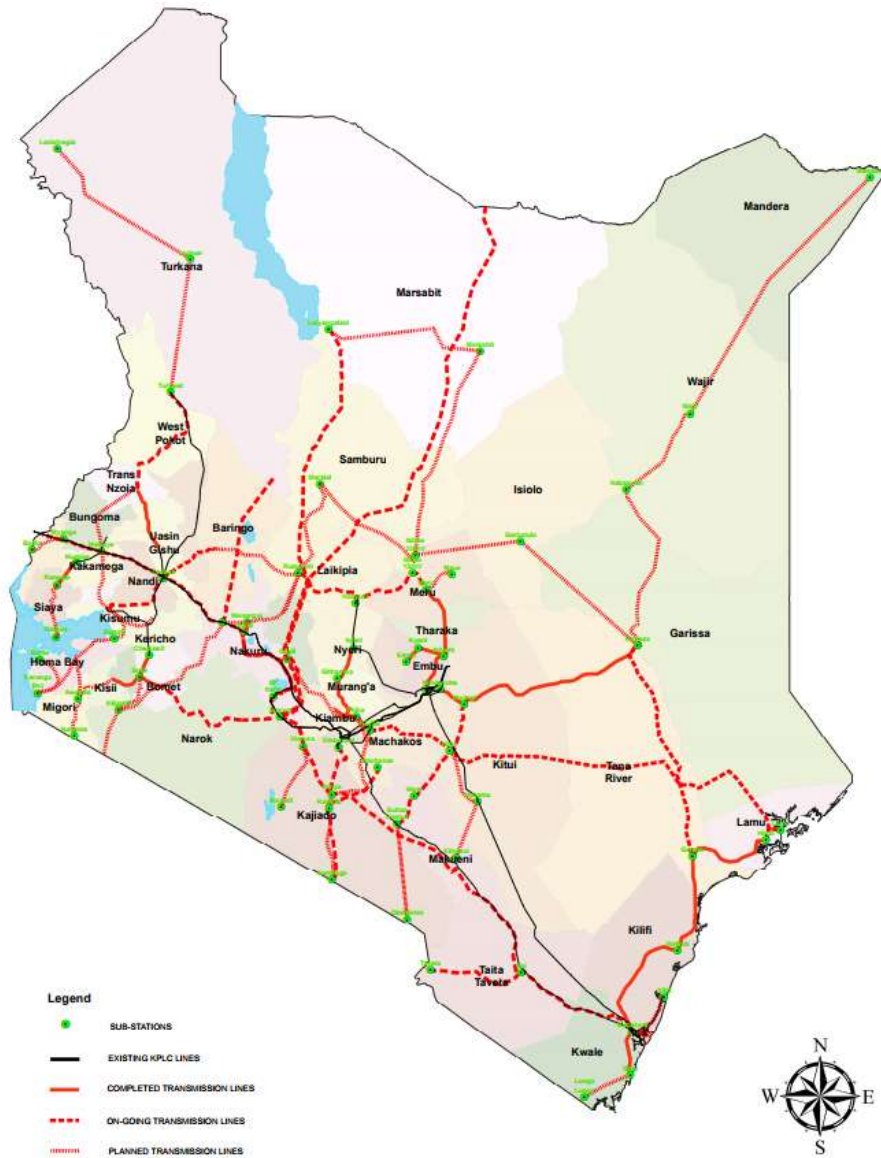
2.2.3.3 Transmission and Distribution

The transmission network in Kenya is operated by the Kenyan Electricity Transmission Company (KETRACO), while distribution falls under the competency of Kenyan Power and Lighting Company (KPLC). KETRACO is a state-owned company created in 2008.

The electricity network in Kenya is composed of transmission lines of various voltage and different types of substations. Network expansion in 2016/2017 saw the extension of high and medium voltage lines by 5 565 km from 68 493 km to 74 058 km (KPLC, 2017c).

The aging transmission and distribution networks in Kenya largely contribute to approximately 16% system loss of the power generated. To address this, KETRACO is in the process of constructing new lines and undertaking further planning to expand and strengthen the grid. In addition, Kenya Power (KP) is building in redundancies, reducing losses and adding in smart technologies to help strengthen the grid. (EU-U.S. and Swiss-U.S. Privacy Shield Frameworks, 2017).

Kenya Power (KP) is currently the sole distribution company of electricity in Kenya. It operates Kenya's interconnected grid, as well as several off-grid stations in the northern regions of the country. As the single off-taker in the country, KP negotiates Power Purchase Agreements (PPAs) with generation providers and distributes the electricity to consumers. KP has been assisted in this effort by the Electrification and Renewable Energy Corporation (REREC), whose mandate has been expanded to spearheading Kenya's renewable energy drive, in addition to accelerate the pace of rural electrification across all 47 counties.



Source: KETRACO, 2017
 Figure 2-13 KETRACO existing and planned transmission lines

2.3 Mining

Mining operations require water for a number of processes including water for mineral processing, dust suppression, cooling, slurry transport and employees' needs. Water for mining operations is primarily sourced from groundwater, surface water dams, rivers or through commercial water service suppliers. Unanticipated issues surrounding water distribution, water quality, water shortages and flooding, can result in detrimental impacts on mining operations related to operational downtime, increased operating costs and environmental contamination.

Water surrounding mining activities is therefore carefully managed to mitigate these risks, improve resistance against climate variability and prevent the release of contaminated water into the environment. These water control techniques can include:

- Diverting of surface water runoff from upstream catchments from entering the mine site through construction of freshwater collection dams or diversion structures.
- Capturing runoff from rainfall events over the mining site through the use of liners, trenches and pipes and directing the water to tailings dams.

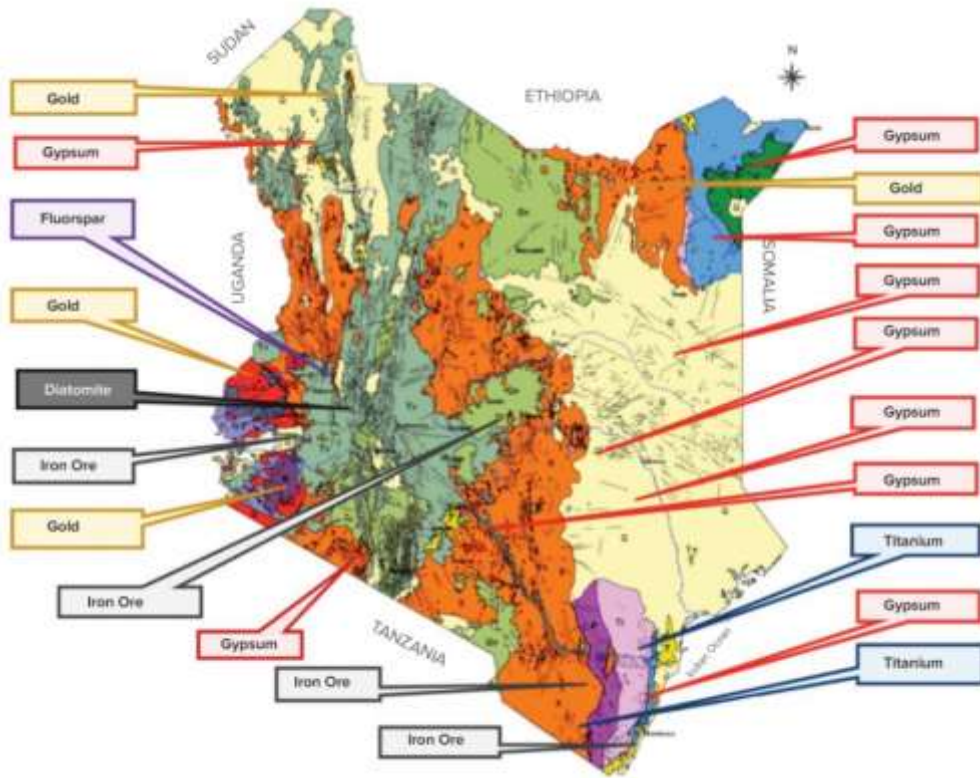
- Evaporation from tailings dams to reduce the volume of contaminated water.
- On-site recycling of water used for processing ore in order to reduce the water requirements
- Installation of liners and covers on waste material and ore piles to reduce the potential for contaminated surface runoff or groundwater seepage.

Water demands are dependent on the type and size of mineral extraction and processing operations. Titanium ore mining in Kenya is associated with large water demands, where water is required during the primary concentration plant section that slurries sand with water for the separation of the different types of titanium ores. Base Titanium Mine in Kwale County needs approximately 34,000 m³/day for a 50% recovery rate (Abuodha & Hayombe, 2006), with higher recovery rates requiring a higher water demand. The surface water source for the operation, the Mkurumunduzi River, with a low flow rate of about 190 m³/day however cannot meet this demand. Therefore, groundwater pumped from the Kilindini aquifer is utilised.

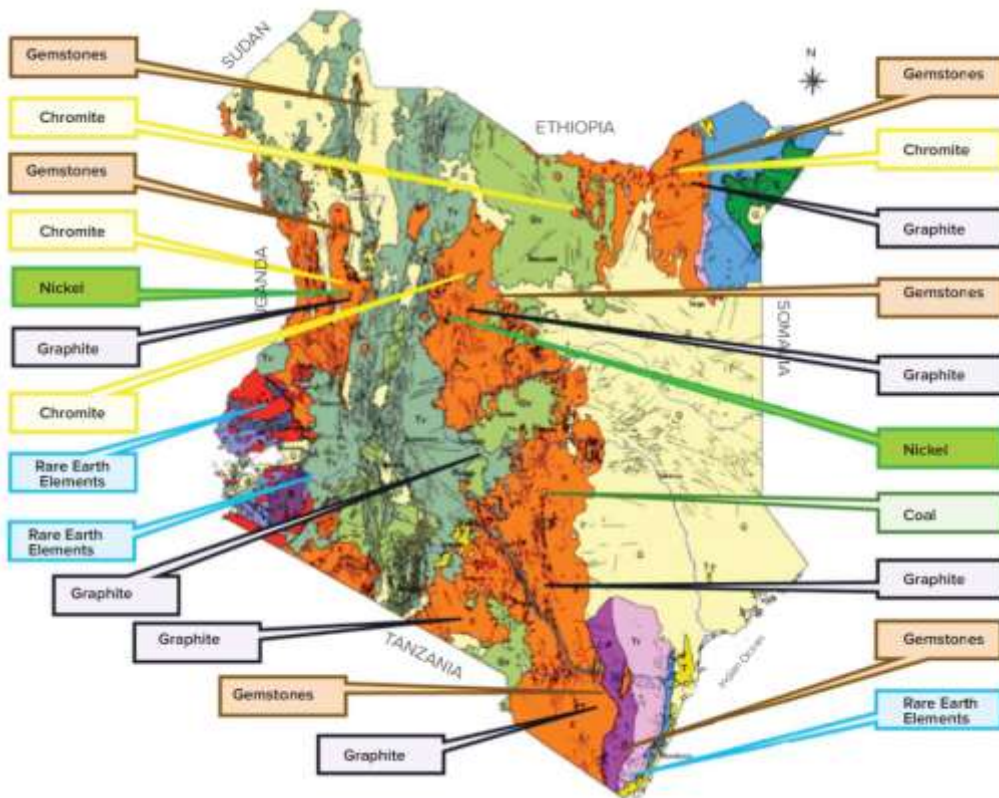
The mining sector in many countries is also associated with a wide range of negative social impacts including inequalities, conflicts, and corruption related to mining projects. Dust emissions and noise and vibrations associated with blasting are issues of great concern and in some instances, they have been reported to cause diverse respiratory health problems among communities, whilst threatening their safety due to blasting (Habitat Planners, 2017). The mining sector in Kenya is associated with a range of environmental risks related to earthworks and excavation, dewatering and tailings disposal. Mining activities are likely to impact natural resources such as land, water, air quality and biodiversity of the surrounding area. Exploratory and mining activities can lead to extensive vegetation clearing presenting a risk to the preservation of native flora biodiversity. Cleared sites are increasingly vulnerable to degradation processes through soil erosion especially where dispersive soils are present or intense rainfall area. Increased soil erosion leads to sediment loads and deterioration of water quality in streams and river courses, as well increased sedimentation downstream.

Kenya is still in early exploration of its mineral potential. The country was originally mapped as an agricultural zone which led to reduced exploration for minerals. The country is thus vastly unexplored and its mining sector is currently dominated by the production of non-metallic commodities. Kenya is the third largest producer of soda ash in the world and the seventh producer of fluorspar. A number of internal mining companies have established operations in Kenya with interest in the sector growing. Known mineral occurrences in Kenya are shown below.

Following recent discoveries of minerals and hydrocarbons, as well announcements on the availability of deposits of oil, gas, coal, iron ore and rare earth minerals across the country, the GoK is attempting to attract increased local and foreign investment into extractive industries. The new legislative and regulatory framework through the Mining Act of 2016, aims to address gaps in previously outdated legislation and align the mining sector to the latest global trends. The new legislation also aims to streamline the sector for investment as well as ensure environmental conservation and sustainable development. The introduction of Community Development Agreements, mandatory for all holders of large-scale mining rights, also ensures the sharing of royalties among the national government, the county governments and the local communities (Ministry of Mining, 2016c).



Source: Ministry of Mining, 2016c
 Figure 2-14 Map of mineral occurrences in Kenya (1)



Source: Ministry of Mining, 2016c
 Figure 2-15 Map of mineral occurrences in Kenya (2)

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The table below presents the total annual quantity and value of mineral production in Kenya from 2012 to 2016.

Table 2-15 Quantities and value of mineral production

Mineral	2012	2013	2014	2015	2016*
Quantities - Tonnes:					
Minerals-					
Soda Ash	449,269.0	468,215.0	409,845.0	319,761.0	301,719.0
Fluorspar	91,000.0	71,987.0	97,156.0	70,096.0	42,656.0
Salt	9,980.0	8,895.0	18,936.0	21,201.0	23,425.0
Crushed Refined Soda	882,801.0	947,074.0	851,906.0	614,055.0	741,000.0
Carbon Dioxide	19,919.0	18,436.0	19,450.0	19,750.0	19,550.0
Diatomite	1,746.0	1,054.0	1,195.0	1,090.0	1,092.0
Gold	3.6	2.1	0.2	0.3	0.2
Gemstones	120.9	563.0	247.3	442.0	518.2
Titanium Ore o/w	-	-	374,131.2	549,897.0	588,421.0
Ilmenite	-	-	281,543.0	444,999.0	465,728.0
Rutile	-	-	52,465.0	78,947.0	87,716.0
Zircon	-	-	40,123.2	25,951.0	34,977.0
TOTAL	1,454,839.5	1,516,226.1	1,772,866.7	1,596,292.3	1,718,381.4
Value - KSh Million					
Soda Ash	9,388.0	8,865.2	7,840.8	6,599.6	6,227.2
Fluorspar	2,942.0	1,783.0	1,901.0	1,427.7	868.8
Salt	65.7	71.6	173.5	197.8	218.5
Crushed Refined Soda	589.0	631.9	568.4	409.7	494.4
Carbon Dioxide	503.0	495.6	503.9	525.6	514.9
Diatomite	85.6	69.6	70.6	70.6	70.7
Gold	13,919.7	7,432.6	695.3	978.7	652.5
Gemstones	157.5	411.0	263.6	798.4	936.0
Titanium Ore o/w	-	-	9,063.4	12,819.0	13,296.9
Ilmenite	-	-	3,697.0	3,763.0	3,430.8
Rutile	-	-	4,085.2	6,329.0	6,818.7
Zircon	-	-	1,281.2	2,727.0	3,047.4
TOTAL	27,650.5	19,760.5	21,080.5	23,827.1	23,279.9
Source: Department of Mines and Geology					
* Provisional					

Source: (Kenya National Bureau of Statistics (KNBS), 2017)

2.3.1 Trona

Tata Chemicals Magadi has its operation in the Lake Magadi region in the Great Rift Valley and is Africa's largest soda ash producer and a leading exporter, with an annual production of about 360,000 tonnes of Soda Ash. Commercial trona (hydrated sodium bicarbonate carbonate) mining in Kenya has been undertaken for over 100 years since 1911 in Lake Magadi located within the south rift region of Kenya. Lake Magadi is among a limited amount of locations in the world where trona forms naturally. Lake Magadi has one of the purest surface deposits of trona, which is one of the few renewable mineral resources. Trona is used in the manufacturing of glass, chemicals, paper, detergents and textiles. Mining of trona forms an important role in the socio-economic fabric of the Lake Magadi region and is a source of employment for approximately 450 people (Habitat Planners, 2017; Ministry of Mining, 2016c).

2.3.2 Fluorspar

Kenya Fluorspar Company Limited has been mining fluorspar in the Kerio Valley within the north rift since 1971, with a production of over 100,000 tons of Fluospar annually. Fluorspar is used directly or indirectly to manufacture products such as aluminum, gasoline, insulating foams, refrigerants, steel, and uranium fuel.

2.3.3 Diatomite

Africa Diatomite Industries Limited (ADIL) has been exploiting diatomite in Gilgil, a town north west of Nairobi, for export since its establishment in 1942. ADIL has access to excellent quality diatomite deposits estimated at over 6 million tons and currently boasts having the only known viable quality deposits of Diatomite in Kenya.

2.3.4 Titanium

In 2014, Kenya joined the league of mineral exporters with the first shipment of 25,000 tonnes of ilmenite to China, from Kwale Mineral Sands Project, owned by Base Resources. The Kwale mine is estimated to have reserves of 140 million tons of titanium. It is estimated that 250,000 tonnes of Titanium ores will be exported annually from Kwale while a further 3.2 billion tonnes of the same mineral deposits are said to exist in the north coast (Habitat Planners, 2017). Through its Kenyan subsidiary Base Titanium, the project will produce an estimated 80,000 tonnes of rutile per year, equivalent to 14% of the world's supply, 330,000 tonnes of ilmenite and 40,000 tonnes of zircon once fully operational (Minsitry of Mining, 2016).

2.3.5 Cement Manufacturing

Kenya has sizeable deposits of limestone, marbles and dolomites which is predominantly used in the cement manufacturing and construction industries. Large cement manufactures present in Kenya include Bamburi Cement (Lafarge Group) with an installed annual capacity of 2.3 million tonnes; the East Africa Portland Cement Company (EAPCC) with 1.4 million tonnes, and Athi River Mining boasting more than one million tons. The Mombasa Cement and Savannah Cement respectively have nearly 1.5 million tonnes of manufacturing capacity (Ministry of Mining, 2016c).

2.3.6 Artisanal and Small-Scale Mining

Artisanal and Small-Scale Mining (ASM) activities take place in many areas of the country in the form of mining for gold, gemstones, gravel, clay and quarrying. Over past decades, gold has been predominantly extracted by artisan workers in western Kenya. However, modern commercial gold extraction is yet to be undertaken which can result in significant contribution to the nation's GDP. Although ASM is an income generating activity benefiting low income communities, some operations are tainted with association with unlawful activities such as smuggling and tax evasion, as well as health and safety risks. The development of sustainable ASM operations which form synergies with the formal sector, have large potential to contribute to the development of the country's mining industry through income generation and local employment (Ministry of Mining, 2016c).



Source: (Ministry of Mining, 2016c)

Figure 2-16 Women pour water onto gold containing crushed ore at a mining site in Macalder, Migori County, in western Kenya

2.3.7 Recent Discoveries

The GoK also recently made announcements of having world class deposits of rare earth elements in the coastal region of the country. Recent discoveries are estimated to be worth USD 62.4 billion and will propel Kenya to the list of top five countries with rare earth deposits in the world. In addition, the country has the world's top six deposits for Niobium. Commercial deposits of coal have been discovered in the north-eastern region of the country and are under review for potential uses and production (Minsitry of Mining, 2016).

2.4 Key issues, challenges and trends

The water resources of Kenya are currently threatened by many issues. These include human conflict, water quality, soil erosion and sedimentation, climate change, catchment degradation, inadequate monitoring, planning and management, water availability and supply issues, inadequate resources, uneven spatial and temporal distribution of water resources, anthropogenic encroachment on environmentally sensitive areas, inadequate flood and drought management and various other issues. In addition to the above issues, each basin has location-specific challenges and issues which, coupled with its unique basin characteristics, are an important consideration for effective water resources management and planning at basin and sub-basin level.

Issues that impact the energy and mining sectors, but also water resources and related impacts resulting from these sectors, in all six river basins in Kenya were identified through the basin planning process in conjunction with stakeholders and categorised under the following main categories:

- Biophysical issues;
- Socio-economic issues;
- Water resources issues;
- Institutional issues.

Issues were presented and addressed based on the framework as depicted in Figure 2-17.

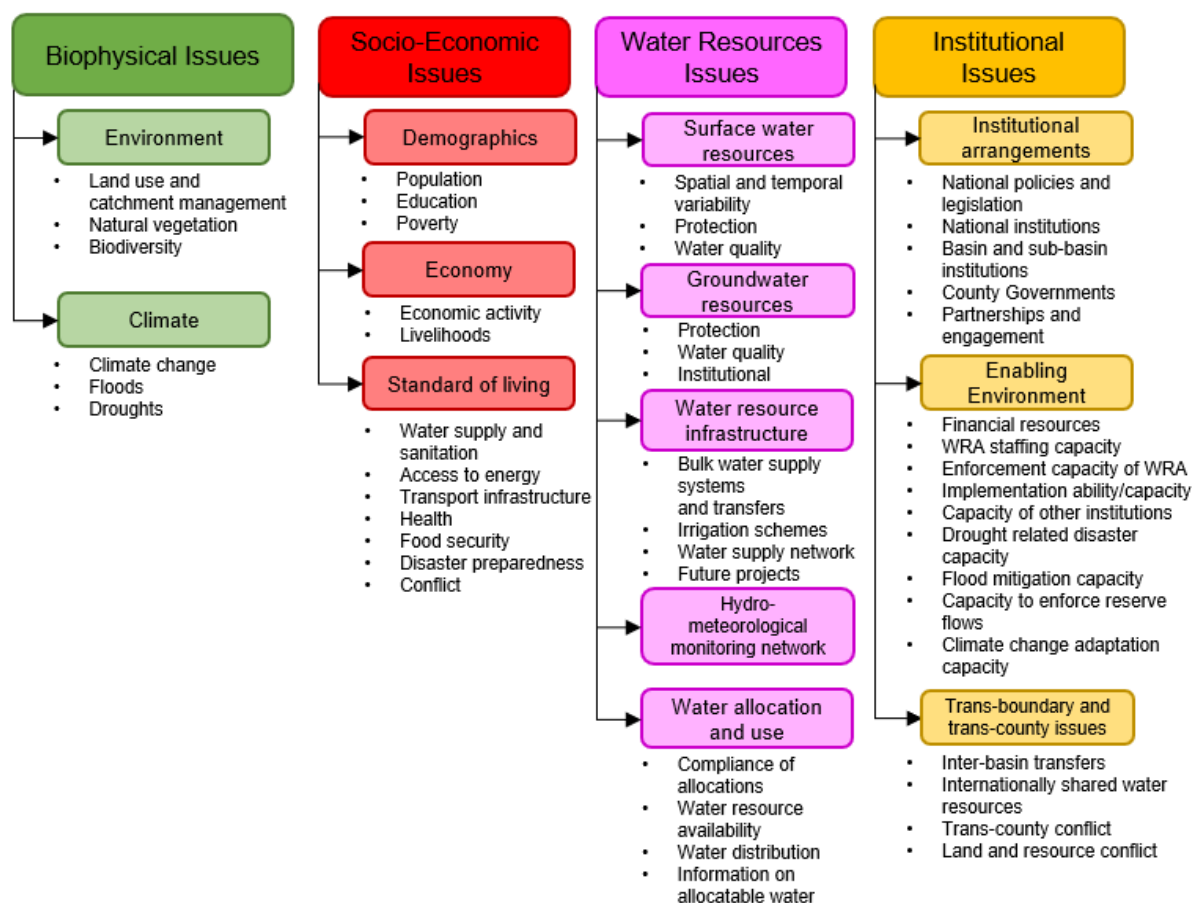


Figure 2-17: Key issues framework

Key biophysical, socio-economic, water resources and institutional issues related to the **energy and mining sectors in Kenya** are summarised in the following sub-sections.

2.4.1 Biophysical issues

2.4.1.1 Environment

The environment encompasses the land, vegetation and biodiversity of Kenya. Sustainable management of the land is necessary to maintain healthy vegetation and biodiversity. Issues arise through poor land use management and vegetation or biodiversity loss. Some of the relevant issues related to the energy and mining sectors are defined below:

- Poor land use, insufficient catchment management practices and loss of natural vegetation
 - Soil erosion and land degradation due to land clearing and poor farming practices
 - Increased soil erosion leads to sediment loads and deterioration of water quality in streams and river courses, as well increased sedimentation downstream
 - Land conversion and habitat loss due to land clearing for crops
 - Extensive vegetation clearing for mining activities presenting a risk to the preservation of native flora biodiversity
 - Wasteful or inefficient water consumption.
 - Pollution due to chemical runoff, fossil fuel usage and effluent waste linked to fertilizers and pesticides
 - Eutrophication of water bodies
 - Unsustainable sand harvesting

- Unsustainable mining
- Deforestation for coal burning
- Environmental degradation associated with mining activities
- Unsustainable use of biomass with associated negative impacts on the environment

2.4.1.2 Climate

Climate change appears to be taking effect in Kenya. Expected impacts include increased temperature, increased intensity and frequency of extreme climate events as well as unpredictable weather patterns. With more rain falling as heavy storm events it will be less effective, and there will be increased erosion, increased streamflow (Omwoyo et al., 2017), and an increased risk of flooding and greater environmental degradation. Higher evaporative demand will also offset any benefits should rainfall possibly increase, also resulting in less effective rainfall (Omwoyo et al., 2017).

Some of the issues potentially impacting mining and tourism are defined below:

- Increasing intensity of extreme events, such as increased intensity of rainfall and increased frequency of floods and droughts
- An increasing temperature predicted for Kenya may result in an increase in evaporation rates and general harsher weather conditions. Water quantity will be affected as a result, as well as water quality due to higher temperatures, land use changes, impacts on rivers and lakes, changes to physicochemical parameters, micro-pollutants and biological parameters.
- Seasonal changes in river flow and an increase in the frequency and severity of droughts, will negatively impact hydropower generation.

2.4.2 Socio-economic issues

Some of the socio-economic issues which are relevant to the mining and energy sectors are listed below:

- Access to electricity
- Vandalism and theft of electric power infrastructure
- Frequent and prolonged power supply interruptions
- Inequalities, conflicts, and corruption related to mining projects
- Dust emissions and noise and vibrations associated with blasting cause diverse respiratory health problems among communities, whilst threatening their safety due to blasting (Habitat Planners, 2017)
- Conflicting and competing land and water uses between various sub-sectors
- Relocation and resettlement of affected persons in development projects
- Kenya is yet to be self-sufficient in food and diversion of food growing resources to produce biofuels can work against food security
- Lack of awareness on the products, opportunities and economic benefits offered by new technologies

2.4.3 Water resources issues

Kenya has many water resources challenges, with insufficient water to meet demand in certain locations and during certain times of the year. Domestic, industrial and irrigation demands are expected to increase in the future. Sedimentation of seasonal rivers and pans is an issue as it limits already scarce water resources. Some of the issues relevant to the energy and mining sectors are listed below:

- Water resources issues
 - Water availability and water security for power generation
 - Flow variability and the impact thereof on hydropower generation
 - Water distribution and water shortages can result in detrimental impacts on mining operations

- Inadequate storage capacity in existing power generating reservoirs
- Limited and poor quality hydrological data in certain regions
- Water quality issues:
 - Small-scale gold mining operations
 - Non-point sources
 - Sedimentation
- Groundwater quality issues:
 - Sedimentation from sand harvesting
 - Mining impacts on shallow aquifers

2.4.4 Institutional Issues

Key institutional issues in Kenya include inadequate capacity of the WRUAs, inadequate capacity and knowledge of integrated water resource management in the County Governments, and inadequate reporting framework to the public.

Some of the issues which are relevant to energy and mining are listed below:

- National policies and legislation
 - Conflicting policies, regulations and mandates
 - Insufficient legal and regulatory framework for energy and mining sectors' projects
 - Non-holistic legislation to facilitate the growth and development of the mining industry
 - Ineffective enforcement of upstream laws and regulations
 - Uncoordinated approach in policy formulation and implementation by the relevant ministries and organizations to reduce overreliance on biomass as a primary source of energy.
- National institutions
 - Uncoordinated institutional roles
 - Weak enforcement of standards and regulations
- County Governments
 - Limited coordination
- Inadequate financial resources
 - Inadequate access to project financing, especially early stage risk capital
 - Limited funding from government for mining exploration activities
 - Financing constraints for renewable energy projects
 - Insufficient promotion of sustainable afforestation programmes.

3 Institutional Overview

3.1 Introduction

At its core, the water-energy nexus is encapsulated by regulation and legislation. For the energy sector, such regulation and legislation focus on production, distribution and more recently efficiency. This also holds true for the water sector, with regulation and legislation focusing on water abstraction, use and discharge. However, how decision making in these sectors are approached, is quite different. In Kenya, the general approach to energy decision making is based on a top-down approach, whilst for the water sector a combination of both top-down and down-top approaches are utilised. The water sector in Kenya tends to see development and utilisation of the resources managed both locally and at a national level, allowing for more effective distribution and relaying of resources to the beneficiaries based on need and availability. Energy distribution and utilisation is for most parts (particularly for hydropower) been influenced by national government decisions with limited participation from local stakeholders.

Following recent discoveries of minerals and hydrocarbons, as well announcements on the availability of deposits of oil, gas, coal, iron ore and rare earth minerals across the country, the GoK is attempting to attract increased local and foreign investment into extractive industries. The new legislative and regulatory framework through the Mining Act of 2016, aims to address gaps in previously outdated legislation and align the mining sector to the latest global trends.

The recent introduction of a decentralised governance system in Kenya also provides an opportunity for sustainable management of mineral resources because the national constitution has ensured that the interests and rights of local communities are considered within all the economic sectors. The potential implications of increased mining developments on environmental and human rights issues however cannot be underestimated.

Water is crucial for the energy and mining sectors, but both these sectors also have an impact on the environment. This section reviews the water, energy, mining and environmental compliance institutional arrangements from national to county level, and identifies the challenges for coordination between them. Subsequent to Kenya Vision 2030, which was completed in 2007, many strategies and development plans for the water, energy and mining sectors in Kenya have been developed to provide the direction for the development and the strengthening of these sectors. To ensure that this Sector Assessment is representative and aligned with current plans and strategies related to water resources planning and management and energy and mining development, relevant current plans and strategies were reviewed and are briefly described.

3.2 Legislative, Policy and Institutional Framework

3.2.1 Introduction

The Constitution of Kenya (2010) provides the basis for water resources management in the country and recognises this through the right to a clean and healthy environment, through the management and sustainable development of natural resources (which includes both surface and ground water), as well as through the economic and social right “*to clean and safe water of adequate quantities*”. Importantly, the State has the obligation to ensure that water is conserved, that development is managed to be sustainable and to ensure that the benefits accrued are shared equitably. Whilst it is noted that the utilisation of natural resources should be for the benefit of the people of Kenya, there is important emphasis placed upon the needs of marginalised communities. Also of importance is the recognition of the link between water and land. As such, this recognition provides the basis for improved integration in the planning, management and sustainable development of natural resources.

3.2.2 National policies

3.2.2.1 Energy

Kenya embarked on fundamental reforms in the energy sector after the mid-1990s following the enactment of the Electric Power Act, No. 11 of 1997, Geothermal Resources Act, No. 12 of 1982, the Petroleum (exploration and production) Act, Cap 308 of 1984 and the Petroleum Development Fund Act, No. 4 of 1991, the Sessional Paper No 4 of 2004 on Energy and later by the Energy Act, No. 12 of 2006. This legislation created the foundation for the separation of generation, from transmission and distribution in the electricity sub-sectors (Institute of Economic Affairs, 2015). However, with the adoption, in 2008, of the Kenya Vision 2030 as the country's new development blueprint and the promulgation of the Constitution in 2010, it was necessary to review the Energy Policy, applicable legislation and regulations to align them with the Vision and the Constitution. In January 2015, the Ministry of Energy and Petroleum (MoEP) released the Final Draft National Energy and Petroleum Policy and the updated National Energy Policy was then published on 2018. The Energy Act, 2019 was signed into law on 12 March 2019 and is now in force.

Kenya Vision 2030 identified energy as one of the key sectors and one of the infrastructure enablers of its socio-economic pillar to enable Kenya's transformation into "a newly-industrialising, middle-income country providing a high quality of life to all its citizens in a clean and secure environment". For achieving this vision, access by all citizens to sustainable, competitive, affordable and reliable energy is essential (Government of Kenya, 2018a).

The Constitution of Kenya provides for a two-tier structure of government, i.e. the National and the County Governments and distributes the functions and powers between these two levels. With regard to the energy sector, Part 1 of the Fourth Schedule provides that the National Government shall be responsible for:

- a) Protection of the environment and natural resources with a view to establishing a durable and sustainable system of development including water protection, securing sufficient residual water, hydraulic engineering and the safety of dams
- b) Energy policy including electricity and gas reticulation and energy regulation; and
- c) Public investment.

With regard to the County Governments, Part 2 of the Fourth Schedule provides that County Governments shall be responsible for county planning and development including electricity and gas reticulation and energy regulation.

The **Feed-in-Tariffs (FIT) Policy** 2008, which was last revised in **2012**, seeks to promote the generation of power from renewable energy sources, such as wind, biomass, small hydro, geothermal, biogas, solar and municipal waste energy and allows a power producer to sell renewable energy generated electricity to a buyer at a predetermined tariff for a given period of time.

The **National Energy Policy 2018** document provides a comprehensive description of the current state of the energy sector and of the policy framework as of 2018, and contains policy recommendations for various sub-themes: coal, renewable energy (including geothermal and hydro in particular), electricity, energy efficiency and conservation, land, environment, health and safety, energy services, energy financing, pricing and socioeconomic issues (International Energy Agency (IEA) & International Renewable Energy Agency (IRENA), 2019).

3.2.2.2 Mining

The **Constitution of Kenya 2010** provides for natural or mineral resources through the following articles:

- Article 62: All minerals are held in trust for the people of Kenya by the national government

- Article 66: Parliament to enact legislation to ensure investments benefit local communities and their economies
- Article 69: State to ensure sustainable development and management of natural or (mineral) resources and environment and equitable sharing of accruing benefits
- Article 71: Requires mineral agreements to be ratified by Parliament
- Article 232: Requires participation by people in policy making

Kenya **Vision 2030** and its Third Medium Term Plan (2018-2022) has included the mining sector as a priority sector under the economic pillar. Its contribution to GDP is expected to increase to three percent by 2017 and 10 percent by 2030, making mining a key driver of economic growth and transformation.

The Final Draft **National Energy and Petroleum Policy** (Government of Kenya, 2015) proposed framework legislation on natural resources revenue management, which includes the creation of a sovereign wealth fund.

The **Mining and Minerals Policy, Sessional Paper No. 7 of 2016** (*Mining and Minerals Policy Sessional Paper No. 7 of 2016*, 2016) provides a framework for ensuring sustainable utilization of mineral resources; harmonizing mining and environmental legislations; mainstreaming activities of artisanal and small-scale miners; local participation in the mining investment ventures; a well-structured mining fiscal regime and equitable sharing of mineral benefits.

The Policy comprehensively addresses the gaps that have existed in the mining sector and provides a basis for reviewing the sector's almost obsolete legal framework and ad hoc regulations. It further aligns the country's mining sector with the aspirations of Kenya Vision 2030, the provisions of the Constitution of Kenya (2010) and the African Union Mining Vision (2009) which aims at positioning mining as a key driver of Africa's socio-economic development.

The policy provides a firm foundation and basis for establishment of an enabling framework for accelerated and sustainable development of the country's mining and minerals resources sector. The policy is expected to ensure that benefits from the sector are shared by stakeholders, including investors, local artisanal and small-scale miners, national and county governments, local communities and the people of Kenya.

3.2.2.3 Water

Worldwide, there is increased recognition of the importance of water in terms of socio-economic development. This is increasingly emerging through the nexus discussions which acknowledge the interfaces between water, food, energy, and more recently, climatic risks. The findings of the World Economic Forum through their Global Risks Reports which repeatedly reflect water and climate related risks as being the most significant to economic growth.

At national level in Kenya, this sentiment has been mirrored in the development of various forms of national development plans. The **Kenya Vision 2030**, published in 2007, provides the national development blueprint. It is structured around economic, social and political dimensions and notes the important role of water in catalysing growth. National targets outlined in the Vision 2030 that have implications for the water sector include:

- Water and sanitation - to ensure that improved water and sanitation are available and accessible to all by 2030
- Agriculture - to significantly increase the area under irrigation by 2030 for increase of agricultural production
- Environment - to be a nation that has a clean, secure and sustainable environment by 2030
- Energy - to generate more energy and increase efficiency in the energy sector

The **Constitution of Kenya (2010)** provides the basis for water resources management in the country and recognises this through the right to a clean and healthy environment, through the management and sustainable development of natural resources (which includes both surface and ground water), as well as through the economic and social right “*to clean and safe water of adequate quantities*”. Importantly, the State has the obligation to ensure that water is conserved, that development is managed to be sustainable and to ensure that the benefits accrued are shared equitably. Whilst it is noted that the utilisation of natural resources should be for the benefit of the people of Kenya, there is important emphasis placed upon the needs of marginalised communities. Also of importance is the recognition of the link between water and land. As such, this recognition provides the basis for improved integration in the planning, management and sustainable development of natural resources.

The Kenya **National Water Resources Management Strategy (2006)** provides the overarching policy framework for water resource management and development in Kenya, despite a number of successive adjustments in the core water legislation. This consistency in policy intent has been critical in guiding the water sector, with legislative amendments being progressively utilised to improve and strengthen the way that policy is affected. At the time of its introduction, the ‘Sessional paper no. 1 of 1999 on national policy on water resources management policy and development’ (Government of Kenya, 1999) introduced key shifts in policy such as the separation of functions (including water resource management, water service delivery, policy, regulation, financing), the devolution of decision making to regional and local levels, the commercialisation of water (i.e. water to be treated as an economic and social good) and stakeholder participation through community and private sector participation.

3.2.2.4 Land

The **National Land Policy (2009)** was established to provide guidance towards equitable and sustainable land use for the wellbeing of Kenya’s people and economy. It is a framework to address critical land related issues in the country, including equitable land access, historical injustices and disparities, land use conflicts and sustainable utilization and management of land and its resources. The Policy recognizes land as a significant finite resource that holds cultural heritage, which should be managed sustainably and productively for economic benefit as well provision of livelihoods. Land in Kenya is classified into Public Land, Community Land and Private Land. Communal land is based on traditional customary rights. Several statutes involving land use matters were enacted following the promulgation of the Constitution. However, lack of institutional coordination poses a challenge for effective land use management across the country. The **National Land Use Policy (2017)** was therefore established in 2017 to provide institutional coordination among the relevant stakeholders. Furthermore, the Policy seeks to optimize the utilization and productivity of land and its resources in a sustainable and equitable manner.

3.2.2.5 Environment and Forestry

To ensure sustainable resource use, growth and employment creation, the Kenyan Constitution and economic blueprint Vision 2030, requires the country to work towards achieving a forest cover of at least 10% of the land area. Realizing these targets will require mobilizing communities and the private sector to:

- invest in commercial forestry;
- expand forestry development to arid and semi-arid areas,
- invest in industry for enhanced processing efficiency and value addition,
- strengthen forest governance policies and institutions;
- give greater consideration of forestry in development programmes such as in agriculture, energy, tourism, and water programmes.

The contribution of forests to the national economy has been grossly undervalued, which results in low level resource allocation to the sector (MEWNR, 2015). There is a need to promote the value of forests

to the economy, and the associated need for adequate resource allocation through public intervention and other funding mechanisms.

In conjunction with the ‘Sessional paper no. 1 of 1999 on national policy on water resources management policy and development’, the **National Environment Policy (NEP)** (Government of Kenya, 2013a) provides an important framework in terms of improved river basin management in that the NEP has the goal of ensuring a “*better quality of life for present and future generations through sustainable management and use of the environment and natural resources*”. As such, this framework policy has relevance to a number of differing sectors that are engaged in the management of natural resources, including water resources. The objectives of this policy that have relevance to the management of the basins include, amongst others:

There is significant alignment in the objectives and principles laid down in NEP with the current approaches utilised within the Kenyan water sector, and this is aligned with best practice.

A key issue to distil from the ‘Sessional paper no. 1 of 1999 on national policy on water resources management policy and development’ and NEP concerns the recognition of the value and benefits that are accrued from ecological infrastructure. This refers to the naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction (SANBI , 2013). Our ability to ensure that ecological infrastructure is managed and maintained will be an essential dimension of our resilience against climate variability and climate change.

The **National Forest Policy of 2014** provides the policy statements for how the government intends to conserve indigenous forests and manage plantation forests, dryland forests, urban forests and roadside tree planting and farm forestry.

3.2.3 Legislation

The water and environmental legislation in Kenya has developed over time and this has enabled successive adjustments in order to improve the manner in which water (and other natural resources) are managed and sustainably developed.

3.2.3.1 Energy

Alongside the 2015 Final Draft policy, the **Energy Bill 2015** was published. The bill is intended to align the current regulatory framework in the energy sector to the devolved structure of government outlined in the Constitution, as well as implement the recommendations contained in the 2015 Final Draft policy.

The **Energy Act, No.1 of 2019** (The Energy Act No 1 of 2019, 2019) was signed into law on 12 March 2019 and is now in force. The new Act introduced several amendments to the repealed Energy Act to consolidate the laws relating to energy, to properly delineate the functions of the national and devolved levels of government in relation to energy, to provide for the exploitation of renewable energy sources, to regulate midstream and downstream petroleum and coal activity and for the supply and use of electricity and other forms of electricity. The new Energy Act has also established several new ‘energy sector entities’ that replaced those existing under the repealed laws and has gone further to restate and expand their mandates where this is necessary for them to properly discharge their functions (Munyaka, 2019).

3.2.3.2 Mining

The **Mining Act, No. 12 of 2016** (*The Mining Act, No. 12 of 2016*, 2016) came into force on 27 May 2016, followed by the Mining Regulations and Guidelines came into force on 19 May 2017. The Act applies to coal and coal seam gas, although it does not apply to petroleum and hydrocarbon gases. The new Act also expands on the definition of a person who is eligible to be issued a prospecting right and appears to be aimed at reducing the incidences of speculation in the mining sector. The Mining Act

sets out the obligations of the state with regards to the use of the environment in particular a sustainable manner.

Artisanal Miners have also been legalised under the new Mining Act. Transparency and accountability are promoted through use of the Online Mining Cadastre portal for licensing and management of mineral rights and permits, as well as separate licensing regimes for small-scale and large-scale mining operations. Licences for large-scale operations can be issued to both local and international investors. Small-scale licensees will however only be awarded to local investors who are citizens of Kenya or body corporates wholly owned by Kenyan citizens. The new mining legislation ensures that investments benefit local communities and their economies as licence applications require submission of a local employment plan and a plan for local procurement of goods and services (GLI, 2017).

Alongside the 2015 Final Draft policy, the **Petroleum (Exploration Development and Production) Bill 2015** was published. This Bill intended to align the current regulatory framework in the mining sector to the devolved structure of government outlined in the Constitution, as well as implement the recommendations contained in the 2015 Final Draft policy. The Petroleum (Exploration Development and Production) Bill 2015 will update the regulatory framework established under the Petroleum (Exploration and Production) Act, establishing a new Upstream Petroleum Regulatory Authority and providing the terms of a new model production-sharing contract (GLI, 2017). On 12 March 2019 the **Petroleum Act, No. 2 of 2019** (The Petroleum Act No 2 of 2019, 2019) was signed and it is now in force, providing a framework for contracting, exploration, development and production of petroleum. In addition to providing a new model petroleum agreement, the Act addresses the regulation of midstream and downstream petroleum operations previously covered in the repealed Energy Act, 2006.

3.2.3.3 Water

The promulgation of the **Water Act 2016** aligned Kenya's water sector with the 2010 Constitution and enables amendments to support the improved management of water resources. The Water Act (Act No 12 of 2016) revises the institutional mandates of key water sector institutions and sets out the role of counties in the water sector. The Act recognises that water related functions are a shared responsibility between the National Government and the County Governments. The mandate for the provision of water and sanitation services and the development of county water works is delegated to county governments. The Act defines a clear role for the WRA in the regulation of water resources, which provides a potential strengthening in the way that water resource development is regulated. The Act gives priority to domestic water users over irrigation and other water users. However, there are some ambiguities in the Act which require resolution in order to clarify institutional matters.

The national government remains in charge of the regulation of water services and water resources. It also continues to manage national public water works, which extend across more than one county by nature of the water resource they use and are funded from the national government budget.

The Water Act does not allocate detailed functions of national and county governments in water resource management but provides instead for a National Water Resource Strategy to address this.

The Act established some new institutions and made changes to others, as listed below:

- **Ministry of Water, Sanitation and Irrigation (MoWSI)** as the sector leader and coordinator, taking responsibility to policy development
- The **Water Resources Authority (WRA)**: mandated to protect, conserve, control and regulate the management and use of water resources and to support the Cabinet Secretary in policy formulation and the establishment of a National Water Resource Strategy. Their role includes the formulation and enforcement of procedures/regulations, water abstraction permitting and collecting of water use fees, flood mitigation and advising the Cabinet Secretary generally on the management and use of water resources. The Act requires the development of water resources allocation plans at basin level, and the WRA needs to permit the development of any water source (surface or groundwater).

- **Water Services Regulatory Board (WASREB)** for regulation of water services' providers. Its functions comprise: issuing of licenses to water services boards and approval of Service Provision Agreements, developing tariff guidelines and carrying out tariff negotiations, setting standards and developing guidelines for service provision, publishing the results of sector monitoring in the form of comparative reports.
- **National Water Harvesting and Storage Authority** for major water infrastructural development,
- **Water Tribunal** for dispute resolution,
- **Water Sector Trust Fund** for water services development towards the un-served and poor segments of the society in peri-urban and rural areas,
- **Water Works Development Agencies** to replace the Water Service Boards. The Water Act provides the Cabinet Secretary for Water with the power to establish an undefined number of Water Works Development Agencies to manage such national public water works, thus replacing the current Water Services Boards.
- **Basin Water Resources Committees** to replace Catchment Advisory Committees (CAACs).
- **Water Services Providers (WSPs)** who, with the **county governments**, provide water and sanitation services in the counties. Operations must be in accordance with a Service Agreement entered between each WSP and WASREB.
- In rural areas where services are not commercially viable, **counties** are now responsible for facilitating access to services, for developing the required infrastructure for distribution, and for contracting community associations, public benefit organizations or private operators to manage such systems (KEWASNET, 2017)
- The **Water Resource User Associations (WRUAs)**: provide community-based management of water resources and resolution of associated conflicts.

Key water sector institutions are shown in Figure 3-1.

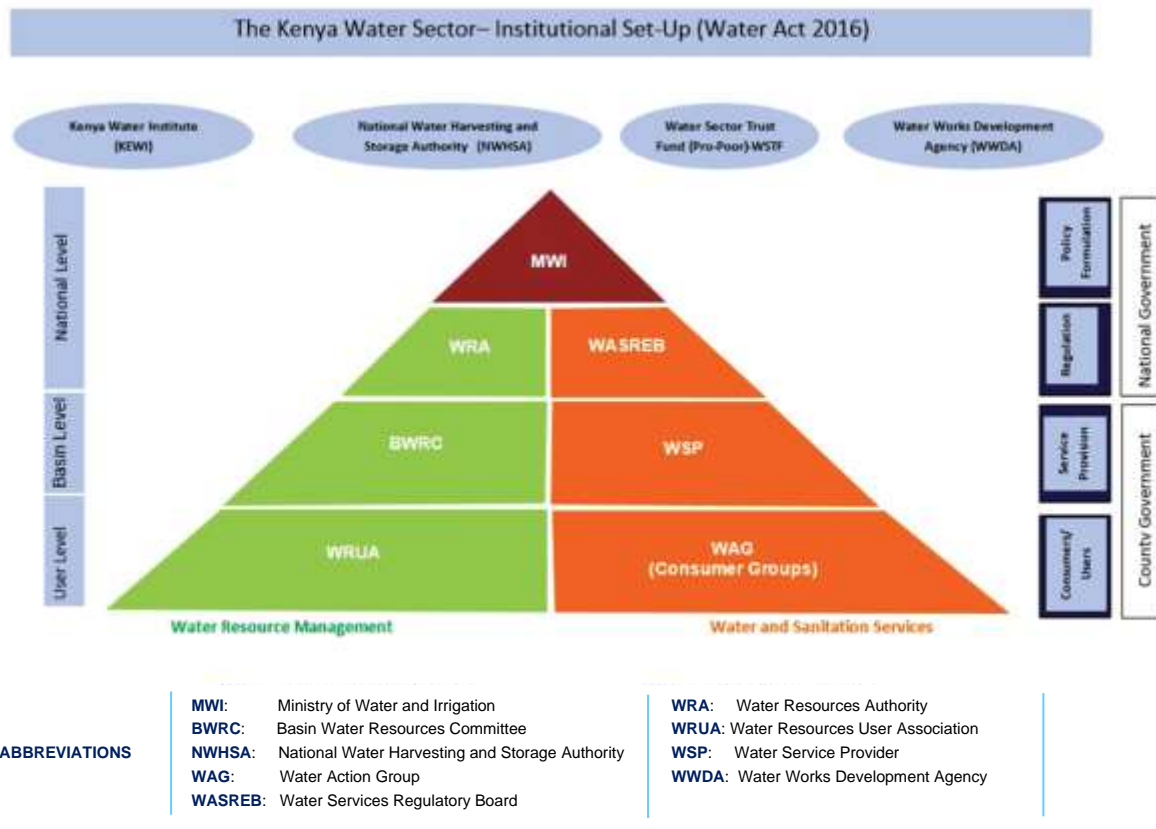


Figure 3-1: Kenya Water Institutions (Water Act 2016)

3.2.3.4 Land

The **Land Act of 2012** outlines the process followed for registering land in Kenya, whilst the **Community Land Act of 2016** outlines the management of community land.

There are a range of legislative instruments that underpin the development of agriculture in Kenya. Amongst these is the **Agriculture, Fisheries and Food Authority Act (Act No 13 of 2013)** which provides for the regulation and promotion of agriculture. This is supported through the establishment of the Agriculture, Fisheries and Food Authority (AFFA) that is charged with, in consultation with County Governments, administering the **Crops Act**, (Act No 16 of 2013) and the **Fisheries Act** (Chapter 378 of 1989).

3.2.3.5 Environment and forestry

The **Environmental Management and Coordination Act, 1999 (as amended 2015) Cap 387 (EMCA)** is the framework law on the environment in Kenya. The EMCA was enacted to provide an appropriate legal and institutional framework for the management of the environment in Kenya. The Act was amended in May 2015 and took effect on 17 June 2015.

The Act aims to improve the legal and administrative coordination of the diverse sectoral initiatives in the field of environment in order to enhance the national capacity for its effective management. In addition, the Act seeks to align the 77 sector specific legislations pertaining to the environment in a manner designed to ensure greater protection of the environment. This is in line with national objectives and sustainable development goals enunciated in the Agenda 21 of the Earth Summit held in Rio de Janeiro in 1992. The ultimate objective is to provide a framework for integrating environmental considerations into the country's overall economic and social development. In terms of environmental management, the EMCA provides a comprehensive legal and institutional framework for the handling of all environmental issues in Kenya and covers all sectoral laws.

EMCA does not repeal the sectoral legislation but seeks to coordinate the activities of the various institutions tasked to regulate the various sectors. These institutions are referred to as Lead Agencies in EMCA.

The EMCA is supported by several subsidiary Regulations such as Solid Waste Management Regulations (2006), Environmental Management and Coordination (Water Quality) Regulations (2006) and Emissions Regulations (2007), as well as other pertinent International Environmental Regulations.

The **Forest Conservation and Management Act No 34 of 2016**, was operationalized on 31st March 2017. This Act makes provision for:

- the conservation and management of public, community and private forests and areas of forest land that require special protection;
- defines the rights in forests and prescribes rules for the use of forest land;
- community participation of forest lands by community forest association, the trade in forest products;
- the protection of indigenous forests and the protection of water resources.

The Act establishes the Kenya Forest Service (KFS) as a body corporate and the Forest Conservation and Management Trust Fund. The Act states the Service's mandate as "to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes"

The Service shall, among other things:

- conserve, protect and manage all public forests in accordance with the provisions of the Act;
- prepare and implement management plans for all public forests and, where requested, assist in preparation of management plans for community forests or private forests in consultation with the relevant owners;
- receive applications for and issue licences and permits;
- establish and implement benefit sharing arrangements in accordance with the provisions of the Act;
- manage water catchment areas in relation to soil and water conservation, carbon sequestration and other environmental services in collaboration with relevant stakeholders;
- prepare regularly a Forest Status Report and a Resource Assessment Report;
- establish forest conservancy areas.

The Act also stated that the KFS shall only give its consent for quarrying operations in forest areas, only if it does not contain any rare species or is used for protection of water resources. The Act also establishes the Kenya Forestry College and defines Forestry functions of County Governments (FAO, 2016).

The **Agriculture Act cap 318: Agriculture (Farm Forestry) Rules, 2009 (Cap. 318)** require farmers to establish and maintain farm forestry on at least ten percent of every agricultural land holding. One of the objectives of the Rules is to preserve and sustain the environment and combating climate change and global warming. Other declared objectives include: the conservation of water, soil and biodiversity; the protection of riverbanks.

3.2.4 National institutions

3.2.4.1 National Ministries and departments

In the aftermath of the 2017 national elections, the national government in Kenya has undergone some changes in configuration to support a more effective and efficient Government. Whilst there are a number of Ministries that can be seen as enablers (e.g. Education, Justice etc), the key sector ministries from a basin planning perspective for the **energy and mining** sectors include:

- Ministry of Energy (MoE)

- Ministry of Petroleum and Mining (MoPM)
- Ministry of Water, Sanitation and Irrigation (MoWSI)
- Ministry of Agriculture, Livestock and Fisheries (MoALF)
- Ministry of Lands and Physical Planning (MoLPP)
- Ministry of Environment and Forestry (MoEF)

The State Department of Energy under the MoE is mandated to undertake national energy and policy management; hydropower development; geothermal exploration and development; rural electrification programme; promotion of renewable energy; and energy regulation, security, and conservation. There are three Directorates; electrical power, renewable energy and geo-exploration.

The MoPM have two departments; the State Department for Mining and the State Department for Petroleum. Relevant functions for the State Department for Mining are developing policy and mineral exploration. The State Department for Petroleum has three sections: the upstream, mid-stream and downstream. The upstream section involves the process of exploration, development and production of crude oil and natural gas. The mid-stream section revolves around storage, refining and transportation of crude oil into consumable petroleum products. In the downstream section, refined products are made available to the consumers through supply and distribution, for example at petrol stations.

The State Department of Irrigation Services under MoWSI has irrigation mandates of benefit to the agricultural sector. The Irrigation Services Department is the leading agency for irrigation and drainage development including operation and maintenance of the existing large-scale public irrigation and drainage facilities. It has offices, which provide services to irrigators and other stakeholders. Under the State Department of Irrigation, there are four departments: Department of Irrigation and Drainage; Department of Irrigation Water Use Services; Department of Water Storage and Flood Control; Department of Land Reclamation.

The MoALF has as its mandate to improve the livelihood of Kenyans and ensure food security by promoting competitive, commercially oriented fisheries, crop and livestock farming through creation of an enabling environment, and ensuring sustainable natural resource management. The Ministry was created in 2013 following the merge of the three ministries of agriculture, livestock development and marketing and fisheries. Its strategic objectives revolve around creating an enabling environment for agricultural development, increasing productivity and outputs in the agricultural sector, enhancing national food security, improving market access and trade and strengthening Institutional capacity. The Agricultural State Department under the MoALF is responsible for advancing technology and infrastructure development, mechanisation, crop resources and agribusiness. The Livestock State Department looks after veterinary services and livestock resources, while the Fisheries State Department is responsible for aquaculture development. All three state departments drive policy research, regulation and market development in their respective agricultural sub-sectors.

The MoLPP is made up of the Department of Lands and Department of Physical Planning. The Department of Physical Planning is considered the lead national authority and advisor on matters of physical planning as well as urban development and management.

The MoEF has three directorates applicable to catchment management and forestry. The Directorate of Environment coordinates environmental and forestry policies and the implementation thereof as well as provides guidance on any environment-related issues. The Directorate of Forestry Conservation is mandated to manage and conserve forestry resources through policy formulation, conservation strategies and management of forest resource utilisation. Lastly, the Directorate of Climate Change guides and coordinates climate change-related matters, including implementation of the national climate change plans.

3.2.4.2 National level public entities

Whilst these Ministries have the broad ambit to develop policy, under legislation they have established various national level public entities that have the mandate to perform regulatory and developmental functions. These public entities that function at a national level are tabulated, in Table 3-1.

Table 3-1 National level public entities that have relevance to the integration of IWRM in the energy and mining sectors

Institution	Roles and responsibilities*
Ministry of Energy (MoE)	
Energy and Petroleum Regulatory Authority (EPRA)	<ul style="list-style-type: none"> - Regulate the generation, importation, exportation, transmission, distribution, supply and use of electrical energy with the exception of licensing of nuclear facilities; - Regulate the production, conversion, distribution, supply, marketing and use of renewable energy - Work with the relevant statutory authorities to formulate, enforce and review environmental, health, safety and quality standards for the upstream petroleum sector; - Develop guidelines, in consultation with other statutory authorities, in relation to the implementation of treaties, conventions or protocols affecting the upstream petroleum sector that have been ratified by Kenya; - Ensure enforcement and compliance with the national values and principles; - Protect consumer, investor and other stakeholder interests; - Collect and maintain energy data; - Develop guidelines on applicable treaties, conventions and protocols affecting the energy sector in consultation with other statutory authorities except those relating to nuclear energy; - Co-ordinate the development and implementation of a national energy efficiency and conservation action plan, in consultation with relevant statutory authorities and other stakeholders; - Promote, in consultation with the Kenya National Accreditation Service, the establishment of accredited laboratories for energy efficiency; and - Perform any other function that is incidental or consequential to its functions under the Energy Act, 2019 or any other written law
Kenya Power and Lighting Company Plc (KPLC)	<ul style="list-style-type: none"> - Plan for sufficient electricity generation and transmission capacity to meet demand; - Building and maintaining the power distribution and transmission network; - Retailing of electricity to its customers.
Kenya Electricity Transmission Company (KETRACO)	<ul style="list-style-type: none"> - Plan, design, construct, own, operate and maintain high voltage electricity transmission grid and regional power interconnectors that will form the backbone of the National Transmission Grid
Rural Electrification and Renewable Energy Corporation (RREC)	<ul style="list-style-type: none"> - Source additional funds for the Rural Electrification Programme and renewable energy; - Develop and update the renewable energy master plan taking into account county specific needs and the principle of equity in the development of renewable energy resources; - Establish framework for collaboration with County Governments in the discharge of its mandate; - Undertake feasibility studies and maintain data with a view to availing the same to developers of renewable energy resources; - Develop, promote and manage in collaboration with other agencies, the use of renewable energy and technologies, including but not limited to biomass (biodiesel, bio-ethanol, charcoal, fuel-wood, bio-gas) municipal waste, solar, wind, tidal waves, small hydropower and co-generation but excluding geothermal; - Undertake, in conjunction with the Agency, research, development and dissemination of appropriate renewable energy technologies; - Provide an enabling framework for the efficient and sustainable production, conversion, distribution, marketing and utilization of biomass, solar, wind, small hydros, and municipal waste; - Promote, in conjunction with the Agency responsible for forests, the use of fast maturing trees for energy production including bio-fuels and the establishment of commercial woodlots including peri-urban plantations; - Promote, in collaboration with other agencies, the development of appropriate local capacity for the manufacture, installation, maintenance and operation of renewable

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Institution	Roles and responsibilities*
	<p>technologies such as bio-digesters, solar systems, turbines and other renewable energy technologies;</p> <ul style="list-style-type: none"> - Promote international co-operation programmes focusing on renewable energy sources; - Harness opportunities offered under clean development mechanism and other mechanisms including, but not limited to, carbon credit trading to promote the development and exploitation of renewable energy sources; - Undertake any other duty or perform such other function as may be necessary for the execution of its mandate under this Act.
Kenya Energy Generation Company (KenGen)	<ul style="list-style-type: none"> - Generate electricity through the development, management and operation of power plants - Generate sustainable power for the nation
Nuclear Power and Energy Agency (NuPEA)	<ul style="list-style-type: none"> - Promote and implement Kenya's Nuclear Power Programme in line with the Government's Vision 2030 development blueprint; - Promote and expedite the development of nuclear electricity generation in Kenya
Geothermal Development Company (GDC)	<ul style="list-style-type: none"> - To promote rapid development of geothermal resources in Kenya through surface exploration and drilling for steam. - To avail steam to power plant developers for electricity generation. - To manage the geothermal reservoirs- to ensure constant supply of steam for power generation. - To promote alternative uses of geothermal resources other than electricity generation. These include greenhouse heating, drying of grains, pasteurizing milk, cooling and heating of rooms, among others.
Energy and Petroleum Tribunal	<ul style="list-style-type: none"> - The Tribunal shall have jurisdiction to hear and determine all matters referred to it relating to the energy and petroleum sector (excluding trial of criminal offences) arising under the Act or any other Act. - The Tribunal shall have original civil jurisdiction on any dispute between a licensee and a third party or between licensees. - The Tribunal shall also have appellate jurisdiction over the decisions of the EPRA and any licensing authority and may refer any matter back to the Authority for re-consideration. - The Tribunal shall have power to grant equitable reliefs including but not limited to injunctions, penalties, damages, specific performance.
Ministry of Petroleum and Mining (MoPM)	
National Oil Cooperation of Kenya (NOCK)	<ul style="list-style-type: none"> - Was incorporated in April 1981 with a mandate to participate in all aspects of the petroleum industry
Kenya Pipeline Company (KPC)	<ul style="list-style-type: none"> - To provide efficient, reliable, safe and cost effective means of transporting petroleum products from Mombasa to the hinterland. - To build a pipeline for the conveyance of petroleum or petroleum products from Mombasa to Nairobi. - To own, manage or operate such pipelines and any other pipelines and associated ancillary facilities. - To market, process, treat, deal in petroleum products and other products and goods and provide transport and other distributive facilities, outlets and services in connection therewith.
National Mining Corporation	<ul style="list-style-type: none"> - to invest in the mining industry on behalf of the national government
Mineral Rights Board	<ul style="list-style-type: none"> - advise and give recommendations in writing to the Cabinet Secretary Mining on various issues including: <ul style="list-style-type: none"> o granting, rejection, renewal, revocation and transfer of Mineral Rights Agreements; o areas suitable for small scale and artisanal mining; o areas where mining operations may be excluded and restricted; o declaration of certain minerals as strategic minerals; o cessation, suspension or curtailment of production in respect of mining licenses; o fees , charges and royalties payable for a mineral right or mineral; and o other pertinent matters referred to it
Ministry of Water, Sanitation and Irrigation (MoWSI)	
Water Resources Authority (WRA)	<ul style="list-style-type: none"> - Formulate and enforce standards, procedures and Regulations for the management and use of water resources and flood mitigation. - Regulate the management and use of water resources.

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Institution	Roles and responsibilities*
	<ul style="list-style-type: none"> - Receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits. - Determine and set permit and water use fees as well as collect water permit fees and water use charges. - Provide information and advice to the Cabinet Secretary for formulation of policy on national water resource management, water storage and flood control strategies.
National Water Harvesting and Storage Authority (NWHSA)	<ul style="list-style-type: none"> - Development of national public water works for water resources storage and flood control. - Maintain and manage national public water works infrastructure for water resources storage. - Develop a water harvesting policy and enforce water harvesting strategies.
Water Works Development Agencies (WWDAs)	<ul style="list-style-type: none"> - Undertake the development, maintenance and management of the national public water works within its area of jurisdiction. - Operate water works and provide water services as a water service provider, as a transitional arrangement or as instructed by the Water Services Regulatory Board (WASREB). - Provide technical services and capacity building to such County Governments and water service providers within its area as may be requested.
Regional Development Authorities (RDAs)	<ul style="list-style-type: none"> - Promote integrated water resources development within jurisdictions to ensure equitable socio-economic development
Ministry of Agriculture, Livestock and Fisheries (MoALF)	
Agriculture, Fisheries and Food Authority (AFFA)	<ul style="list-style-type: none"> - Administer Crops Act and Fisheries Act in accordance with the provisions of these Acts. - Promote best practices in, and regulate, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural and aquatic products excluding livestock products as may be provided for under the Crops Act, and the Fisheries Act. - Collect and collate data, maintain a database on agricultural and aquatic products excluding livestock products, documents and monitor agriculture through registration of players as provided for in the Crops Act and the Fisheries Act. - Responsible for determining research priorities in agriculture and aquaculture. - Advise National Government and County Governments on agricultural and aquatic levies for purposes of planning, enhancing harmony and equity in the sector. - Carry out such other functions as may be assigned to it by this Act, the Crops Act, the Fisheries Act and any written law while respecting the roles of the two levels of governments.
Ministry of Lands and Physical Planning (MoLPP)	
National Land Commission (NLC)	<ul style="list-style-type: none"> - Develop a framework for monitoring, oversight and reporting on performance of various public, private, communities, non-state actors and individual land holders in performing their obligations; - Conduct research on matters related to land and the use of natural resources and make recommendations to the relevant authorities; - Prepare reports to bring out challenges in the implementation of National Land Use Policy by the different sectors - Carry out periodic reviews on sectoral performance in the implementation of this Policy to be submitted to all levels, specific agencies, county governments, Parliament and President; - Carry out resource mobilization for the sectors in the implementation of the Policy as the lead advocacy agent
Ministry of Environment and Forestry (MoEF)	
National Environmental Management Authority (NEMA)	<ul style="list-style-type: none"> - Co-ordinate environmental management activities being undertaken by lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects to ensure the proper management and rational utilisation of environmental resources. - Take stock of natural resources in Kenya and their utilisation and conservation. - Establish and review in consultation with the relevant lead agencies, land use guidelines. - Monitor and assess activities, including activities being carried out by relevant lead agencies, to ensure that the environment is not degraded by such activities and environmental management objectives are adhered to.

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Institution	Roles and responsibilities*
Kenya Water Towers Agency (KWTA)	<ul style="list-style-type: none"> - Coordinate and oversee the protection, rehabilitation, conservation, and sustainable management of Kenya's water towers. - Co-ordinate and oversee the recovery and restoration of forest lands, wetlands and biodiversity hot spots. - Promote the implementation of sustainable livelihood programmes in the water towers in accordance with natural resource conservation.
Kenya Forestry Service (KFS)	<ul style="list-style-type: none"> - Increase net forest cover - Enhance conservation, sustainable management and utilisation of forests by improving livelihoods in rural areas

* The roles and responsibilities provided are not comprehensive but provides some of the key functions relevant to the River Basin Planning.

To achieve effective integrated planning and management, there is a need for integrated approaches between different departments and agencies at the national level. However, there are significant challenges in terms of ensuring the alignment in policy and legislation, which requires capacity in the respective institutions, to be able to work in an integrated manner and have the necessary systems to support this integration.

3.2.5 Regional and local level institutions

3.2.5.1 Energy

The Electrical Power Directorate is charged with hydropower development and the Renewable Energy Directorate with renewable energy development. These directorates are mainly involved with developing projects and do not necessarily act at the local level.

3.2.5.2 Mining

Within the upstream petroleum division there are four petroleum exploration basins (Lamu Basin, Anza Basin, Manderu Basin and Tertiary Rift Basin) are considered. As at December 2015 74 wells had been drilled with 12 hydrocarbon discoveries to date, nine of which are in Turkana County. The other three are in Anza Basin and Offshore Lamu. As at December 2015, there were 46 petroleum exploration blocks in Kenya of which 44 have been licensed and are operated by 23 International Oil Exploration Companies.

The midstream petroleum division involves the Petroleum is one of the prime movers of the country's social and economic development. Petroleum products are predominantly used in transport, commercial and industrial sectors. The MoPM coordinates this activity with oil marketing companies through a process known as an Open Tender System. The Kenya Pipeline Company provides product movement infrastructure including storage and oil pipeline services.

3.2.5.3 NEMA Regional Offices

There are eight NEMA regional offices that manage the county field offices in Kenya. County Environmental Committees (CEC) are the District level bodies chaired by respective County Commissioners and bringing together representatives from all the ministries; representatives from local authorities within the province/district; two farmers/pastoral representatives; two representatives from NGOs involved in environmental management in the province/district; and a representative of each regional development authority in the province/district. To each CEC in the country is attached a County Environmental Coordinator who serves as the secretary to the CEC, and as the NEMA Officer on the ground, is charged with responsibility of overseeing environmental coordination among diverse sectors.

Table 3-2: NEMA regional offices

Region	Regional office	Counties
COAST REGION	Mombasa	Kilifi, Kwale, Lamu, Mombasa, Taita Taveta
CENTRAL	Isiolo	Embu, Isiolo, Kirinyaga, Laikipia, Marsabit, Meru, Tharaka-Nithi
NORTH LAKE	Kisumu	Bungoma, Busia, Kakamega, Kisumu, Siaya, Vihiga
NAIROBI METROPOLI	Nairobi	Kajiado, Kiambu, Machakos, Makueni, Muranga, Nairobi
NORTH EASTERN	Garissa	Garissa, Kitui, Mandera, Tana River, Wajir
NORTH RIFT	Eldoret	Elgeyo Marakwet, Nandi, Trans-Nzoia, Turkana, West Pokot, Uasin Gishu
SOUTH RIFT	Nakuru	Baringo, Nakuru, Kericho, Narok, Nyandarua, Samburu
SOUTH LAKE	Kisii	Bomet, Homa Bay, Kisii, Migori, Nyamira

3.2.6 Basin and sub-basin institutions

Noting the requirements of Integrated Water Resources Management, institutions have been established at basin and sub-basin levels to improve the day-to-day management of water resources as well as to improve the regulation and oversight required to ensure that water is efficiently used in accordance with water use permits. Under the auspices of the 2016 Water Act, this is achieved through the six Regional and 26 Sub-Regional Offices of the Water Resources Authority (WRA) and the Water Resource User Associations (WRUAs).

Each of the six basins in Kenya has a **WRA Regional Office (RO)** and a number of **Sub-Regional Offices (SROs)**. Each SRO looks after a number of Catchment Management Units (CMUs), delineated based on hydrological and water resource considerations. Water users apply for water permits through the relevant WRA SRO, and the application is then sent to the RO for processing. Class A to C permits are handled at RO level, while Class D permits are handled at Head Office. A hydrological or hydrogeological assessment report conducted by a qualified professional must be submitted by the water user with the application. The water permits are recorded in the Water Permit Database at the RO.

At a more localised level, the establishment of the **Water Resource User Associations (WRUAs)** has been essential in ensuring a focus on the operational management functions within a sub-basin. WRA has delineated Kenya into 1 237 sub-catchment areas with the intention of forming Water Resources User Associations (WRUAs) for each. The WRUAs are community-based, voluntary associations made up of water users and riparian owners interested in proper management of their water resources and were established to enable the collaborative management of water resources and to provide essential support in the resolution of conflicts concerning the use of water resources. Crucially, the Water Act 2016 makes provision for BWRCs to be able to finance WRUAs for services rendered under contract. To date, WRUAs have performed important local functions, but have faced an array of challenges that have served to hinder their effectiveness. Many of these are enabling factors such as capacity in terms of having sufficient skills and training, but also include such issues as inadequate equipment and insufficient financial resources. These challenges will require redress in order to support the implementation of this Basin Plan and realise the local level capacitation that can unlock the localised socio-economic development required to support Vision 2030. This is supported by the 2016 Water Act that provides in Section 29 (3) that “*basin area water resources management strategy shall facilitate the establishment and operation of water resources user associations*”.

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Sub catchment management plans (SCMP) is a planning tool that is developed by the Water User Associations (WRUA) under regulation by the Water Resources Authority (WRA). Its main objective is to guide the implementation of water resources management and regulation activities within a defined period of time in any given sub catchment. The activities, in most cases, relate to catchment protection, pollution control and water infrastructure development.

The 2016 Water Act in effect strives to strengthen the management of water resources at the basin and sub-basin level, whilst strengthening the regulatory role of WRA both at national and basin scales. This not only removes the dichotomy that WRA faced as being manager and regulator, but also attempts to create a stronger management regime within the basins and sub-basins, noting that counties have a key role to play in water service delivery as well as ensuring that water is used efficiently within their jurisdictions. To this end, the 2016 Water Act introduced **Basin Water Resource Committees (BWRCs)** as a replacement for the previous Catchment Area Advisory Committees (CAACs), with a more managerial intent than the purely advisory role that was played by the CAACs. At this juncture, during what is effectively a period of transition, the BWRCs will initially provide a more advisory function, however, it will be critically important to learn from the challenges that were experienced with the CAACs so that the BWRCs become more effective in supporting water resource management. The regulatory function of the WRA will continue to be strengthened and, in the transition period, ring-fencing of staff within the Regional and Sub-Regional Offices will be essential to separate staff and functions that are managerial in nature, and as such, supportive of the BWRCs. The BWRCs fall under the WRA, and their responsibilities (which must be delegated by WRA) include the formulation of Basin Water Resources Strategies, management of basins, advice to WRA and the facilitation of WRUA establishment. The BWRCs may contract WRUAs as agents to perform certain duties in water resource management. There are conflicting mandates for the BWRCs in the Water Act (2016) where they have both advisory and management functions. ISC has an understanding that the BWRCs will remain advisory for the foreseeable future with a long-term plan of making the BWRCs have an executive role. There is a need to develop tools to support the operationalisation of the BWRCs, when they are finally established, and to ring-fence WRA staff at the Ros who will provide both technical and secretariat services to the BWRCs. The actual responsibility and how the BWRCs will work with WRA at the regional offices will only be clear once the mandates are agreed upon.

Table 3-3 WRA sub-regions, offices and CMUs

Basin	Sub-Region	WRA SRO	CMUs
Athi (RO: Machakos)	Upper Athi	Kiambu	Ruiru, Ndarugu
	Mbagathi - Nairobi	Nairobi	Mbagathi/ Nairobi
	Middle Athi	Kibwezi	Thwake
	Noltresh - Lumi	Loitokitok	Tsavo
	Coastal - Athi -Mombasa	Mombasa	Coastal Zone/ Mombasa
Tana (RO: Embu)	Upper Tana	Murang'a	Sagana-Gura, Lower Sagana, Upper Thika and Lower Thika
	Thiba	Kerugoya	Tana, Karaba, Ena and Thiba
	Kathita - Mutonga	Meru	Mutonga, Kathita, Ura / Tharaka
	Tiva - Tyaa	Kitui	Tiva and Lower Reservoirs
	Lower Tana	Garissa	Lower Tana, Ijara / Lamu
LVS (RO: Kisumu)	Northern Shorelines / Nyando	Kisumu	Northern Shorelines, Upper and Lower Nyando
	Southern Shorelines / Gucha-Migori	Kisii	Southern Shorelines, Gucha and Migori
	Mara / Sondu	Kericho	Sondu, Upper and Lower Mara
LVN (RO: Kakamega)	Kipkaren – Upper Yala	Eldoret	Kipkaren, Upper Yala
	Elgon – Cherangani	Kitale	Upper Nzoia, Middle Nzoia, Sio-Malaba-Malakisi, Mount Elgon

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Basin	Sub-Region	WRA SRO	CMUs
	Lower Nzoia - Yala	Siaya	Lower Nzoia, Lower Yala
RV (RO: Nakuru)	Lower Turkwel	Lodwar	Lake Turkana Basin, Lokitipi Plains
	Upper Turkwel	Kapenguria	Upper Turkwel
	Lakes Baringo/ Bogoria	Kabarnet	Upper Kerio, Suguta River, Lakes Baringo/ Bogoria
	Lakes Naivasha/ Nakuru	Naivasha	Lakes Nakuru/ Elementaita, Lake Naivasha
	South Rift Valley	Narok	Upper and Lower Ewaso Ng'iro South
ENN (RO: Nanyuki)	Engare Narok – Merghis Upper Ewaso Ng'iro	Rumuruti	Ewaso Narok, Nundoto
	Upper Ewaso Ng'iro	Nanyuki	Upper Ewaso Ng'iro, Nanyuki
	Middle Ewaso Ng'iro North Ewaso Laggas	Isiolo	Middle Ewaso Ng'iro, Lower Ewaso Ng'iro
	Ewaso Daa	Mandera	Daa, Ewaso Laggas, Lower Ewaso Ng'iro
	North Ewaso Laggas	Marsabit	Daa, Chalbi and Ewaso Laggas

3.2.6.1 Agricultural extension services

The various State Departments under the MoALF have extension officers and farmer training programmes for engagement with county governments and local farmers. County Coordination Units (CCUs) and County Steering Committees (CSCs) have been instrumental in establishing sound and constructive linkages between national agricultural structures and county governments following devolution, despite the many challenges resulting from the devolution process. The CCUs and CSCs have the potential to play important roles in facilitating the coordination of agricultural investments and interventions at the county level, and in facilitating the provision of capacity building support towards sector coordination by the county governments. To ensure long-term agricultural sustainability at county level, the CSCs and CCUs need to seek and pursue all possible opportunities to strengthen their collaboration with and integration into the county structures and development agenda.

3.2.6.2 Technical Implementation Committees for Land use

There are both National and County technical implementation committees that act as the coordinators for implementation of the National Land Use Policy.

3.2.7 County governments

The 2010 Constitution introduced a decentralised system, with 47 county governments and one national government with specific functions accorded to the two levels. Guided by the overarching objectives and principles of the county governments as set out in the Constitution, specific functions of counties are provided in Schedule Four of the Constitution. County functions on energy and mining sectors entail the following:

1. County Energy Planning

- a) Preparation of county energy plans, incorporating petroleum and coal, renewable energy and electricity master plans.

Physical planning relating to energy resource areas such as dams, solar and wind farms, municipal waste dumpsites, agricultural and animal waste, ocean energy, woodlots and plantations for production of bio-energy feed-stocks.

Provision of land and rights of way for energy infrastructure.

- Facilitation of energy demand by planning for industrial parks and other energy consuming activities.
- Preparation and implementation of disaster management plans.
- 2. County Energy Regulation
 - a) Regulation and licensing of retail supply of petroleum and coal products.
 - Regulation and licensing of designated parking for petroleum tankers.
 - Regulation and licensing of biomass and charcoal producers, transporters and distributors.
 - Customize national codes for energy efficiency and conservation in buildings to local conditions.
- 3. County Energy Operations and Development
 - a) Electricity and gas reticulation.
 - Provide and maintain adequate street lighting.
 - Provision of designated parking for petroleum tankers.
 - Collect and maintain energy data.
 - Implementation of county electrification projects.
 - Undertake feasibility studies and maintain data with a view to availing the same to developers of energy resources and infrastructure.
 - Establishment of energy centres for promotion of renewable energy technologies, energy efficiency and conservation.
 - Protection of energy infrastructure including oil and gas fields and pipelines, refineries, power plants, control centres, electric supply lines, substations and depot.

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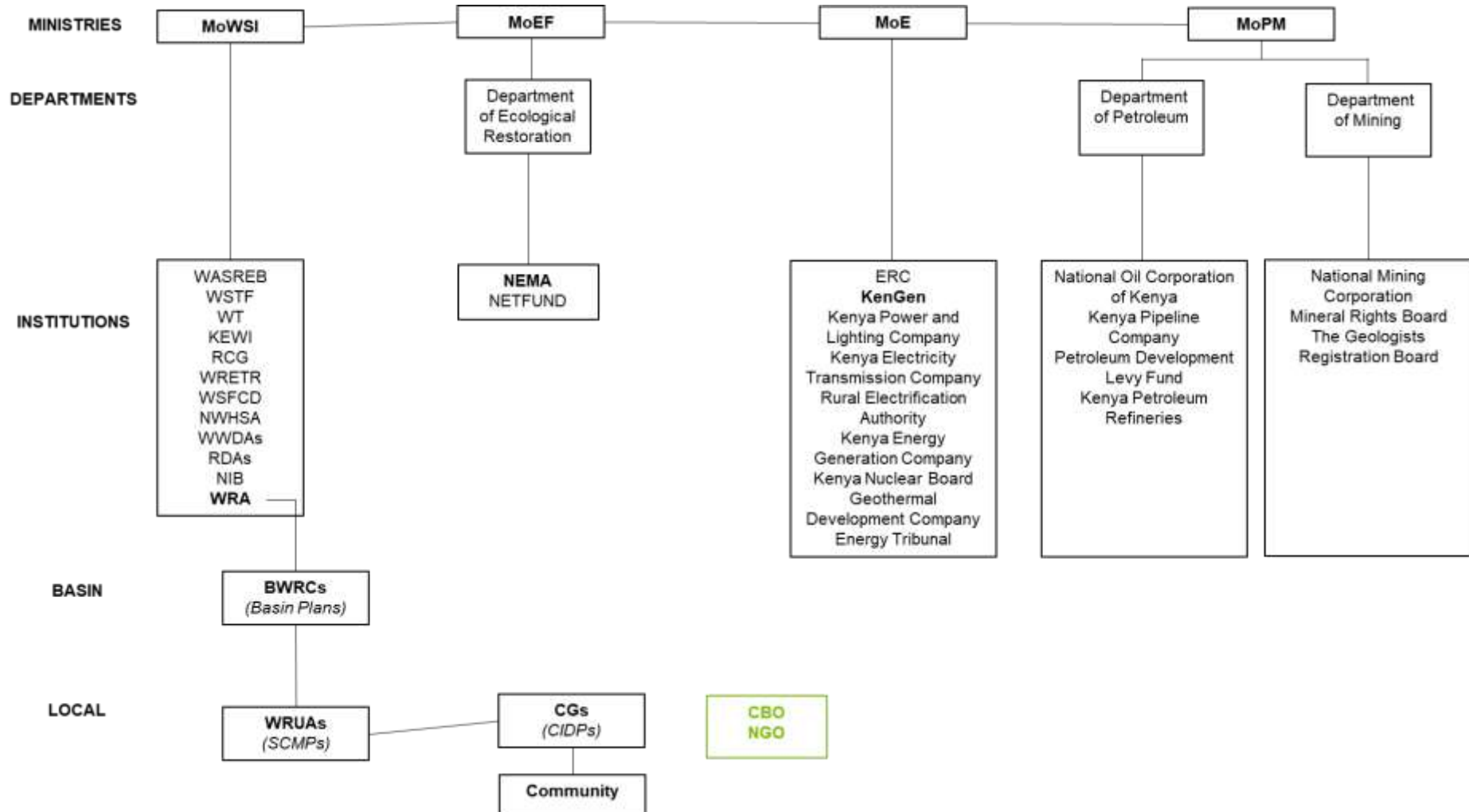


Figure 3-2: Key institutions involved in the energy and mining sector in Kenya

3.3 Existing Planning

3.3.1 Energy

3.3.1.1 Third Medium Plan 2018–2022

The Third Medium Term Plan (MTP III) is a nationwide multi-sectoral document that outlines the main policies, legal and institutional reforms as well as programs and projects that the Government plans to implement during the period 2018-2022. It is a part of the implementation process of the Kenya Vision 2030, the national strategy covering the period from 2008 to 2030 which aims to transform Kenya into a newly industrializing, middle-income country providing a high-quality life to all its citizens through three pillars: economic, social and political. (Food and Agriculture Organization (FAO), 2018) The MPT III identified several energy flagship infrastructure programmes and projects, which are indicated in Table 3-4.

Table 3-4 Programmes and Projects for 2018-2022

Energy Flagship Programmes and Projects	
Infrastructure	
Increase Power Generation:	The programme aims at promoting development and use of renewable energy sources to create a reliable, adequate and cost-effective energy supply regime to support industrial development. Key programmes and projects are prioritized for implementation to increase additional electricity installed capacity to 5,221 MW by 2022 from the following sources: <ul style="list-style-type: none"> - 93MW from Hydro Power Projects; - 913MW from Geothermal Power Projects; - 800MW from Wind Power Projects; - 157MW from Biomass Power Projects; - 442MW from Solar Power Projects; - 328MW from Coal Power Project; and - 400MW from Imports.
Nuclear Power Development Programme	This will involve development of a legislative and regulatory framework; site identification of the nuclear power plants; continued capacity building through both national programme and international partnerships; public education and advocacy; establish a Research and Development Institute in the energy sector.
Power Transmission	During the Plan period, a total of 5,121Km of power transmission lines and 77 high voltage substations will be constructed in addition to an ultra-modern National System Control Centre, and construction of transmission lines in offgrid townships to interconnect these regions to the national grid. Further, regional interconnector transmission lines (Ethiopia-Kenya, Kenya-Uganda and Kenya-Tanzania) will be constructed.
Last Mile Connectivity Project	A total of 5 million new households are targeted for connection to electricity through grid and off-grid solutions and 15,739 public facilities other than primary schools will be connected. In addition, public street lighting project will be completed. To stimulate the 24-hour economy and catalyse the manufacturing sector, the cost of off-peak power to heavy industries will be reduced by 50%.
Distribution Network	The Sector targets to construct 116 new primary distribution substations with a

Energy Flagship Programmes and Projects	
Expansion and Improvement	distribution capacity of 2,809 Megavolt-Ampere (MVA) and 1,244 Km of associated 66KV and 33 Kilo Vaults (KV) lines, 20 new bulk supply substations and installation of 336.5 Megavolt-Ampere Reactive (MVAR) power compensation equipment in 15 transmission substations.
Improved Power Supply Reliability	The programme aims at improving power supply reliability by at least 20% by 2022. This will be achieved through replacing overhead distribution power lines across major towns and their environs, such as Nairobi, Mombasa, Kisumu, Eldoret, Thika and Nakuru with underground distribution power lines. In addition, system audits to identify weak points in the network will be undertaken while accurate calculation and monitoring of power supply quality indices will be initiated.
Renewable Energy Technologies	The programme will include: preparation of a renewable energy resources inventory and resource map; formulation of a national strategy for coordinating research in renewable energy; and promoting the use of municipal waste for energy production. It will also involve: promoting the development of appropriate local capacity for the manufacture, installation, maintenance and operation of basic renewable technologies such as bio-digesters, solar systems and turbines; harnessing opportunities offered under clean development mechanism and other mechanisms; and promoting international co-operation on programmes focusing on renewable energy sources and climate change.

3.3.1.2 Least Cost Power Development Plan (revised March 2011)

The Least Cost Power Development Plan (LCPDP) is a long-term least cost power generation expansion plan that was prepared by the MoEP and Energy Regulatory Commission in collaboration with the power utilities. It also contains proposed transmission investments and rural electrification. The candidate generating plants and technologies considered for the inclusion in the plan were: (a) oil-fired thermal -- medium and high-speed diesels; (b) geothermal; (c) hydro power; (d) wind; (e) co-generation -- combined heat and power; and (f) coal-fired steam.

Based on the LCPDP strategy, Kenya's electricity demand is projected to increase to 18 000 MW by 2030 with planned generation expansion based on reduced dependence on hydropower and diesel, and increased expansion of geothermal, nuclear, coal, and wind energy. It is estimated that over 38 million cubic metres will be required for energy generation in 2030/31.

3.3.1.3 Power Generation and Transmission Master Plan (2016)

The Power Generation and Transmission Master Plan (MoEP, 2016) undertook an extensive energy demand forecast analysis to provide a sound basis for the power system expansion planning. Suitable scenarios for analysis were selected reduce the impact of the forecast uncertainty on the planning results. The forecast was developed for three scenarios and one sub-scenario:

1. Reference scenario: applying key assumptions for a probable development based on the historic development and actual plans (technical, demographic and economic issues diligently assessed).
2. Vision scenario: normative scenario; applying the wide range of largely ambitious government plans (e.g. 100% connectivity level by 2020; less challenged flagship project developments).
3. Low scenario: scenario for sensitivity and risk analyses; applying more conservative assumptions than reference scenario and similar to historic developments.
4. Energy Efficiency (reference sub-scenario): applying the EE potential to the reference scenario, as detailed in the separate EE report.

The forecasted electricity consumption and peak load values for the analysis period from 2015 to 2035 is displayed in Table 3-5. Based on the reference scenario, electricity consumption was forecasted to grow in the long term by an annual average rate of 7.3% per year. The annual peak load was forecasted to grow at slightly higher rate of 7.5% per annum from 1,600 MW in 2015 to 6,700 MW in 2035.

Table 3-5 Electricity consumption and peak load forecast -reference, vision, low scenarios (2015 - 2035)

Scenario		Unit	Growth	2015 ¹	2016	2020	2025	2030	2035
LTP									
Refer- ence with flagship projects	Consumption gross	GWh	7.3%	9,453¹	10,093	13,367	19,240	27,366	38,478
	Growth	%		5.4%	7%	8%	9%	8%	7%
	Peak load	MW	7.5%	1,570¹	1,679	2,259	3,282	4,732	6,683
	Growth	%		4%	7%	8%	9%	10%	7%
		MW		58	109	169	260	412	462
Vision with flagship projects	Consumption gross	GWh	9.6%		10,592	16,665	25,469	39,260	58,679
	Growth	%			12%	13%	10%	11%	8%
	Peak load	MW	9.8%		1,770	2,845	4,431	6,833	10,219
	Growth	%			13%	13%	12%	11%	8%
		MW			200	330	478	689	786
Low without flagship projects	Consumption gross	GWh	5.6%		10,035	12,632	16,427	21,375	28,153
	Growth	%			6%	6%	5%	6%	6%
	Peak load	GWh	5.7%		1,669	2,116	2,769	3,618	4,788
	Growth	%			6%	6%	5%	5%	6%

¹ Derived from latest available data (peak: NCC hourly load indicate 1,550 – 1,570 MW peak in October 2015; consumption: KPLC annual report 2014/2015 and preliminary half annual accounts 2015).

Source: (MoEP, 2016)

3.3.1.4 Power Generation Expansion Plan

The formulation of the generation expansion plan was based on a two-step least cost generation system optimisations with consideration of the transmission network. The proposed energy mix of the generation expansion plan was intended to be, providing increased security of supply with substantial contribution from renewable sources. The generation expansion path and electricity generation for the reference scenario is displayed in Figure 3-3. The key results and corresponding conclusions and planning recommendations as presented in the Power Generation and Transmission Master Plan were:

- Main base load expansion is reached through geothermal capacity (geothermal will represent one third of the installed generation capacity providing more than half of the annual generated electricity in 2035), about half of the geothermal capacity will be located in the Olkaria area. In case of high demand developments, base and intermediate load capacity is supplemented by coal.
- Second largest share in the long-term energy mix is represented by hydropower (16% in 2035 in the reference scenario, down from a share of some 40% today). HPPs will also play a major role in the provision of flexible capacity to the system.
- Back-up capacity expansion is about 1,890 MW (about 20% of the total system capacity in the reference expansion scenario). It is mainly providing the required cold reserve (in the plan as generic gas turbines which could also represent other means such as import (sharing) of reserve or storage, if available).
- In the long term, more than 85% of the electricity demand will be covered by domestic renewable energy sources (56% by geothermal, 16% by hydropower, 11% by wind, 2% by biomass cogeneration and 2% by PV in the reference expansion plan). Imports and coal power will supplement the energy mix (7% and 6%, respectively).

3.3.1.8 Scaling-Up Renewable Energy Program

The objective of the Scaling-Up Renewable Energy Program (SREP) was to pilot and demonstrate the economic, social and environmental viability of low carbon development pathways in the energy sector by creating new economic opportunities and increasing energy access through the use of renewable energy.

3.3.1.9 Adaptation Plan (2015-2030)

The Kenya National Adaptation Plan (NAP) (GoK, 2016) provides a background of Kenya's national circumstances, including socio-economic circumstances; and future climate scenarios that the country needs to consider in decision making, planning and budgetary processes. A vulnerability analysis is also presented against the identified hazards in the NCCAP, namely drought, floods, and sea level rise. It proposes macro-level adaptation actions and sub-actions in 20 planning sectors, categorising them into short-, medium- and long-term time frames. For each sector, the NAP identifies gaps, estimates costs of the macro-level actions projected to 2030, and identifies key institutions required for their implementation. It also proposes adaptation indicators at county, sectoral and national levels for monitoring and evaluation (M&E).

3.3.1.10 National Climate Change Action Plan and National Adaptation Plan (2018-2022)

The Kenya National Climate Change Action Plan (NCCAP) (GoK, 2013) framework is highly relevant to the link to water resources planning and management. Climate change is a major risk enhancer in relation to water security and agriculture. The NCCAP supports efforts towards the implementation of the Kenya Constitution 2010 and the attainment of Vision 2030. It addresses the enabling aspects of finance, policy and legislation, knowledge management, capacity development, technology requirements and monitoring and reporting. The comprehensive NCCAP document is supported by almost sixty technical reports developed by teams of international consultants guided by Kenya based thematic working groups and under the oversight of a multi-sectoral multi-stakeholder taskforce.

3.3.2 Mining

3.3.2.1 Third Medium Plan 2018–2022

The Third Medium Term Plan (MTP III) is a nationwide multi-sectoral document that outlines the main policies, legal and institutional reforms as well as programs and projects that the Government plans to implement during the period 2018-2022. It is a part of the implementation process of the Kenya Vision 2030, the national strategy covering the period from 2008 to 2030 which aims to transform Kenya into a newly industrializing, middle-income country providing a high-quality life to all its citizens through three pillars: economic, social and political. Oil, Gas and Mineral Resources was identified as one of the eight priority sectors to drive economic growth alongside with: (1) Agriculture and Livestock; (2) Manufacturing; (3) Tourism; (4) Trade; (5) Business Process Outsourcing; (6) Financial Services; and (7) the Blue Economy (Food and Agriculture Organization (FAO), 2018).

3.3.3 Water resources management and development

3.3.3.1 National Water Master Plan 2030

The NWMP 2030 was completed in 2013 and covers all six river basins in Kenya. For each basin, the NWMP 2030 provides information related to water resources, water demands, high level water allocations, economic evaluations of proposed interventions and implementation programmes. In addition, the NWMP 2030 presents development plans related to water supply, sanitation, irrigation,

hydropower and water resources. The aim of the plan was to form a framework for the development and management of Kenya’s water resources in line with the country’s social and economic development goals. The specific objectives of the NWMP 2030 were set based on the National Water Policy 1999, as well as the targets identified in the Kenya Vision 2030. The NWMP 2030 includes nine Sectoral Development Plans covering different sectors.

3.3.3.2 Sub-catchment management plans

WRA has delineated Kenya into 1 237 sub-catchment areas with the intention of forming WRUAs for each. These WRUAs are at varying stages of development across the country (Table 3-6). The sub catchment management plan (SCMP) is a planning tool that is developed by the WRUAs under regulation by the WRA. Its main objective is to guide the implementation of water resources management and regulation activities within a defined period of time in any given sub catchment. The activities, in most cases, relate to catchment protection, pollution control and water infrastructure development. Being the lowest planning tool developed to implement the National Water Master Plan and the basin area plan, it is directly held in the custody of the WRUAs who are in charge of its implementation. The plan is a resource mobilization tool that the WRUA uses to source for implementation funds and other resources.

The constitution 2010, Fourth Schedule Part 2, section 10, outlines water resource management as a function of the county government. This devolvement of the conservation role to the counties creates a direct linkage between the SCMP and the County Integrated Development Plan (CIDP). The county sets aside funds for the management of catchments that are absorbed through the implementation of SCMP or directly through CIDP identified activities. The regulation of the process to ensure the catchments are well protected and the harmony of the two planning perspectives rests with the Authority.

The six Basin Plans have been used as a reference document in the preparation of the SCMPs. As SCMPs are the resource mobilization tool for the WRUAs, these will have an impact on the land and water resources within protected areas and tourist destinations.

Table 3-6: Stages of formation of WRUAs and number of SCMPs developed

	Athi	Tana	LVS	LVN	RV	ENN
No. sub-catchments	309	240	137	106	175	270
WRUA formed	150	170	106	94	83	92
SCMPs developed	53	77	46	34	48	50

3.3.3.3 Catchment management strategies (2015-2022)

Each of the six basins have a Catchment Management Strategy (CMS) for the period 2015-2022. The CMS provides a vision and framework for the management of water resources and related land resources in the basins and outlines how the concept of integrated water resources management should be implemented at catchment level. It proposed water resources and related strategies for:

- **Protection of the right to water:** Management approaches; Water balance and demand management; Water allocation and use management
- **Water resource protection:** Water resource protection; Catchment protection and conservation
- **Resource augmentation adaptation and development:** Flood and drought management; Climate change adaptation; Water resources infrastructure development; Rights based approach; Livelihoods enhancement
- **Implementation, information management and financing:** Institutional strengthening; Monitoring and management; Financing and implementation

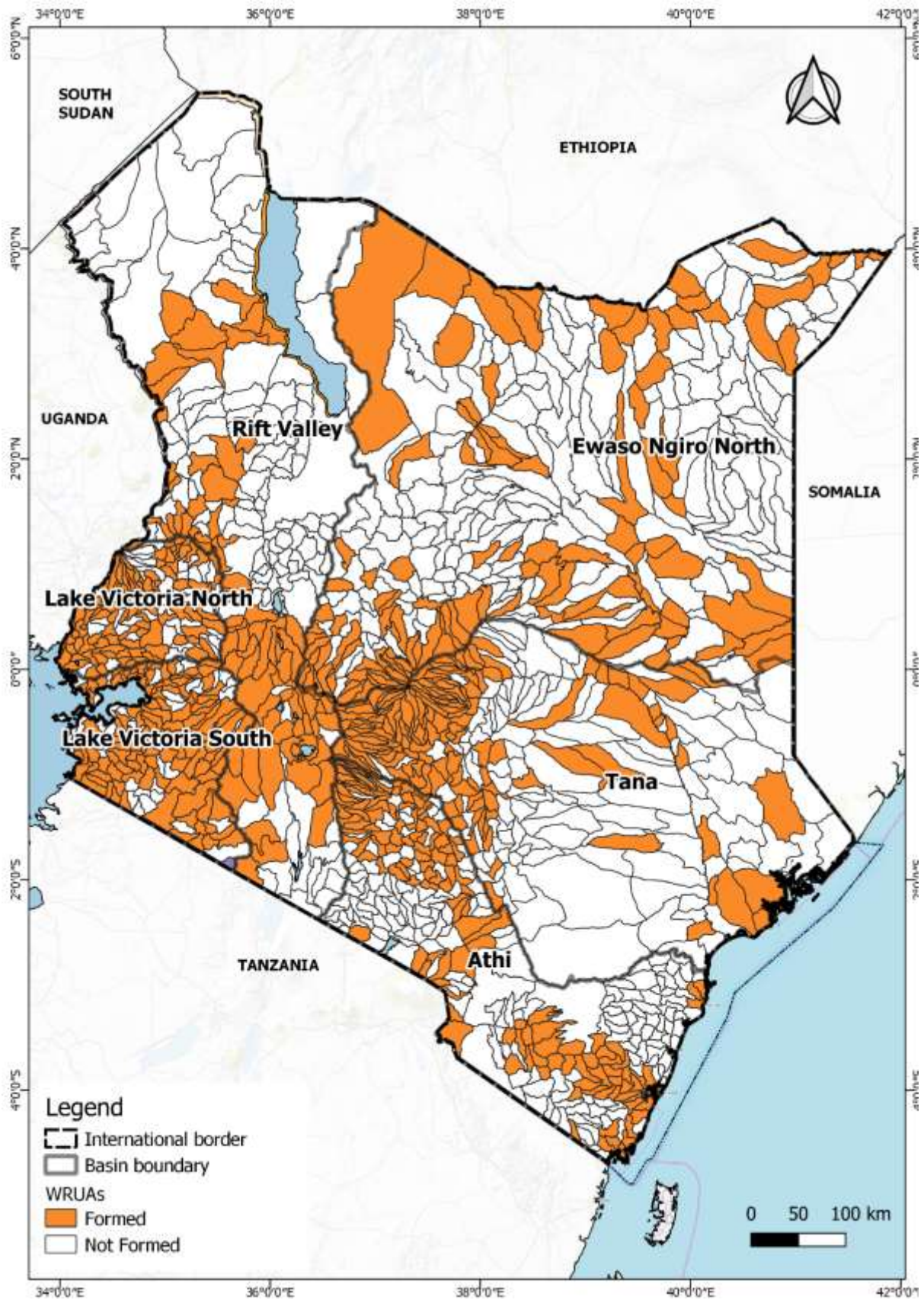


Figure 3-4: Locations of operational stream flow gauging stations in the six basins of Kenya

3.3.3.4 Regional development plans

The regional bodies within the six basins (Table 3-7) are responsible for development activities within their respective areas of jurisdiction. The development plans of these regional bodies will need to be updated with the proposed development options from the National Plan and will need to consider forestry, land use and catchment management as critical measures to ensure the sustainability of the proposed developments.

Table 3-7: Regional development bodies

Basin	Development Authority
Athi	Tana and Athi River Development Authority (TARDA)
	Coast Development Authority (CDA)
Tana	Tana and Athi River Development Authority (TARDA)
	Coast Development Authority (CDA)
LVS	Lake Basin Development Authority (LBDA)
LVN	Lake Basin Development Authority (LBDA)
RV	Kerio Valley Development Authority (KVDA)
	Ewaso Ng'iro South Basin Development Authority (ENSDA)
ENN	ENN River Basin Development Authority (ENNDA)

3.3.3.5 Projects planned by Water Works Development Agencies

Following the enactment of the Water Act 2016, Water Services Boards (WSBs) have transformed into Water Works Development Agencies (WWDAs). The WWDAs have ongoing and proposed projects that vary from rehabilitation of water supply schemes, extension of service lines, construction of storage tanks and drilling and equipping of boreholes in all the counties, to major dam and water resource projects. The projects planned by WWDAs will need to be updated with the proposed development options from the Basin Plans.

Table 3-8: Water Works Development Agencies in the six basins of Kenya

Basin	Development Agency
Athi	Athi Water Works Development Agency (AWWDA)
	Tanathi Water Works Development Agency (Tanathi WWDA)
	Coast Water Works Development Agency (CWWDA)
Tana	Tana Water Works Development Agency (Tana WWDA)
	Coast Water Works Development Agency (CWWDA)
	Northern Water Works Development Agency (NWWDA),
	Tanathi Water Works Development Agency (Tanathi WWDA)
LVS	Lake Victoria South Water Works Development Agency (LVSWWDA)
	Rift Valley Water Works Development Agency (RVWWDA)
LVN	Lake Victoria North Water Works Development Agency (LVNWWDA)
RV	Rift Valley Water Works Development Agency (RVWWDA)
ENN	Northern Water Works Development Agency (NWWDA)

3.3.3.6 Upper Tana-Nairobi Water Fund

The Nature Conservancy has developed a business case for the Upper Tana-Nairobi Water Fund. Current partners and investors are: Nairobi City Water & Sewerage Company, Kenya Electricity Generating Company (KenGen), Pentair Inc, Coca Cola, East Africa Breweries Ltd, International Centre for Tropical Agriculture (ICTA), Global Environment Facility (GEF), The Government of Kenya, Water

Resources Management Authority (WRMA), Tana & Athi Rivers Development Authority (TARDA), International Fund for Agriculture (IFAD) and Frigoken Kenya Ltd. The fund's business case showed that a \$10 million USD investment in water fund-led conservation interventions is likely to return \$21.5 million USD in economic benefits over a 30-year timeframe.

3.3.4 Land management and development

3.3.4.1 Agricultural Sector Development Strategy (2010-2020)

The Agricultural Sector Development Strategy (ASDS) (Government of Kenya, 2010a) is the overall national policy document for the sector ministries and all stakeholders in Kenya. The overall development and growth of the sector is anchored in two strategic thrusts: increasing productivity, commercialization and competitiveness of agricultural commodities and enterprises; and developing and managing key factors of production. This will require support from enabling sectors such as the water and environmental sector. Strategic objectives include the need to rehabilitate and protect water catchments due to issues such as increased runoff, flash floods, reduced infiltration, erosion and siltation, and limited water resource base. Improved water security will also assist in achieving the overall goal of increased agricultural productivity.

3.3.4.2 SDDA Strategic Plan (2018-2022)

The SDDA Strategic Plan (ref) focuses on four key areas: coordination of development in ASALS, resilience building, social and cultural integration and governance. Lessons learnt from the previous planning period (2013-2017) were the need to strengthen collaboration mechanisms to support coordination of activities in the ASALS and the need for a coordinated multi-sectoral approach to implementation of development programmes in the ASALS for maximum benefit to the communities.

3.3.4.3 Kenya Climate Smart Agriculture Strategy (2017-2026) and Implementation Framework (2018-2027)

The Kenya Climate Smart Agriculture Strategy is based on the fact that the changes in climate and weather patterns will expose the rain-fed farming systems, especially the arid and semi-arid lands, to more climate related vulnerabilities. This will predispose farming communities to food insecurity and poverty through loss of the productive assets and the weakening of coping strategies and resilience. On the other hand, the agriculture sector contributes to the climate change problem through emissions arising from inefficiencies in crop, livestock, fisheries and forestry production systems. These inefficiencies lead to greater levels of enteric fermentation in livestock, poor manure and agro-based waste management systems, improper land preparation systems, inefficient input and resource use in crop management systems as well as inefficiencies that raise emissions from agro-based machinery. Innovative and transformative measures are therefore urgently required to assist stakeholders in the sector across the agricultural value chains to cope with effects of current and projected change in climate patterns. Climate smart agriculture (CSA) has been identified as a viable approach to provide solutions towards increased agriculture sector productivity while addressing impacts of changing climate. CSA involves farming techniques which are meant to reduce water supply needs and increase resilience to changes in rainfall.

3.3.4.4 Agricultural Sector Transformation and Growth Strategy (ASTGS) and National Agriculture Investment Plan (2019-2024)

Kenya's National Agriculture Investment Plan (NAIP) for 2019-2024 is the five-year investment plan accompanying the country's 10-year Agriculture Sector Transformation and Growth Strategy (ASTGS). The NAIP is designed to accelerate Kenya's agricultural transformation in alignment with the Big Four Presidential Agenda, Comprehensive Africa Agriculture Development Programme (CAADP), the United

Nations Sustainable Development Goals (SDGs) and Kenya's Medium-Term Plan III. The ASTGS introduces nine flagships under three anchors and enablers. Those linked to the water sector are as follows:

- Anchor 2 – Increase agricultural output and value addition
 - FLAGSHIP 4: Unlock 50 new large-scale private farms (bigger than 2,500 acres) and sustainable water supply for more than 150,000 acres of irrigation from existing infrastructure
- Anchor 3 – Boost household food resilience
 - FLAGSHIP 6: Boost the food resilience of 1.2 million farming and pastoralist households in arid and semi-arid lands (ASALs) through community-driven intervention design
- Enablers
 - FLAGSHIP 9: Monitor two key food system risks - those addressing sustainability and climate, and a second category for crisis management for pests, diseases and global price shocks

3.3.5 Forestry management and development

3.3.5.1 National Forestry Programme (2016-2030)

According to the National Forestry Programme (2016-2030) most of the forest land in Kenya is under community and private ownership while 23% is public. As forestry is a devolved function, county governments have the responsibility of implementing specific national government policies on natural resources and environmental conservation. Counties therefore have a shared responsibility in meeting the national target of 10% forest cover and are expected to raise their current individual forest cover. The relevant programmes under the NFP (2016) are under the theme “Forests for water” and involve watershed conservation and management and soil conservation and management. These will be implemented with lead agencies and key stakeholders.

3.3.5.2 KFS Strategic Plan (2017-2022)

According to the KFS Strategic Plan (2017-2022) the KFS flagship projects involve rehabilitation of water towers (i.e. Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon) and management of water catchments; conservation and management of mangroves forests; farmland and dry land tree-planting initiative; forest plantation development; forest protection and security programme; promotion of bamboo establishment and utilization; and control of invasive species. Tree planting is being promoted in order to realise the 10% forest and tree cover increase by 2030 and promotes commercial tree species in ASALs in order to control desertification and improve livelihoods.

The Forest Management and Conservation division under the KFS is charged with the management and conservation of the natural forests in Kenya, of which most form water towers. Strategic outputs involve increasing percentage cover through tree planting and gazetting new forests; as well as improving livelihoods. The Division includes forest biodiversity conservation, participatory forest management and fire management, natural forest management, licencing and eco-tourism.

3.3.5.3 NEMA strategic plan (2019-2024)

The NEMA strategic plan provides a situational analysis of the previous strategic plan and outlines future objectives and strategies. The objective of promoting a sustainable blue economy and promoting green and circular economy will require cooperation with the agriculture and water sectors. Key challenges with the previous strategic plan period (2013-2018) were inadequate funding, low implementation of the devolved environmental functions, overlap in mandates with lead agencies and poor land use planning.

3.3.5.4 Forest and landscape restoration programmes

Forest restoration has been made a high priority on the GoK's agenda, and this is reflected in a number of different legislations and policies. From a number of initiatives, it is clear that Kenya has a strong commitment to landscape restoration and has been putting in place the building blocks for improving its tree cover and restoring its landscapes and associated ecosystem services: Several high-level initiatives and laws have been put in place that are strongly linked to restoring lands. These include:

- The 2010 Constitution calls for reforestation and maintaining a tree cover of at least 10% of the country.
- The National Climate Change Response Strategy calls for growing 7.6 billion trees on 4.1 million hectares of land during the next 20 years.
- Kenya's Vision 2030 has a flagship project underway for rehabilitating and protecting indigenous forests in the five water towers (Mount Kenya, the Aberdare Range, the Mau Forest Complex, Mount Elgon and the Cherangani Hills), with the goal to increase forest cover and volume of water flowing from the catchment areas.
- The Trees-for-Jobs Programme intends to plant one billion trees to increase forest cover and at the same time create employment for youth.

In addition to these initiatives, Kenya is also involved with REDD+ Readiness Preparation. One of the priority topics in the national REDD+ Readiness process is based on the enhancement of forest carbon stocks and proposes several strategy options to restore forests, including providing support to the GoK's target for reforestation and maintaining a tree cover of at least 10% of the country.

To help reach set targets, the GoK in September 2014 established a multi-stakeholder Technical Working Group led by the KFS to carry out this assessment of the country's forest and landscape restoration opportunities (MENR, 2016a). The Landscape Restoration Technical Working Group (LRTWG) includes a large number of stakeholders from multiple sectors. Over the subsequent two years, the LRTWG held a series of landscape restoration workshops that focused on analysing different landscape restoration options for the country and identified the most pressing land use challenges currently affecting Kenya.

A list of restoration options was identified that could help address these challenges and restore the ecosystem services that are currently lacking. The various landscape restoration options identified include:

- Reforestation and rehabilitation of degraded natural forests
- Agroforestry and woodlots on cropland
- Commercial tree and bamboo plantations
- Tree-based buffers along waterways, wetlands and roads
- Silvopastoral and rangeland restoration
- Afforestation in community grounds e.g. markets schools, etc

The LRTWG was additionally tasked with mapping and quantifying where these different restoration options could potentially be implemented in order to help inform a national restoration target that will contribute to the many national priorities. Through extensive work and stakeholder engagement, the LRTWG produced several maps indicating potential areas for landscape restoration. Maps have been made available to the public through an interactive website and allows users to explore these opportunities (MENR, 2016a; KFS, 2017a).

3.3.6 County integrated development plans

County Integrated Development Plans (CIDPs) are prepared every five years by counties as a road map for development. The plan touches on all sectors devolved to county governments, some of which need to be coordinated with the energy and mining sectors.

4 Key Strategic Areas

4.1 Introduction

To comprehensively and systematically address the range of water resources related issues and challenges in the basins and to unlock the value of water as it relates to socio-economic development, ten Key Strategic Areas (KSAs) were formulated as part of each Basin Plan as presented in Table 4-1. The key aim of these KSAs is to provide a clear way forward for the integrated management and development of the water resources of the basins as a pathway towards a future which achieves a sustainable balance between utilisation and development of water resources and the protection of the natural environment, i.e. minimising environmental and social impacts and maximising socio-economic benefits, taking into consideration the availability of water.

Table 4-1 Key Strategic Areas and Objectives

Key Strategic Area		Strategic Objective
1	Catchment Management	To ensure integrated and sustainable water, land and natural resources management practices
2	Water Resources Protection	To protect and restore the quality and quantity of water resources of the basin using structural and non-structural measures
3	Groundwater Management	The integrated and rational management and development of groundwater resources.
4	Water Quality Management	Efficient and effective management of water quality to ensure that water user requirements are protected in order to promote sustainable socio-economic development in the basin
5	Climate Change Adaptation	To implement climate change mitigation measures in the water resources sector and to ensure water resource development and management are adapted and resilient to the effects of climate change.
6	Flood and Drought Management	To establish and guide a structured programme of actions aimed at ensuring the prevention of, mitigation of, timeous response to, and recovery from, the harmful impacts of floods and droughts across the Basin or specific catchment area.
7	Hydromet Monitoring	An operational and well-maintained hydromet network supported by effective and functional data management and information management systems
8	Water Resources Development	To develop water resources as a key driver for sustainable economic and social development
9	Strengthened Institutional frameworks	To achieve an appropriate balance between operational functionality and the need for effective oversight and governance.
10	Enabling environment	To enhance human and institutional capacities for sustainable management of the water, land, ecosystems and related resources

Strategies and themes which are relevant to the **energy and mining** sectors under each KSA are presented below. (The Basin Plans provide a comprehensive list of all themes and strategies under each KSA.)

Implementation Plans for the KSAs constitute the next step towards implementation of the strategies and themes under each KSA and are discussed in Section 5.

4.2 Catchment Management

4.2.1 Introduction

Water resources degradation is intimately linked to land degradation and influenced by various catchment management and land use factors. Implementing effective catchment management therefore requires a bigger picture perspective and an understanding of the role of natural resource use within a water resources context. People, animals and plants constitute those components of a catchment that make use of the physical resources of land and water. Misuse of these resource elements will therefore lead to unstable natural and social systems, often resulting in further land and water degradation. Integrated catchment management acknowledges the relationships between households, villages, communities and the broader catchment and envisages that individuals take ownership of their role in catchment management - as opposed to a top-down approach lead by legislation and regulations. This is the cornerstone of Integrated Water Resources Management. A key issue in many catchments in Kenya relates to the influence of population pressures on the existing landscape-biodiversity dynamics. With an increasing demand for natural resources and under the influence of historic-political and socio-economic drivers, the human footprint has pushed many natural systems beyond a stable threshold. Any disruption to the natural system impacts the human population, more so in rural areas where communities still live and work very closely to the natural environment.

The objective of Catchment Management is to enable communities, county governments and other relevant governing bodies and institutions to implement integrated catchment management interventions through increased knowledge. As water is the common link among resource users in a catchment, it is appropriate that the catchment is used as a planning unit for resource management. Integrated catchment management is aimed at deriving the greatest possible mix of sustainable benefits for future generations and the communities in a catchment, whilst protecting the natural resources upon which these communities rely. This approach seeks to maintain a balance between the competing pressures exerted by the need to maintain natural resources in the long-term, against the need for continuous economic growth and use of these resources.

4.2.2 Strategy

Catchment Management is important for the **energy and mining sectors**. In order to comprehensively and systematically address the Catchment Management issues and challenges in the basins, the table below presents specific Themes and Strategies under Catchment Management which are critical for the energy and mining sectors.

Table 4-2 Strategic Framework – Catchment Management

1	Key Strategic Area:	Catchment Management
1.1	Theme:	Promote improved and sustainable catchment management
1.1.1	Promote sustainable land development and planning	
<p>NEMA Environmental Sustainability Guidelines for Ministries, Departments and Agencies (MDAs) defines sustainability as meaning “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainability is defined as not being an end goal, but rather a journey that MDAs should take to improve the social equity, environmental, and economic conditions in their jurisdiction.</p> <p>In order to reduce the degradation of land and water resources, a sustainable management approach must be implemented. It is important that resource management activities not only apply to new activities, but rehabilitation of degraded resources is critical in order to ensure sustainable management of ecosystem functions and availability of resources for future generations. Degradation of resources will continue if no action is implemented and resources will be further depleted.</p> <p>MDAs should explore the environmental issues within their operations, develop appropriate interventions and document the same in the form of an environmental sustainability policy.</p>		

1	Key Strategic Area:	Catchment Management
1.1.2	Strengthen participatory approaches	
<p>The National Environment Policy (Government of Kenya, 2013a) guiding principles emphasises the inclusion of communities in decision making. These participatory approaches need to be strengthened for sustainable catchment management as communities are closely connected with resources in a catchment. Communities need to take ownership of catchment management activities, and this can be achieved through participatory processes through SCMPs, agricultural extension services and Integrated Development Plans (IDPs).</p> <p>The aim of SCMPs is to plan the activities of the sub-catchment in an efficient and sustainable manner to achieve optimum benefits for all in the sub-catchment, through making use of available resources in a sustainable and efficient manner. The process and purpose of a SCMP is to empower the people of the sub-catchment to make decisions and take responsibility for and promote the collective action for the rehabilitation, sustainable management and utilisation of their natural resources. The SCMP is developed by the community of the sub-catchment, for the community of the sub-catchment. The SCMP addresses the resources available to the village community and their needs.</p> <p>Agricultural extension officers and Farmers Field Schools from the AFFA need to be aware of the SCMPs and ensure that catchment management activities fit in with this plan.</p> <p>County Governments are also required to consider the SCMPs in the CIDPs.</p> <p>Appropriate catchment management activities should be considered from theme 1.2. to 1.4.</p>		
1.2	Theme:	Sustainable water and land use management practices
1.2.1	Promote water conservation and management at catchment level	
<p>Water conservation and management is considered a priority throughout Kenya due to high water use and limited supply. Water is important for both urban use and agricultural use; therefore, water management and access to water are important. Access can be improved through community or household storage of water and through resource protection. Access to water is also improved through water efficiency and through recycling water. Temporal access to water is also important as the seasonality of water resources in various parts of Kenya lead to various outcomes, such as certain areas experiencing water scarce seasons and human/wildlife conflict as pastoralists move into National Parks in search of water.</p> <p>Water resource management has been identified as a strategic objective in most county IDPs, with strategies involving water harvesting, storage and treatment. Catchment management activities that can also be implemented to promote water conservation and management are as follows (Braid & Lodenkemper, 2019):</p> <ol style="list-style-type: none"> 1. Water use efficiency and recycling <p>By improving water efficiency through suitable crop selection, proper irrigation scheduling, effective irrigation techniques, and using alternative sources of water for irrigation, it will be possible to increase water availability and make the water last longer. These also address point source protection of water collection points. These activities should be implemented by smallholder farmers.</p> <ul style="list-style-type: none"> ○ Water use efficiency ○ Wastewater recycling ○ Excess water reuse 2. Water harvesting and storage <p>By providing access to additional water by harvesting water (collecting runoff) and storing water. By harvesting water, farmers can increase the area they irrigate, grow crops in the dry season, and support livestock. Water storage at the household or village level improves access to water, and reduces the labour burden, by reducing the number of trips to boreholes. These activities should be implemented in the semi-arid regions of Kenya. Ridging and swales should be implemented on steep hillslopes where small scale farming is being practiced.</p> <ul style="list-style-type: none"> ○ Roof runoff and storage ○ Below ground storage ○ Road runoff 		

1	Key Strategic Area: Catchment Management
	<ul style="list-style-type: none"> ○ Ridging ○ Swales <p>3. Groundwater protection and Infiltration</p> <p>By providing information to improve groundwater resources, particularly the infiltration of rainwater into the soil, thereby increasing availability of water stored in the rooting zone and groundwater. Increased water availability in the rooting zone reduces dependence on surface water irrigation and provides increased potential for cultivation during dry seasons. Increased groundwater feeds the spring and improves surface water flow lower down the catchment as well as the level of water in wells close-by. These activities should be implemented as a priority in groundwater recharge zones.</p> <ul style="list-style-type: none"> ○ Contour bunds ○ Zai planting pits ○ Infiltration trenches ○ Spring protection and management
1.2.2	Promote soil conservation and management at catchment level
	<p>Soil erosion, deforestation, poor agricultural practices, loss of soil fertility, inadequate runoff management and gully formation each contribute to the degradation of land resources with resultant impacts on the catchment both up and downstream. To reduce land degradation, mitigate degradation and implement sustainable land use practices, various aspects of sustainable land management are required. Implementing these techniques and practices will minimise the loss of topsoil (through erosion) and reduce the erodibility of a catchment.</p> <p>The steeper regions of the landscape which do not have a dense vegetation cover are more prone to high levels of erosion than the lower plains. Improved erosion and runoff control measures and sediment trapping will improve resilience to floods and erosion. In the lower plains rangeland management should be implemented to prevent overgrazing. The movement of livestock up slopes and over rivers also needs to be managed as this can lead to eroded paths.</p> <p>Although there are many different parties involved in providing soil conservation and management advice, it is recommended that consensus is built, and a consistent message is given by the SCMPs, CIDPs and Extension Officers.</p> <p>Most of the county IDPs promote soil and water conservation as a key programme, with the objective to promote sustainable land use and environmental conservation. Activities that are promoted are on farm water harvesting structures (i.e. terraces), tree planting during rainy season, use of organic manure, river bank protection, rehabilitation of degraded land and gully control, excavation of water pans, construction of check dams/sand dams and desilting of water pans. Catchment management activities that can be implemented to promote soil conservation and management are as follows (Braid & Lodenkemper, 2019):</p> <ol style="list-style-type: none"> 1. Rangeland management 2. Erosion and runoff control measures 3. Gully management and sediment trapping 4. Stream/River bank management
1.2.3	Promote conservation agriculture and improved farm management
	<p>One of the most important natural resources is the soil. Healthy and fertile soils produce good yields of crops; whereas poor or degraded soils produce low and unreliable yields. Soil health is a function of rooting depth, nutrient fertility, structure, organic matter content, below-ground biodiversity and water holding capacity – all of which are related. Ensuring soils remain healthy and fertile requires a variety of management techniques including climate-smart farming practices and nutrient management.</p> <p>Most of the county IDPs promote soil fertility improvement and agroforestry but a more holistic approach would be to consider conservation agriculture and improved farm management as follows (Braid & Lodenkemper, 2019):</p> <ol style="list-style-type: none"> 1. Climate-smart agriculture

1	Key Strategic Area:	Catchment Management
		<ul style="list-style-type: none"> ○ Conservation agriculture ○ Natural farming (small scale) <p>2. Nutrient management</p> <ul style="list-style-type: none"> ○ Compost ○ Natural fertilizer ○ Micro dosing ○ Weeding ○ Agroforestry
1.2.4	Promote erosion control measures	
	Refer to Strategy 1.2.2.	
1.2.5	Promote soil fertility management	
	Refer to Strategy 1.2.2.	
1.3	Theme:	Natural resources management for the protection and sustainable use of natural resources
1.3.2	Promote alternative/sustainable livelihoods	
	<p>Communities rely on natural resources to live and earn an income. Over utilisation leads to the depletion of natural resources. Natural resources need to be managed and utilised in a sustainable manner, to maximise the goods and services received from them, while still maintaining their function and production capacity. Natural forests, grasslands and wetlands are finite resources that must be managed sustainably; similarly, alien vegetation can provide useful resources but needs to be managed to prevent uncontrollable spread.</p>	
1.3.4	Improved forestry management	
	<p>Forests are important to return moisture to the air through evapotranspiration, which then generates rain, as well as to stabilise soils with their root systems; they can also be rich in terms of biodiversity as well as stores of carbon. Sustainable management of forests both natural and plantation, for reforestation of areas where forests have been removed including the selection of beneficial tree species.</p> <p>The Vision 2030 requires the country to work towards achieving a forest cover of at least 10% of the land area to ensure sustainable resource use, growth and employment creation. The National Forest Policy (Ministry of Environment and Natural Resources, 2014) indicates that the sustainable management of forests includes:</p> <ul style="list-style-type: none"> • Indigenous forests • Plantation forests • Dryland forests • Urban forests and roadside tree planting • Farm forestry <p>To achieve the national forest cover target of 10% of land area, the major afforestation effort will have to be in community and private lands. Dryland forests offer great potential for intensified afforestation but woody vegetation in the arid and semi-arid areas are unique and require special attention. Most county IDPs promote reforestation through agroforestry, and in some cases water catchment areas are being protected through the use of alien trees (i.e. eucalyptus). Consideration needs to be made to the objective of these programmes as there could be significant long-term challenges associated with planting trees with high water requirements in counties with limited water supply.</p>	
1.3.7	Improved energy management	
	<p>To ensure that catchment management activities and resource protection activities can be implemented, it is important that activities around the household, farm and village are also sustainable and of a high standard. These include activities such as energy management. Renewable sources of energy should be promoted to generate electric power for use in the household, or community, as a replacement for the burning of wood or charcoal.</p>	

1	Key Strategic Area:	Catchment Management
Most county IDPs promote “green energy” as an alternative fuel to wood and charcoal.		
1.3.8	Improved sand mine management	
Develop policies for sand harvesting. Consider alternative sources of sand.		
1.4	Theme:	Rehabilitation of degraded environments
1.4.1	Rehabilitation and Restoration Plan	
Develop a restoration and rehabilitation programme. Also refer to Strategy 1.2.2.		
1.4.6	Mining area rehabilitation	
Mining removes the protective covering from the land and exposes soils to soil erosion as well as pollution impacts. During mining activities exposed soils must be revegetated and soil conservation techniques implemented.		

4.3 Water Resources Protection

4.3.1 Introduction

Water is critical to social and economic development but also supports key ecological systems which underpin human wellbeing and provides essential ecosystem goods and services. According to the Kenya Water Act (2016), a water resource is defined as “any lake, pond, swamp, marsh, stream, watercourse, estuary, aquifer, artesian basin or other body of flowing or standing water, whether above or below the ground, and includes sea water and transboundary waters within the territorial jurisdiction of Kenya”. It is important to differentiate between surface and groundwater resources as these are treated differently within the context of water resources protection: surface water resources include rivers (i.e. stream, watercourse), wetlands (i.e. lakes, ponds, swamp, marsh, spring) and estuaries, while groundwater resources refer to aquifers and artesian basins.

The 2016 Water Act also outlines the designation of Basin areas, with functions of Basin Water Resource Committees (BWRCs) within each Basin clearly stated. Furthermore, the Act defines the establishment and functions of Water Resource Users Associations (WRUAs) i.e. associations of water resource users at the sub-basin level in accordance with Regulations prescribed by the Authority. These associations are community based for collaborative management of water resources and resolution of conflicts concerning the use of water resources.

Protection of water resources in Kenya therefore starts at the National level with the WRA developing policies and legislation for protection of water resources. BWRCs then enact these measures to fulfil the water resource quality objectives for each class of water resource in a basin and need to put in place measures for sustainable management of the water resources; whilst at the sub-basin level more local level community-based management occurs through WRUAs.

4.3.2 Strategy

Water Resource Protection is important for the **energy and mining sectors**. In order to comprehensively and systematically address the Water Resource Protection issues and challenges in the basins, the table below presents specific Themes and Strategies under Water Resource Protection which are critical for the energy and mining sectors.

Table 4-3 Strategic Framework – Water Resources Protection

2	Key Strategic Area:	Water Resources Protection
2.1	Theme:	Classification of water resources
2.1.1	Determine the baseline for Resource Directed Measures: Surface and groundwater assessments at appropriate scales to inform the classification of water resources in the basin.	

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2	Key Strategic Area:	Water Resources Protection
<p>Water Quality and Quantity assessments are required in order to set a baseline for Resource Directed Measures. This baseline will inform the classification and resource quality objectives for the significant water resources in the basins.</p>		
2.1.2	Determine Class of water resources	
<p>Determining the Class of a water resource is the first step in the Water Resource Management cycle. A vision for the desired future state of water resources results in Ecological Categories for water resources based on the level of protection or increasing levels of risk. Ultimately the determined Class of a resource will determine the Reserve and associated Resource Quality Objectives that are set to achieve it.</p>		
2.2	Theme:	Ecological Reserve
2.2.1	Reserve determination	
<p>In order to protect the water resources of the basins the environmental Reserve needs to be determined. The total water resource (surface and groundwater) is made up of what is available for allocation or use and the Reserve. The Reserve (in terms of quantity and quality) is made up of what is needed to satisfy the basic human needs of people who are or may be supplied from the water resource (i.e. Basic Human Needs) and what is needed to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the water resource (i.e. Ecological Reserve). The water requirements of the ecosystem must therefore be met before any allocation may be made. This forms part of the Water Resource Management cycle which is an adaptive management approach focused on goal-setting. Once the environmental reserve is defined then the resource quality objectives can be determined for priority water resources.</p>		
2.2.2	Reserve compliance	
<p>Water Quantity is a key driver of water resources therefore its management is critical in the maintenance of ecosystems and for the provision of water for socio-economic purposes. Once the environmental reserve has been set then the flows required to maintain the reserve need to be managed. Implementing the operating rules to ensure that the releases from infrastructure required by users and the ecology are met in time and at EWR site. This may consist of the operation of dams, abstractions and other infrastructure as well as management through licensing and implementation of restrictions. Compliance hydrological monitoring is required, based largely on the continuous monitoring at a network of flow and water level gauges. Compliance monitoring is also required, based on monitoring low flows and water levels at gauging weirs and boreholes.</p>		
2.3	Theme:	Determine Resource Quality Objectives
2.3.1	Set Resource Quality Objectives	
<p>Determine the Resource Quality Objectives for prioritised water resources in the basins.</p>		
2.4	Theme:	Conservation and protection of ecological infrastructure
2.4.1	Integrate environmental considerations into basin development and planning	
<p>Water is critical to social and economic development but is also a critical component in supporting key ecological systems which underpin human wellbeing as well as providing essential ecosystem goods and services. A strategic social and environmental assessment is therefore an important component of the Classification of the basins water resources. The Classification of water resources requires a balance between social and environmental considerations.</p>		
2.4.2	Groundwater protection	
<p>Rehabilitate polluted aquifers, springs and wells as part of Catchment Management Plan. Groundwater source protection zones defined by WRA and gazetted under Water Act 2016.</p>		
2.4.3	Riparian areas protection	
<p>Riparian areas, as defined by WRA, gazetted under Water Act 2002 and WRM Regulations 2007, currently under amendment by Attorney General in accordance with revised definition agreed on at sixteenth meeting held on 2 June 2020 by the National Development Implementation and Communication Cabinet Committee.</p>		

2	Key Strategic Area:	Water Resources Protection
2.4.4	Ecosystem services protection	
<p>Water is critical to social and economic development but is also a critical component in supporting key ecological systems which underpin human wellbeing as well as providing essential ecosystem goods and services. In particular, certain environmentally sensitive areas are reliant on the protection of water resources. Although environmentally sensitive areas are defined by NEMA, this information should be provided to WRA during the Classification of water resources in order for WRA to classify and protect according to the Water Act 2016.</p>		

4.4 Groundwater Management

4.4.1 Introduction

Groundwater has provided and will continue to provide much of the water needed for livelihoods and development for many communities and industries in Kenya. Numerous rural communities and small towns across the Republic depend on groundwater from boreholes and shallow wells for their domestic and livestock needs, and to support other economic activities. Spring flow and baseflow contribute significantly to maintaining streamflow, particularly during dry seasons. Groundwater management is known to be one of the most important, least recognised and highly complex of natural resource challenges facing society (Foster, 2000).

Groundwater in Kenya is currently not managed in a coherent fashion (Mumma et al., 2011). A final Final Draft National Policy on Groundwater Resources Development and Management was published in 2013 (Ministry of Water and Irrigation, 2013), but despite the best of intentions, groundwater remains poorly understood and poorly managed. The policy document highlights a number of specific issues:

- Availability and vulnerability of groundwater resources in Kenya are poorly understood
- Institutional arrangements for groundwater management in Kenya, including management capacity and financing are weak
- Very limited integrated water resources management in Kenya, with groundwater and surface water typically being treated as separate water resources
- Very limited groundwater quality management in Kenya

In addition to the National Policy on Groundwater Resources Development and Management, the National Water Quality Management Strategy (Ministry of Water and Irrigation, 2012) addresses groundwater protection in S. 2.7. It recommended the “Development of Ground Water Protection programs” without defining or describing them. The NWQMS lays out the following “strategic responses”:

- Extraction of groundwater at sustainable rates to avoid seawater intrusion.
- Intensifying groundwater quality monitoring by sinking observation boreholes.
- Establishing a monitoring program for selected production wells to capture any changing trends.
- Requiring all borehole owners to have their water tested periodically as part of the water quality monitoring programme.
- Maintain updated database of borehole data.

A groundwater management strategy is influenced by hydrogeological, socio-economic and political factors and is informed by both policy and strategy. This Groundwater Management Plan is necessary for the integrated and rational management and development of groundwater resources in the Tana Basin. It aims to capture and integrate a basic groundwater understanding, describes sustainable management measures and presents an action plan with clear objectives and desired outcomes. It also estimates the financial requirements needed for implementation and the timeframe for its

implementation. It is not a static instrument. As resources monitoring and data analysis takes place across the planning period, improvements and even whole new aspects may need to be incorporated.

The key objectives of the Plan include:

- Conserve the overall groundwater resource base and protect its quality
- Recognise and resolve local conflicts over resource allocation (abstraction or pollution)

4.4.2 Strategy

Groundwater management and development is important for the **energy and mining sectors**. In order to comprehensively and systematically address the groundwater issues and challenges in the basins, the table below presents specific Themes and Strategies under Groundwater Management which are critical for the energy and mining sectors.

Table 4-4 Strategic Framework – Groundwater management

3	Key Strategic Area:	Groundwater management
3.1	Theme:	Groundwater resources assessment, allocation, regulation
3.1.1	Groundwater assessment – assess groundwater availability in terms of quantity	Assessing groundwater resource quantity is an essential pre-requisite for any water management process. Nationally, the Kenya Groundwater Mapping Project (47 Counties, 2017-2023; Government of Kenya, 2017b) should be implemented and supported. In parallel, more detailed estimates of sustainable groundwater yield in priority areas / aquifers should be undertaken.
3.1.2	Groundwater assessment – groundwater quality and use	Abstraction surveys (quantity and quality) for Priority Aquifers and other affected aquifers should be undertaken in order to assess current groundwater use and quality across Kenya.
3.1.3	Update and improve permit database	The permit database (PDB) in relation to groundwater requires considerable improvement if it is to be the vital planning tool it must become. The fully functional PDB should allow the following types of data to be extracted from it: a) Permitted groundwater abstraction by aquifer unit or sub-catchment (or both) b) Calculate unallocated groundwater for each aquifer unit or sub-catchment (or both). This requires that each groundwater Permit is ascribed to a named and geographically-defined aquifer unit. This aquifer classification process is a work in progress, relying as it does on the re-definition of aquifers. The PDB also needs to be broadened so as to allow the capture of digitised borehole completion records.
3.1.4	Groundwater allocation	National Resource Quality Objectives (RQOs) should be developed. In relation to a groundwater resource, the RQO means the quality of all aspects of the resource and could include any or all of the following (Colvin et al., 2004): a) Water levels, groundwater gradients; storage volumes; a proportion of the sustainable yield of an aquifer and the quality parameters required to sustain the groundwater component of the Reserve for basic human needs and baseflow to springs, wetlands, rivers, lakes, and estuaries. b) Groundwater gradients and levels required to maintain the aquifer's broader functions. c) The presence or absence of dissolved and suspended substances (naturally occurring hydrogeochemicals and contaminants). d) Aquifer parameters (e.g. permeability, storage coefficient, recharge); landscape features characteristic of the aquifer type (springs, sinkholes, caverns); subsurface and surface ecosystems in which groundwater plays a vital function; bank storage for alluvial aquifers that support riparian vegetation.

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3	Key Strategic Area:	Groundwater management
		<p>e) Aquatic biota in features dependent on groundwater baseflow, such as rivers, wetlands, and caves, or biota living in the aquifer itself or the hyporheic zone. Terrestrial plants and ecosystems dependent on groundwater.</p> <p>f) Land-use and water use which impact recharge quantity or quality. Subterranean activities, such as mining or waste disposal, that affect the aquifer directly. The control of land-based activities by aquifer protection zoning of land-use.</p> <p>g) Any other groundwater characteristic.</p>
		<p>It is clear that RQOs can include any requirements or conditions that may need to be met to ensure that the water resource is maintained in a desired and sustainable state or condition.</p> <p>The Guidelines for the Development of Water Allocation Plans in Kenya (Water Resources Authority, 2018f) discuss the determination of water balances and accommodates both surface water and groundwater. Current groundwater potential by sub-basin in Kenya should be determined from the assessment of available groundwater and the current use (from the abstraction survey). Groundwater allocation plans should be developed. Groundwater allocation varies according to the importance of, and knowledge base for, a given aquifer:</p> <ul style="list-style-type: none"> • POOR and MINOR aquifers: 25% of test discharge in an individual borehole is the safe allocable volume. Where an aquifer is reasonably well described (i.e. representative transmissivity values are available, as is the width, length and hydraulic gradient across the aquifer), then Darcy's Law (Darcy, 1856) may be used to determine mean through-flow ($Q = -k.i.A$). In this case, total allocable water should be 25% of average through-flow. • For MAJOR aquifers, the approach proposed in the NWMP 2030 is proposed. The NWMP 2030 adopts a cautious approach to determining sustainable groundwater abstraction; this is defined as 10% of recharge, but specifically excludes the riparian zone, which it determines as total river length x 1km. Recharge was defined as annual renewable resource minus annual surface water runoff, with 'annual renewable resource' defined as precipitation minus evapotranspiration. • For STRATEGIC and SPECIAL aquifers that are not (or not yet) designated Priority Aquifers and subjected to modelling, the NWMP 2030 approach should be used. • For Priority Aquifers that have been modelled, allocable GW is 10% of mean annual recharge. Mean annual recharge should, wherever possible, take into account both wet and dry years in order to recognise natural recharge variability. • The allocation of groundwater from aquifers that experience episodic recharge or are fossil aquifers remains unresolved, e.g. the Merti aquifer (Blandenier, 2015). How they should be treated in Kenya requires further debate and ultimately, a policy decision. <p>All of the above require the completion of the aquifer classification exercise.</p>
3.4	Theme:	Conservation and protection of groundwater
3.4.1	Source protection	
		<p>Groundwater vulnerability assessment: Once a National Policy for the Protection of Groundwater has been formulated and put into place, Vulnerability Assessments should be conducted for groundwater.</p> <p>Saltwater intrusion prevention: As above for saltwater intrusion prevention; assess significance of groundwater saltwater intrusion, prioritise and select aquifers requiring active intervention to contain or reverse saltwater intrusion. Draw up Plans for intervention to prevent, mitigate or reverse seawater intrusion;</p> <p>Groundwater conservation areas (GCAs): As above for GCAs; assess which aquifers or parts of aquifers require formal protection. Draw up Plans for the protection of Priority Aquifers or parts of Priority Aquifers.</p> <p>Groundwater dependent ecosystems (GDEs): As above for GDEs; assess which aquifers contain important GDEs. Draw up Plans to protect important GDEs.</p>
3.4.2	Rehabilitation of polluted aquifers, springs and wells	

3	Key Strategic Area:	Groundwater management
		<p>Where groundwater protections have failed, measures need to be taken to address polluted aquifers. Here aquifers, springs and wells are lumped together as ‘aquifers’.</p> <p>Define Kenya’s polluted aquifers: Use the Guidelines for Groundwater Quality Surveys in Kenya (Water Resources Authority, 2018e) to define the extent of polluted aquifers, and determine what pollutants are present. Follow guidance presented in the NWQMS (Ministry of Water and Irrigation, 2012).</p> <p>For each polluted aquifer, determine the optimum and most cost-effective way to rehabilitate it. The approach to be adopted will depend on the following:</p> <ul style="list-style-type: none"> • Whether the aquifer is confined or unconfined; • The nature of the pollutant; e.g. dense non-aqueous phase liquids (DNAPLs) require a different treatment approach – pump, treat, return - compared with an aquifer polluted with human wastewater – eliminate the pollution source(s) followed by natural attenuation and remediation; • Whether the source of the pollution is diffuse or from a point source; • The affected aquifer area. • Prioritise aquifers for rehabilitation and implement rehabilitation programmes.

4.5 Water Quality Management

4.5.1 Introduction

Water quality is the physical, chemical, biological and aesthetic properties of water that determine its fitness for its intended use, and that are necessary for protecting the health of aquatic ecosystems.

Water quality management is the maintenance of the fitness for use of surface and groundwater resources, on a sustainable basis, by achieving a balance between socio-economic development and water resources protection. Fitness for use is an evaluation of how suitable water is for its intended purpose (e.g. domestic, agricultural or industrial water supply) or for protecting the health of aquatic ecosystems. The fitness for use evaluation is based on scientific evidence in the form of water quality guidelines or standards for different water uses (e.g. drinking water standards). The business of water quality management is the ongoing process of planning, development, implementation and administration of Kenyan water quality management policies, the authorisation of water uses that impact on water quality, and monitoring and auditing all these activities.

This section provides an introduction of the key water pollutants responsible for the deterioration of water quality in the basin, the point and non-point sources associated with the pollutants, and overview of the water quality status and threats in the basin, and a strategic framework for water quality management in the basins.

4.5.2 Strategy

Water Quality Management is important for the **energy and mining sectors**. In order to comprehensively and systematically address the Water Quality Management issues and challenges in the basins, the table below presents specific Themes and Strategies under Water Quality Management which are critical for the energy and mining sectors.

Table 4-5 Strategic Framework – Water Quality Management

4	Key Strategic Area:	Water Quality Management (surface and groundwater)
4.2	Theme:	Promote sound water quality management governance in Kenya
		With so many institutions involved in different aspects of water quality management in Kenya, it is inevitable that there may be uncertainty about the mandate of each institution with respect to water quality management. This

4	Key Strategic Area:	Water Quality Management (surface and groundwater)
<p>objective can be met by clarifying the mandates, and roles and responsibilities of the different institutions involved in the respective basins. This can be achieved by reviewing the mandates, and roles and responsibilities of institutions. It is also important that there be effective arrangements between role players with regard to water quality management to ensure that cooperative governance of water quality is achieved. This can be accomplished by establishing mechanisms for cooperation between government institutions on water quality management and pollution control issues.</p> <p>Two strategies have been identified to help alignment, collaboration, and institutional efficiency.</p>		
4.2.1	Harmonise policies and strategies to improve water quality management	
<p>There are a number of institutions involved in different aspects of water quality and pollution management (e.g. WRA, NEMA, MoA, NIB, counties, basin authority, PCPB, etc.). Their policies, strategies and plans are not always aligned because they are responsible for different aspects of water resources management. WRA should advocate alignment of strategies to serve a common purpose of rehabilitating urban rivers and streams in Kenya.</p>		
4.2.2	Coordination and cooperation mechanism on water quality issues established at a catchment level	
<p>WRA should establish a coordination and cooperation mechanism to ensure there is alignment of actions to address water pollution management in the six basins.</p> <p>Participate in river clean-up campaigns of rivers. This can be achieved by using the inter-agency task-force to mobilize resources, carry out clean-ups, creating awareness, and where appropriate, demolishing structures in riparian buffers.</p>		
4.3	Theme:	Efficient and effective management of point and nonpoint sources of water pollution
<p>The water quality challenges in the basins will require efficient and effective management of pollution sources, as well as mitigating the symptoms of pollution in rivers, reservoirs, and lakes.</p> <p>Point sources - Monitoring of compliance with Kenyan domestic and industrial effluent standards should be strengthened. All effluent monitoring data should be stored in a central database (Mike Info in this case). Protocols should be implemented for enforcing standards, and for dealing with non-compliant dischargers. To meet this goal, producers of wastewater should be encouraged to treat wastewater at source. This can be achieved by identifying industrial polluters with no wastewater treatment and not meeting effluent standards and directing them to implement onsite wastewater treatment. It can also be achieved by requiring onsite wastewater treatment at all new industries being established. Consideration should also be given to the design and construction of centralised WWTWs and sludge treatment facilities for large urban centres, and to progressively connect households and large wastewater producers to the sewerage network. Lastly, the focal areas of the Kenya National Cleaner Production Centre (KNCP) should be supported, and industries should be encouraged to participate in this initiative.</p> <p>Nonpoint sources - Nonpoint sources of pollution probably have the greatest impacts on water quality in the basins.</p> <p>Erosion and sedimentation from agricultural lands is probably a major concern and interventions to manage its impacts should be implemented. It has also been the focus of many soil conservation initiative undertaken in Kenya over many years. Reducing erosion and sedimentation also has a large positive impact on water pollution as many pollutants adhere onto sediment particles, and intercepting the particles before they enter water courses, also prevents these pollutants from entering streams, rivers, and lakes. To meet this objective, a number of target sources have been identified dealing with urban stormwater, riparian buffer strips, hydrocarbon pollution, runoff from informal settlements, other agricultural impacts, and runoff from unpaved roads.</p> <p>The management of stormwater in urban areas is important because it is the conduit for transporting pollutants into urban streams, and eventually nearby rivers and lakes. This requires promoting the use of structural stormwater control and treatment facilities (e.g. instream detention ponds) in urban areas, as well as reducing stormwater runoff by improved rainfall infiltration systems, efficient drainage network, and improved rainwater harvesting by households, complexes, and commercial buildings. Riparian buffer strips is an important measure to intercepting and filter polluted runoff. The installation and maintenance of riparian buffer zones and vegetated buffer strips should be promoted and enforced. Hydrocarbon pollution from the dumping of used oil into stormwater drains can contaminate large volumes of water rendering it unfit for use. The installation of oil separators at all garages and vehicle workshops should be enforced, and illegal dumping of used oil at informal workshops should be policed and culprits be prosecuted.</p>		

4	Key Strategic Area:	Water Quality Management (surface and groundwater)
		<p>Informal settlements have a huge negative impact on urban water quality due to indiscriminate disposal of liquid and solid household wastes.</p> <p>A number of strategies have been identified to focus management of water pollution.</p>
4.3.1		Improve sewerage systems and treatment
		<p>Promote wastewater treatment at source, especially at industrial sites, housing estates, hospitals, etc. This could be in the form of septic tanks for households or package plants for larger housing or industrial estates. The objective is to improve the quality of effluent discharges before it enters the environment or sewerage network.</p>
4.3.2		Cleaner production methods
		<p>Support initiatives by the Kenya National Cleaner Production Centre (KNPCPC) to promote excellence in Resource Efficient and Cleaner Production in industries in order to reduce water usage and effluents, as well as their impacts on water quality in receiving water bodies.</p>
4.3.3		Urban stormwater, sanitation, and solid waste management, and protection of upper reaches of rivers
		<p>Control sediment pollution from construction sites and unpaved urban roads in urban areas by adopting best urban stormwater management practices such as erecting sediment traps or screens, sediment detention ponds, etc.</p> <p>Compel county governments to maintain sewerage infrastructure and fix leaks or blockages as a matter of urgency to minimise sewage leaks into stormwater drains.</p> <p>Promote solid waste removal in urban centres and disposal at solid waste disposal sites that meet best national or international design standards. Rehabilitate existing solid waste dumps to intercept and treat poor quality drainage water and prevent it from running into water courses.</p> <p>Compel county governments to delineate and maintain riverine buffer zones to prevent encroachment. Stop encroachment of wetlands.</p>
4.3.5		Management of hydrocarbon pollution
		<p>Control of oil and grease pollution from petrol stations and oil storage facilities by ensuring that all are equipped with functional oil and grease traps and monitoring nearby surface and groundwater for hydrocarbons.</p> <p>Control dumping of used motor oil at informal workshops by promoting recycling of used oil, and monitoring stormwater drains for hydrocarbon pollution.</p> <p>Protect groundwater against hydrocarbon contamination near petrol stations and dump sites by drilling observation wells at high risk areas and monitoring boreholes for hydrocarbons.</p>
4.3.8		Enforcement of effluent standards
		<p>Use the results of compliance monitoring of effluent discharge licence or permit conditions to prosecute offenders that consistently violate their licence/permit conditions and demonstrate no intention of meeting them.</p>
4.3.9		Control discharges from sand mining operations
		<p>Control sediment pollution from sand harvesting operations by enacting by-laws for its control, delineating sand harvest areas away from river riparian, and implementing good sand mining guidelines to mitigate their impacts. See for example the River Sand Mining Management Guidelines of Malaysia for good management practices to consider.</p>
4.3.10		Rehabilitation of polluted aquifers, springs and wells
		<p>See Strategy 3.4.2</p>

4.6 Climate Change Adaptation

4.6.1 Introduction

In the face of a changing climate, adaptation and resilience are Africa's and indeed Kenya's priority responses to address vulnerabilities and risks. The 15th African Ministerial Conference on the Environment 2015 strongly promoted investment in building resilience as a top funding priority and an

integral part of national development funding. This aligns very well with Kenya's approach of mainstreaming climate adaptation in national and sub-national development planning.

The Kenya National Climate Change Response Strategy (NCCRS) (Government of Kenya, 2010b) acknowledged that the impacts of observed and projected climatic change pose serious threats to sustainable development. These predominantly relate to severe weather and changes in the climate extremes which will reduce the resilience in many sectors of the economy.

The Climate and Development Knowledge Network in their Government of Kenya Adaptation Technical Analysis Risk Report (Government of Kenya, 2012) identified various sectors in Kenya which are at-risk, either directly or indirectly, from climate change. These sectors include agriculture, livestock and fisheries, manufacturing, retail and trade, water, health, financial services, tourism, urban and housing sectors, infrastructure, energy, transport, natural resources and environment, political and social sectors.

The Climate Change Act 2016 aims to strengthen climate change governance coordination structures and outlines the key climate change duties of public and non-state actors. It establishes a high-level National Climate Change Council chaired by the President, a Climate Change Directorate as the lead technical agency on climate change affairs, and a Climate Change Fund as a financing mechanism for priority climate change actions/interventions. Climate desks/units have subsequently been established in certain line ministries staffed by relevant climate change desk officers. The Act is to be applied across all sectors of the economy, and by both the national and county governments. Mainstreaming of climate change has to some extent been undertaken at the county government level, where some counties have taken measures to include climate change in their County Integrated Development Plans (CIDPs) and to develop relevant county legislation.

The National Climate Change Action Plan (NCCAP) 2013 to 2017 (Government of Kenya, 2013b) sets out a vision for a low carbon development pathway for Kenya and lists specific adaptation and mitigation actions for each national planning sector to support this vision. One of the "big wins" identified in the Final Draft NCCAP 2018-2022 relates to "improved water resources management".

The Final Draft NCCAP 2018-2022 (Government of Kenya, 2018b) builds on the first Action Plan (2013-2017) and provides a framework for Kenya to deliver on its Nationally Determined Contribution (NDC) under the Paris Agreement of the United Nations Framework Convention on Climate Change. The Final Draft NCCAP 2018-2022 guides the climate actions of the national and county governments, the private sector, civil society and other actors as Kenya transitions to a low carbon climate resilient development pathway. It identifies strategic areas where climate action over the next five years is linked to Kenya's Big Four Agenda, recognising that climate change is likely to limit the achievement of these pillars. One of the "big wins" identified in the Final Draft NCCAP 2018-2022 relates to "improved water resources management". Of particular relevance to water resources management and planning is "Food and Nutrition Security" where food security may be threatened through climate change-driven declines in agricultural productivity. The Final Draft NCCAP 2018-2022 also prioritises seven climate change actions (Table 4-6), three of which (nos. 1 to 3) align very strongly with the planning and management of water resources.

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Table 4-6 Priority climate change actions

1. Disaster Risk (Floods and Drought) Management	Reduce risks to communities and infrastructure resulting from climate-related disasters such as droughts and floods.
2. Food and Nutrition Security	Increase food and nutrition security through enhanced productivity and resilience of the agricultural sector in as low-carbon a manner as possible.
3. Water and the Blue Economy	Enhance resilience of the water sector by ensuring access to and efficient use of water for agriculture, manufacturing, domestic, wildlife and other uses.
4. Forestry, Wildlife and Tourism	Increase forest cover to 10% of total land area; rehabilitate degraded lands, including rangelands; increase resilience of the wildlife and tourism sector.
5. Health, Sanitation and Human Settlements	Reduce incidence of malaria and other diseases expected to increase because of climate change; promote climate resilient buildings and settlements, including urban centres, Arid or Semi-Arid Land (ASALs) and coastal areas; and encourage climate-resilient solid waste management.
6. Manufacturing	Improve energy and resource efficiency in the manufacturing sector.
7. Energy and Transport	Climate-proof energy and transport infrastructure; promote renewable energy development; increase uptake of clean cooking solutions; and develop sustainable transport systems.

Source: (Government of Kenya, 2018b)

The Kenya NAP 2015 to 2030 (Government of Kenya, 2016a) builds on the NCCRS and NCCAP and promotes adaptation as the main priority for Kenya, while also proposing that adaptation and development goals complement each other. Some of the key objectives of the NAP which are applicable to the Basin Plans include understanding the importance of adaptation and resilience building actions in development; integrating climate change adaptation into national and county level development planning and budgeting processes; and enhancing the resilience of vulnerable populations to climate shocks through adaptation and disaster risk reduction strategies.

Within the context of the Basin Plans, the objective of this component of the Plan is to understand the degree to which climate change will compromise the water resources sector and how those impacts will in turn alter the exposure to food security and to flood and drought risk. This component will also explore opportunities presented by climate change such as climate financing.

4.6.2 Strategy

Climate Change is important for the **energy and mining sectors**. In order to comprehensively and systematically address the Climate Change issues and challenges in the basins, the table below presents specific Themes and Strategies under Climate Change Mitigation, Adaptation and Preparedness which are critical for the energy and mining sectors.

Table 4-7 Strategic Framework - Climate Change Mitigation, Adaptation and Preparedness

5	Key Strategic Area:	Climate Change Adaptation and Preparedness
5.1	Theme:	Understand impacts of climate change on water resources at appropriate spatial scales
5.1.1	Quantify climate change impacts (rainfall & temperature) on surface water and groundwater resources and demands in the six basins at appropriate scales for planning and management	

This is undertaken through research and public consultation processes, and where necessary, engaging with the private sectors for further insights. Climate change impacts on surface water and groundwater availability and variability at sub-basin scale as well as changing demand patterns, mainly linked to irrigation, should be investigated using scientific based approaches. As the impacts will be felt in a practical sense, this process should also focus on the in-situ impacts, thresholds and exposer accounts rather than as only a technical theoretical review.

5	Key Strategic Area:	Climate Change Adaptation and Preparedness
5.1.2	Assess relevance, and scale of potential social, environmental and economic climate change impacts as defined in NCCAP in the six basins and its relation to water resources planning and management; prioritise areas for interventions	
<p>This will assess climatic trends to evaluate frequency and magnitude of extreme climate events. Furthermore, the highlighting of hotspot areas will act as a pre-emptive measure building resilience. Assessment of meteorological data relative to the El Niño–Southern Oscillation cycle and associated hydrological and water requirement impacts may provide forewarning into future drought occurrence and severity. Furthermore, there should be analysis of rainfall onset and cessation, particularly in rainfed agricultural areas and areas highly reliant on surface water rather than reticulation. Engage local private sector, NGOs and knowledgeable individuals to facilitate wider experience transfer of adaptation practices.</p>		
5.2	Theme:	Climate change mitigation
5.2.2	Promote the generation and use of clean energy	
<p>Endorse the usage of renewable energy source as more than just hydropower, wind power and solar geysers</p>		
5.2.4	Improve efficiency of water use	
<p>Promote water use which is energy efficient e.g. solar heating, energy efficient water treatment, reducing water use which will save energy etc.</p>		
5.3	Theme:	Climate change adaptation
5.3.1	Promote climate resilient infrastructure	
<p>Promote the development in low risk areas and increase setback from rivers and ocean interfaces. Build to increased threshold specifications to address future climate impacts for both road and stormwater infrastructure.</p>		
5.3.2	Climate-related disaster risk management	
<p>Reduce the risk of disasters linked to climate change e.g. floods, droughts, health-related risks, crop production etc. by understanding the potential threats and risks and by implementing structural and non-structural mitigation measures.</p>		
5.3.3	Promote water conservation	
<p>Employ likely increased stress impact principles promoting soil quality, better drainage and weed/disease control in agricultural practices.</p>		
5.3.4	Promote agroforestry	
<p>Enhance the CO₂ sink by promoting varied land usage to increase biodiversity and minimise soil erosion and increase soil nutrients retention. Actively plant living fences, medicinal and fruit trees.</p>		

4.7 Flood and Drought Management

4.7.1 Introduction

Floods and droughts are caused by extreme climatic events and can have devastating consequences for the socio-economic welfare of rural and urban communities and regions.

Flooding of land surfaces occurs when heavy rainfall leads to runoff volumes that exceed the carrying and storage capacities of stream channels and urban drainage systems. In the process, crop and grazing lands, villages and urban neighbourhoods become inundated, transport infrastructure destroyed, and powerlines flattened. Floods can cause displacement of people, loss of life (human and livestock), increases in water related-diseases, severe soil erosion, land-slides, increased food insecurity and significant losses to the economy of a region.

Drought can be defined as an extended period (consecutive months or years) of unusually low rainfall, depleted soil moisture and groundwater levels and a severe reduction in availability of surface water

resources in streams, reservoirs and lakes. Drought can be referred to as a “creeping disaster” since its effects accumulate slowly and may linger for years after the termination of the event. Droughts can decimate dryland crop production, severely curtail irrigated crop production, cause severe loss of life of livestock and game, diminish freshwater fish-stocks, result in severely restricted municipal and industrial water supplies and give rise to substantial losses to the economy of a region.

It follows from the above that systematic preparedness planning for floods and droughts is an imperative to ensure mitigation of and protection against the above negative consequences of extreme floods and droughts.

4.7.2 Strategy

Flood and drought management are important for the **energy and mining sectors**. In order to comprehensively and systematically address the Flood and drought management issues and challenges in the basins, the table below presents specific Themes and Strategies under Flood and drought management which are critical for the energy and mining sectors.

Table 4-8: Strategic Framework – flood and drought management.

6	Key Strategic Area:	Flood and drought management
6.1	Theme:	Flood management
6.1.1	Undertake flood risk assessment	
<p>High-level assessments of the stormwater drainage problems and related infrastructure of major cities will be conducted, based on a review of recent studies of these problems and related proposals for resolving the ongoing flooding problems in these cities.</p> <p>For the flood-prone rural counties, high-level assessments will be made of the flood exposure of each village and town in terms of proximity to river channels, flood-plains and low-lying land, as well as vulnerable transport, access and escape routes and river crossings. Both the characteristics of past floods and flooding and the existing flood protection structures and drainage systems will be noted and the risk of flooding will be determined by reviewing anecdotal information about the frequency of high water levels and long-duration inundations.</p> <p>The above information will be systematised in a <i>Flood Risk Register</i> for the basins, which will provide a starting point for the Integrated Flood Management Plans discussed below.</p>		
6.1.2	Formalise institutional roles and partnership collaborations.	
<p>The government institutions and agencies and other stakeholders with partnership roles in flood management are as follows¹:</p> <ul style="list-style-type: none"> • KMD • NDMU (including its County Coordinators) • NDOC • National WRA and Regional and Sub-Regional WRA Offices • County Governments and County Disaster Risk Management Committees • BWRCs • WRUAs • Village Disaster Risk Management Committees 		

¹ There are currently three bills seeking to establish a National Disaster Management Authority and a National Disaster Management Fund. However, the three bills differ in content and structure e.g. proposed governance structure, membership and functions among other things. The mandates of NDMA, NDOC and NDMU overlap in various ways. The Disaster Risk Management Bill, currently under consideration by parliament, is aimed at bringing NDMA, NDOC and NDMU together as a new “Disaster Risk Management Authority.” The sponsors of the bills will have to sit and agree on how to collapse the three bills into one or alternatively, the first bill to pass through all the stages of development will be adopted and the rest will be nullified.

6 Key Strategic Area: Flood and drought management

- Various Ministries; particularly Departments dealing with Roads, Railways and Health
- Kenya Red Cross Service
- International Relief Aid Agencies
- NGOs

Formalising and aligning the roles of and proactive partnership collaborations among the above entities are crucial to ensuring that the above objectives of the flood response protocol are achieved. To this end, it is proposed that a *Basin Flood Response Forum (FRF)* be established for each of the six basins that integrates all flood-relevant resource mobilisations and related interventions in each basin by the various collaboration partnerships listed above. The *Basin FRF* must operate under the auspices of the KMD and, to ensure continuity, it must be served by a Secretariat. The Secretariat can be physically housed in the WRA Regional Office or in one of the WRA Sub-Regional Offices. Furthermore, the activities of the *Basin FRF* must be systematised through the development of appropriate standard operating procedures (SOPs)².

6.1.3 Develop flood response protocol

The flood response protocol: The flood response protocol follows a *multi-stakeholder* approach and comprises a structured set of inter-connected institutional and partnership roles, focus areas and mechanisms to prepare for, respond to and recover from a flood disaster. The components of the flood response protocol are as follows:

- Formalised institutional roles and partnership collaborations.
- A flood preparedness plan that is understood by both institutional actors and communities in flood-prone zones.
- A key principle of the plan is that it is better to protect more people from the frequent smaller floods, than fewer people from the rarer larger floods. Flood early warning systems should be used to warn communities when larger floods may occur.
- SOPs that comprise sequential response actions: monitoring ⇌ early warning alerts ⇌ severity trigger alerts ⇌ pro-active resource mobilisations ⇌ emergency interventions ⇌ post-flood recovery interventions.

Objectives of the flood response protocol:

- Minimise the impacts of flooding on the safety and quality of life of affected communities.
- Minimise environmental impacts.

Accelerate recovery of prior homestead environments, livelihoods and transport routes of affected communities.

6.1.4 Develop Integrated Flood Management Plans

An Integrated Flood Management Plan (IFMP) needs to be developed for each of the flood-prone sub-catchments in each basin. The IFMPs should be structured around the following topics:

- Overview of the natural conditions (topography, climate, soils, land-use, land-cover, hydrology) and the socio-economic make-up of each catchment.
- Overview of the statutory, institutional and civil society stakeholder context of each catchment.
- Characteristics of floods and flooding in each catchment, namely identifying all flood-prone locations, flash floods, long-duration overbank inundations, sediment dumping floods, etc.
- Overview of existing flood management/counter measures – both structural and non-structural.

² SOPs aim at: (1) Providing a list of major executive actions involved in responding to disasters and necessary measures needed for preparedness, response and relief; (2). Indicating various actions that should be taken and by which actors within their sphere of responsibilities – linking up with their contingency plans; (3) Ensuring that all concerned actors and agencies know the precise actions required of them at each stage of the response and that all actions are closely and continuously coordinated (DFID, 2017).

6	Key Strategic Area:	Flood and drought management
		<ul style="list-style-type: none"> • Analysis and costing of required flood management/counter measures at all flood-prone locations, categorised as follows: <i>prevention measures; protection measures; preparedness measures; flood early warning systems; emergency response measures.</i> • Stakeholder participation in prioritising required flood management/counter measures at all flood-prone locations. • Proposed Implementation Schedules of flood management/counter measures at all flood-prone locations. • Funding sources for the proposed flood management/counter measures.
6.1.5	Implement flood management measures	
	<p>The above proposed Implementation Schedules for the IFMPs that cover the basins, will be reviewed by the <i>FRFs</i> and, through negotiation with representatives of each of the affected stakeholders and villages/communities, be re-prioritised according to both non-structural and structural measures that cover all the short-term, medium-term and long-term flood management/counter measures that are required across the basins at all flood-prone locations.</p> <p>The above re-prioritised non-structural and structural flood management/counter measures will encompass the following: <i>prevention measures; protection measures; preparedness measures; flood early warning systems; emergency response measures.</i> These measures will be focused on flood-prone river reaches and flood-plains in the basins. Wherever feasible, <i>community-based</i> flood early warning and flood preparedness approaches will be followed.</p> <p>The <i>FRF</i> will provide a platform for coordinating the resourcing and supervision of the funding of the above re-prioritised non-structural and structural flood management/counter measures. In all instances, labour-intensive approaches will be followed.</p>	
6.1.6	Capacity development	
	<p>Capacity for flood management in the basins will be assessed according to three categories, namely, <i>organisational alignment/collaboration, technical skills and community preparedness.</i> The outcomes of these assessments will inform the strategy for development of capacity in each of the three categories.</p> <p><i>Organisational alignment/collaboration:</i> The strategy is to expand organisational capacity in the Athi Basin by aligning the flood response roles and responsibilities of the government institutions/agencies, International Relief Aid Agencies, Kenya Red Cross, NGOs and other stakeholders with partnership roles in flood management. The vehicle for this strategy will be the <i>Flood Response Forum (FRF)</i> introduced above.</p> <p><i>Institutional technical skills:</i> The strategy is to strategically expand institutional technical skills relevant to flood response activities across three different sets of competencies, namely, (i) competence at translating Flood Early Warning Bulletin information to support prioritisation of resource mobilisations for humanitarian interventions; (ii) competence at logistical planning of required interventions followed by subsequent operationalisation; (iii) competence at communicating technical and logistical information in multi-stakeholder environments.</p> <p><i>Community preparedness:</i> Community-based flood early warning drills as well as emergency evacuation drills will be prioritised by the Secretariat of the Athi Basin <i>FRF</i>. The resources and experience of the NDMU/NDOC (or their successor institution) can make valuable contributions to developing community self-help awareness in terms of flood management.</p>	
6.2	Theme:	Drought management
6.2.1	Formalise institutional roles and partnership collaborations.	
	<p>The government institutions and agencies and other stakeholders with partnership roles in drought management are as follows³:</p>	

³ There are currently three bills seeking to establish a National Disaster Management Authority and a National Disaster Management Fund. However, the three bills differ in content and structure e.g. proposed governance structure, membership and functions among other things. The mandates of NDMA, NDOC and NDMU overlap in various ways. The Disaster Risk Management Bill, currently under consideration by parliament, is aimed at

6 Key Strategic Area: Flood and drought management

- NDMA
- NDMU (including its County Coordinators)
- NDOC
- KMD
- National WRA and Regional and Sub-Regional WRA Offices
- County Governments and County Disaster Risk Management Committees
- BWRCs
- WRUAs
- Village Disaster Risk Management Committees
- Ministry of Agriculture, Livestock and Fisheries as well as Ministry of Health
- Kenya Red Cross Service
- International Relief Aid Agencies
- NGOs

Formalising and aligning the roles of and proactive partnership collaborations among the above entities are crucial to ensuring that the above objectives of the drought response protocol are achieved. To this end, it is proposed that the *Basin Drought Response Forum (DRF)* be established for each basin that integrates all drought-relevant resource mobilisations and related interventions in each basin by the various collaboration partnerships listed above. The *Basin DRF* must operate under the auspices of the NDMA and, to ensure continuity, it must be served by a Secretariat. The Secretariat can be physically housed in one of the drought-prone counties' offices. Furthermore, the activities of the *Basin DRF* must be systematised through the development of appropriate standard operating procedures (SOPs.)

6.2.2 Develop drought response protocol.

The drought response protocol: The drought response protocol should follow a multi-stakeholder approach to comprise a structured set of inter-connected institutional and partnership roles, focus areas and mechanisms to prepare for, respond to and recover from a drought disaster. The components of the proposed protocol are as follows:

- Formalised institutional roles and partnership collaborations.
- A drought preparedness plan that is understood by both institutional actors and communities in drought-prone zones.
- SOPs that comprise sequential response actions: monitoring ⇔ early warning alerts ⇔ severity trigger alerts ⇔ pro-active resource mobilisations ⇔ recovery interventions.

Objectives of the drought response protocol:

- Minimise the impact of water shortages on the quality of life of affected communities.
- Minimise environmental impacts.
- Ensure equitable allocation of water despite systematic restrictions of supply.

Accelerate restoration of prior homestead environments and livelihoods of affected communities.

6.2.3 Improve drought preparedness.

The above DRF must address five primary drought response needs, i.e. drought monitoring, drought early warning, drought severity assessment, mitigation interventions and recovery interventions.

bringing NDMA, NDOC and NDMU together as a new “Disaster Risk Management Authority.” The sponsors of the bills will have to sit and agree on how to collapse the three bills into one or alternatively, the first bill to pass through all the stages of development will be adopted and the rest will be nullified.

6 Key Strategic Area: Flood and drought management

Currently, drought monitoring, drought early warning and severity assessment are conducted by the NDMA, who issues regular Drought Early Warning Bulletins for ASAL counties, with inputs from KMD, the above two Ministries and WRA Offices. Regarding mitigation interventions and recovery interventions, NDMA oversees two coordinating bodies at the national level that bring together various stakeholders in drought preparedness. These are the Kenya Food Security Meeting and the Kenya Food Security Steering Group. At the county level, this is organised under County Steering Groups.

The drought severity assessments of the national and county-level coordinating structures of the NDMA relevant to the basins must be reviewed and deliberated by the collaboration partnership participants in the DRF. In the case of an adverse severity assessment, the DRF participants will have a common point of reference from which to launch and systematically coordinate their various drought-relevant resource mobilisations and related interventions in the basins.

6.2.4 Develop drought early warning system

The NDMA currently issues regular Drought Early Warning Bulletins for ASAL counties.

SOP responses based on the Bulletins' early warning findings and alerts must be an integrating force in the above DRF. The sub-county scale of the Bulletins' reporting ensures that such responses can be spatially accurately focused. Furthermore, such informed responses will secure appropriate and timely resource mobilisations and humanitarian interventions across all the collaborating partnerships at county, sub-county and local community scales across the drought-prone counties in the basins.

The Famine Early Warning Systems Network (FEWS NET), which produces monthly reports and maps detailing current and projected food insecurity in a number of regions in the world, has a Regional Office in Kenya and FEWS NET outputs will support the deliberations by the participants in the DRF.

6.2.4 Capacity development

Capacity for drought management in the basins will be assessed according to three categories, namely, *funding*, *organisational alignment* and *institutional technical skills*. The outcomes of these assessments will inform the strategy for development of capacity in each of the three categories.

Funding: The funding strategy is to secure a standing allocation from the recently-established National Drought Emergency Fund (DEF) to the basins drought-prone counties to ensure that finance for early drought response will always be available when needed. This will avoid the hitherto time-consuming approach of emergency budgetary re-allocations, which is also counter-productive, because it takes resources away from the long-term development that should enhance resilience to drought.

Organisational alignment/collaboration: The strategy is to expand organisational capacity in the Athi Basin by aligning the drought response roles and responsibilities of the government institutions/agencies, International Relief Aid Agencies, Kenya Red Cross, NGOs and other stakeholders with partnership roles in drought management. The vehicle for this strategy will be the *Drought Response Forum (DRF)* introduced above.

Institutional technical skills: The strategy is to strategically expand institutional technical skills relevant to drought response activities across three different sets of competencies, namely, (i) competence at translating Drought Early Warning Bulletin information to support prioritisation of resource mobilisations for humanitarian interventions; (ii) competence at logistical planning of required interventions followed by subsequent operationalisation; (iii) competence at communicating technical and logistical information in multi-stakeholder environments.

4.8 Hydro-meteorological Monitoring

4.8.1 Introduction

An operational and well-maintained hydro-meteorological network is critical to support the WRA with its key functions related to water resources planning, regulation and management in the basins. The WRA is responsible for all aspects related to the monitoring (quantity and quality) of surface and groundwater in Kenya, including the construction and maintenance of monitoring stations, related equipment, data collection, transmission, capturing and storage, and dissemination.

4.8.2 Strategy

Hydro-meteorological monitoring is important for the **mining and energy** sectors. In order to comprehensively and systematically address hydro-meteorological monitoring issues and challenges in the basins, Table 4-9 presents specific Themes and Strategies under hydro-meteorological monitoring which are critical for the mining and energy sectors.

Table 4-9: Strategic Framework - Hydrometeorological Monitoring.

7	Key Strategic Area:	Hydrometeorological Monitoring
7.1	Theme:	Improved monitoring network
7.1.1	Surface water monitoring: River flow	
	<p>Under this Consultancy, the current flow gauging station network in Kenya was assessed in terms of operational status, challenges, maintenance and equipment needs and data quality. Stations were prioritised for rehabilitation, for improvements and upgrades and for re-calibration. New station locations were identified based on pre-defined criteria and should be implemented according to the recommendations made in the Monitoring Network Design Report. A maintenance plan with budgets, timeframes and structured responsibilities should be prepared. The type of flow gauging stations to be installed should take into account that changes in river channel form due to floods often lead to changes in the rating curve, which requires re-calibration. Consideration should therefore also be given to fixed weirs (concrete structures) as opposed to rated sections.</p>	
7.1.2	Monitoring: Dams and lakes	
	<p>The current instrumentation and level gauging network in dams and lakes in Kenya should be assessed in terms of operational status, challenges, maintenance and equipment needs and data quality. Stations should be prioritised for rehabilitation where required, for improvements and upgrades and for re-calibration. New station locations should be identified based on pre-defined criteria and designed and implemented according to an implementation plan. A maintenance plan with budgets, timeframes and structured responsibilities should be prepared. Bathymetric surveys of dams and lakes should also be included in the plan.</p>	
7.1.3	Groundwater monitoring	
	<p>Priority aquifers in Kenya should be defined and monitoring requirements for each aquifer specified. A Groundwater Monitoring Network Design should be undertaken and necessary monitoring instrumentation procured and installed in accordance with an Implementation Plan.</p>	
7.1.4	Water quality monitoring: Surface water and groundwater	
	<p>Under this Consultancy, the current water quality monitoring network in Kenya was assessed in terms of operational status, challenges, maintenance and equipment needs and data quality. Stations were prioritised for rehabilitation where required, for improvements and for upgrades. New station locations were identified based on pre-defined criteria and should be implemented according to the recommendations made in the Monitoring Network Design Report. A maintenance plan with budgets, timeframes and structured responsibilities should be prepared.</p>	
7.1.5	Meteorological monitoring	
	<p>Under this Consultancy, the current rainfall station network in Kenya was assessed in terms of operational status, challenges, maintenance and equipment needs and data quality. WRA stations were prioritised for rehabilitation where required, for improvements and for upgrades. New station locations were identified based on pre-defined criteria and should be implemented according to the recommendations made in the Monitoring Network Design Report.</p> <p>A maintenance plan with budgets, timeframes and structured responsibilities should be prepared. WRA's requirements as far as meteorological data needs in relation to water resources planning and management are concerned should be discussed with KMD and roles and responsibilities with regard to the design, upgrade and maintenance of the meteorological monitoring network should be clearly defined.</p>	
7.1.6	Flood early warning monitoring network	

7	Key Strategic Area:	Hydrometeorological Monitoring
<p>Under this Consultancy, the current flood early warning network in Kenya was assessed in terms of operational status, challenges, maintenance and equipment needs and data quality. Stations were prioritised for rehabilitation where required, for improvements and for upgrades. New station locations were identified based on pre-defined criteria and should be implemented according to the recommendations made in the Monitoring Network Design Report. A maintenance plan with budgets, timeframes and structured responsibilities should be prepared</p> <p>WRA's requirements as far as meteorological data needs in relation to flood management are concerned should be discussed with KMD and roles and responsibilities with regard to the design, upgrade and maintenance of the meteorological monitoring network should be clearly defined.</p>		
7.1.7	Metering of water use and abstractions	
<p>Abstractions from dams and rivers as well as groundwater abstractions should be identified, prioritised and flow meters installed. The prioritisation and selection of meter locations and types should be dictated by a needs assessment in relation to data requirements e.g. for operational, monitoring of compliance, water balance or other purposes.</p>		
7.2	Theme:	Improved data and information management
7.2.1	Enhanced data management	
<p>Data protocols and procedures with regard to data collection, transfer, capture, storage, quality control and dissemination should be evaluated, standardised and improved where necessary in accordance with international best practice. Technical and computing capacity for processing, analysis and reporting of data should be addressed and enhanced. The MIKE Info database application which was developed for the WRA under this Consultancy should be employed by WRA SRO, Regional Office and Head-quarters staff to capture, store, quality control and manage hydromet data in accordance with training provided.</p>		
7.2.2	Improved water resources information management systems	
<p>The knowledge base tools which were developed under this Consultancy should be employed by WRA SRO, Regional Office and Head-quarters staff to manage and disseminate information related to water resources planning and management taking into consideration the specific needs and challenges across different organisations and institutions as stakeholders.</p>		
7.2.3	Improved forecasting systems	
<p>The real-time system developed under this Consultancy for accessing, visualizing and analysing hydromet observations in near real-time should be employed to inform decision making with regard to flood forecasting and water resources management. Shared mandates and responsibilities should be discussed and agreed with KMD.</p>		

4.9 Water Resources Development

4.9.1 Introduction

Water resources planning and development relate to large-scale water resources and related infrastructure which will support socio-economic development in the basins to improve water availability and assurance of supply for current and projected future water use in the basin, while taking into consideration environmental sustainability. The rationale for the development of the basin plans was to assess whether the basin's water resources are sufficient to meet the expected growth in water requirements with 2040 as the planning horizon. The approach entailed an evaluation of the need for and the capacity of large-scale water resources development interventions such as dams and transfers, some of which include multi-purpose projects. Most of the interventions which were considered were already identified as part of previous planning studies. Proposed schemes should be implemented in conjunction with management interventions i.e. water conservation and demand management initiatives. Such an approach, in combination with the phased development of new infrastructure, will allow an adaptive development strategy towards improving climate resilience.

4.9.2 Strategy

Water resources development is important for the **energy and mining sectors**. In order to comprehensively and systematically address the Water resources development issues and challenges in the basins, the table below presents specific Themes and Strategies under Water resources development which are critical for the energy and mining sectors.

Table 4-10 Strategic Framework – Water resources development

8.	Key Strategic Area	Water resources development
8.1	Theme:	Water resources assessment, allocation and regulation
8.1.1	Surface water resources assessment	<p>Before decisions are made regarding water resources developments, it is critical to have reliable information on availability of surface water at relevant spatial scales for planning, management and allocation. The existing hydrological and systems models which have been configured for each basin, need to be refined as appropriate for decision making.</p>
8.1.2	Groundwater resources assessment	<p>Refer to Strategy 3.1.1</p>
8.1.3	Assess water use and fitness for use	<p>It is imperative that information with regard to current water use is improved through abstraction surveys. This relates to both water quantity and quality.</p>
8.1.4	Update and improve permit database	<p>The accuracy and completeness of the information in the PDB are questionable. The PDB should be checked and updated (based on the abstraction survey data) to ensure that it is a true reflection of the state of water allocation.</p>
8.1.5	Water allocation	<p>Water allocations should be re-assessed based on the improved understanding of water availability and current water use at relevant spatial scales. Allocation should be informed by updated water balances which should take into account the reserve and RQOs.</p>
8.2	Theme:	Water resources planning
8.2.1	Updated planning for bulk water resources development	<p>It is imperative that detailed plans are put in place to guide the phased development and optimisation of integrated water supply systems (storage, conveyance, treatment) for the major urban areas in line with water demand projections in the respective basins. The conjunctive use of surface and groundwater to meet urban and rural demands should be investigated. The existing inter- and intra-basin transfers should be assessed in terms of water resource sustainability and/or infrastructure capacity constraints. Enough lead time should be allowed for the implementation of the future phases.</p>
8.3	Theme:	Water storage and conveyance
8.3.1	Implement large dams	<p>To utilise the available water resources in the country and to improve the reliability of supply will require significant storage of water during the wet seasons – specifically as part of the water supply systems to major urban areas and for the various large-scale irrigation schemes being planned. The proposed dams should be investigated in more detail and implemented in line with the investment plan.</p>
8.3.2	Maintain existing dams	<p>There is a need to dredge existing dams to improve the capacity volume. Enhanced catchment management will decrease erosion and siltation of existing dams, and dredging will be required on a less frequent basis.</p>
8.3.3	Compile infrastructure development programme for small dams and pans	

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8.	Key Strategic Area	Water resources development
<p>At sub-basin scale, there is a need for storage of surface water on tributaries to improve the reliability of supply for local domestic, livestock and small-scale irrigation use. Studies should be initiated, and an infrastructure development programme should be compiled to guide the phased implementation of storage at sub-basin scale.</p>		
8.3.4	Provide other types of storage	
<p>Sand dams, artificial recharge and water harvesting should be investigated and implemented where feasible to provide storage of water during the wet season for use during the dry season, especially in areas without reliable river flows.</p>		
8.3.5	Upgrade/new water transfers	
<p>There are a number of inter and intra-basin transfers which convey water from springs, abstraction points and adjacent basins to demand nodes. Proposed expansion of these transfers should be implemented timeously to ensure reliability of supply in line with future water demands.</p>		
8.4	Theme:	Groundwater development
8.4.1	Develop groundwater resources	
<p>Implement under Strategic Theme 3.2</p>		
8.5	Theme:	Hydropower development
8.5.1	Large scale hydropower development	
<p>Hydropower generation is critical for the national economy. There are several proposed multipurpose large dams, which will be used for hydropower generation. The possibility of retrofitting existing large dams with hydroelectric power generation capabilities should also be investigated.</p>		
8.5.2	Small scale hydropower development	
<p>Hydropower is an important source of energy for economic and social development, on both a large and small scale. The potential for small-scale hydropower plants should be assessed across the country, especially in the upper catchments of the six basins.</p>		
8.6	Theme:	Water for agriculture
8.6.1	Large scale irrigation development	
<p>Extensive large-scale irrigation development is possible in the country but will require storage. This includes both new irrigation and the upgrading of existing schemes. Certain originally proposed developments should also be scaled down in light of constraints associated with water availability, environmental concerns and assurance of supply.</p>		
8.6.2	Small scale irrigation development	
<p>Small scale irrigation in the basin should be encouraged due to the significant socio-economic benefits associated with this. Water supply should be improved and/or expanded by means of storage (small dams) and boreholes.</p>		
8.6.3	Promote water conservation in irrigation	
<p>As part of the sustainable scenarios proposed in the Basin Plans, increased irrigation efficiency and reduced water demand for large-scale irrigation accounts largely for more sustainable water use. Water use efficiency can be increased through the rehabilitation or improvement of irrigation technologies and techniques, and through the use of smart metering.</p>		
8.8	Theme:	Non-conventional water resources
8.8.1	Seawater desalination	
<p>The feasibility of seawater desalination as an alternative and/or integrated supply option to certain coastal urban centres should be evaluated as part of detailed feasibility studies</p>		
8.8.3	Reuse	
<p>The feasibility of re-use as an alternative and/or integrated supply option to certain urban centres should be evaluated as part of detailed feasibility studies</p>		

8.	Key Strategic Area	Water resources development
8.8.4	Water Conservation and Demand Management	
WCDM should be implemented as an immediate option to reduce water demand in certain urban centres.		
8.9	Theme:	Water resources systems operation
8.9.1	Optimise system operating rules	
The operation of existing and future bulk water supply systems should be integrated and optimised, taking into consideration the various uses and priorities within particular systems e.g. large scale irrigation, hydropower generation, domestic water supply, environmental water requirements, flood protection etc.		
8.9.2	Annual operating analysis	
Annual operating analyses, taking into consideration the current storage state, projected water demands, and infrastructure constraints should be conducted for the bulk water supply systems in each basin to inform decisions with regard to curtailment of water use and the need for/phasing of new augmentation schemes.		
8.9.3	Maintenance of piped network	
Maintenance of piped network should be conducted to improve (reduce) NRW.		

4.10 Institutional Strengthening and Enabling Environment

4.10.1 Introduction

In effect, the key aspect of any institutional reform process is to find an appropriate balance between operational functionality and the need for effective oversight and governance. Despite the various efforts that have been targeted at improving the institutional framework in the basins, there still remain challenges that warrant dynamic and progressive approaches to address them. Thus, this Plan provides the opportunity to integrate institutional reforms with the various elements of water resources management and development, noting that these reforms are an important part of ensuring that this Plan is implemented. Whilst, the various technical dimensions of this Plan are of significant importance, it does need to be highlighted that the ability of institutions to implement, oversee and review approaches accordingly will determine the efficacy of the basin plan.

Noting the variability of the climate and the potential impacts of climate change, the ability of institutions to manage adaptively will become increasingly important. In addition, the importance of the basins in terms of Kenya's socio-economic development cannot be underestimated. This will require strengthened inter-governmental approaches and inter-sectoral partnerships. These will be imperative noting the importance of the water-food-energy nexus, and will need to not only ensure improved levels of inter-sectoral planning, but equally improved effectiveness and efficiency from better implementation alignment as well as coordinated oversight. This is especially important when one notes the ongoing capacity constraints that face most sectors.

Whilst there will be ongoing pressures to develop and use water resources to enable socio-economic growth and development in the basins, the need to ensure that this takes place in a sustainable manner will become increasingly imperative. The shifts towards strengthening the regulatory role of the WRA, aligned to the 2016 Water Act, are important and will have an impact on the institutional roles and responsibilities within the basins. Hence, the drive to enable better coordinated resource development will be balanced by an improvement in the regulatory response by WRA. This will mirror and support the drive at a national level to strengthen catchment-based water resources management.

4.10.2 Strategies

Institutional Strengthening and an Enabling Environment is important for the **mining and energy sectors**. In order to comprehensively and systematically address the Institutional issues and challenges

in the basins, Table 4-11 and Table 4-12 present specific Themes and Strategies under Institutional Strengthening and Enabling Environment which are critical for the mining and energy sectors.

Table 4-11 Strategic Framework – Institutional Strengthening

9	Key Strategic Area:	Strengthen the Institutional Frameworks
9.1	Theme:	Promote improved and sustainable catchment management
9.1.1	Strengthen WRA's regulatory role	
<p>The 2016 Water Act, aligned to the Constitution of Kenya (2010), provides for the strengthening of the regulatory functioning of the WRA. Towards this end there is a need to separate out the regulatory and management functions of the Authority and provide different reporting lines for these differing functions. This will enable WRA to focus on its regulatory functions and in the longer-term work towards the delegation of management and operational functions to the BWRCs when they are established, the County Governments and WRUAs. Acknowledging that the process of establishing the BWRCs may be lengthy, and the need to strengthen the institutional capacity of the Counties and WRUAs will require time, there is need for WRA to establish interim modalities to bridge this gap and to ensure a smooth transition. This will require an optimisation of the ROs and the SROs supported by a capacity building drive (see KSA 10). At the same time, there is a need for the ongoing improvement and strengthening of the regulatory approaches utilised by the WRA. This will include a number of enabling factors (see KSA 10) but also requires a clarification of roles and responsibilities across the entire institutional framework. This will include working with various sector stakeholders to support the improved harmonisation of legislation and regulatory instruments across a range of sectors. This will need to incorporate the development of operational modalities across institutions as well as across administrative and hydrological boundaries.</p>		
9.1.2	Strengthen BWRCs	
<p>The BWRCs have more representation from different stakeholders in the Basin and will thus enable improved engagement across a wider range of stakeholders as well as inter-sectoral issues. There are lessons to be learned from the CAACs and these need to be translated into improved operational modalities for the BWRCs. These lessons include ensuring adequate and sustainable financing, ensuring frequent and well-structured engagements of the members of the BWRCs, WRA providing secretariat and technical assistance services, clear communication and reporting channels between WRA and the BWRCs, modalities for WRA taking on board recommendations of BWRCs, detailed guidelines on appointing members to the committees including qualifications, operationalisation guidelines, prescribed remuneration for the committee members and continued training and capacity building for the members. In addition, strengthening the BWRCs will include WRA providing secretariat services through the ROs and SROs. There is need to provide appropriate channels for enabling recommendations made by the Committee to be taken on board by WRA for further action. This will need to be supported by designated line functions within WRA that do not dilute the WRAs regulatory authority. Training and capacity building will be an ongoing requirement for the BWRCs including a thorough on-boarding upon establishment. This would include not only the more technical dimensions of water resource management, but also a range of skills to enable sound governance.</p>		
9.1.3	Strengthen county governments engagements in WRM in the basin	
<p>The introduction of county governments into the management frameworks provides an opportunity for improved management at local levels. The key role of county governments to support localised socio-economic development is crucial and therefore there is a very important need to align planning instruments to ensure that the sustainable development of water resources does underpin this developmental agenda. To date, engagements with the county governments are unstructured, partly borne from a lack of clarity as to institutional mandates, roles and responsibilities. WRA needs to clarify these roles and responsibilities and to introduce more structured strategic planning and operational engagement. The BWRCs will provide a platform for structured engagements with the county governments, at a governance and strategic level, however, there is need to explore more ways of engaging with the Counties at the basin and sub basin level for day to day issues that may arise. Training and capacity building (see KSA 10) is required for the county governments as well as awareness creation which can be achieved through a collaborative partnership approach with the counties. In addition, the ongoing development of protocols for the sharing information and knowledge exchange need to be established to provide the necessary information required for decision making.</p>		
9.1.4	Strengthen WRUAs	

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9	Key Strategic Area:	Strengthen the Institutional Frameworks
<p>WRUAs play an important role in sub-catchment management, but there are a range of institutional and capacity challenges that require resolution to enable WRUAs to be more effective. The institutional linkages between county governments and the WRUAs are important and ways to improve and strengthen these will be an important part of improving localised operational water resource management and development. WRUAs have had sustainability issues and exploring approaches that enhance their livelihoods while promoting catchment management will be an added advantage. More importantly, a more sustainable financing approach for WRUAs' activities is most needed to ensure financial sustainability of WRUAs.</p> <p>There is a need to provide training and capacity building to the members periodically on matters relating to WRM. Equally, improvements in information dissemination are needed to ensure community members can understand the message being passed across.</p>		
9.2	Theme:	Guidelines, codes of practice and manuals
9.2.1	Develop guidelines, codes of practice and manuals	
<p>Technical guidelines, codes of practice and manual which are relevant to water resources planning and management need to be updated and/or developed based on international best practice and aligned with the policy and legal framework which dictates.</p>		

Table 4-12 Strategic Framework – Enabling environment to support effective water resources planning and management

10	Key Strategic Area:	Enabling environment to support effective water resources planning and management
10.1	Theme:	Develop institutional capacity
10.1.1	Strengthen policies and regulatory instruments	
<p>Updating WRA's standards, policies and regulations in line with the WA2016 is needed. This should be followed by awareness creation and training and capacity building for the new standards, policies and regulations. Respective tools to support the new legislative instruments should also be developed to aid the implementation phases. Development of these tools should adopt a participatory approach in consultation with major stakeholders to ensure buy in and ownership of the new legislative instruments that will trickle down to implementation.</p>		
10.1.2	Development of technical and management capacity	
<p>Across the institutional framework there is a need to develop a range of technical and managerial skills to improve the institutional ability to deliver on mandate. This includes not only ensuring appropriate levels of staffing, but also the upskilling and training of staff to be able to perform functions to the required technical and managerial levels. This will need to take place in alignment with the ongoing work to clarify institutional roles and responsibilities (see KSA 9) and will look to introduce training opportunities across institutions supported by a basin level capacity building framework. Thus, training interventions will support the ongoing development of a community of practice within the basin and will enable more effective inter-institutional functionality.</p>		
10.1.3	Strengthen partnerships	
<p>The importance of inter-sectoral engagement in water resource management and development has increasingly been recognised. This will support the development of more aligned planning approaches to both management and development, as well as provide additional capacity support when and where appropriate. This could also introduce efficiencies that adjust institutional capacity requirements. To this end, there is a need for the development of a partnership framework that provides the basis for the approach towards partnerships. This will then be implemented through the ongoing development of partnership arrangements over time.</p>		
10.1.4	Strengthen stakeholder engagement	
<p>The importance of stakeholder engagement cannot be over emphasised. The improvement in the development of water resource management and development solutions, the improvement in alignment of operational activities and the development of a sense of ownership of the management regime all provide the basis for more robust and sustainable management. There is a clear understanding that there is a need to improve upon the levels of stakeholder engagement and this cuts across the various institutions that play a role in water resource management and development. In this regard, the development of an agreed upon basin-wide framework for</p>		

10	Key Strategic Area:	Enabling environment to support effective water resources planning and management
<p>engagement is a key first step, supported then by the implementation of this framework. A key element of this, will include improving the functionality of the existing forum.</p>		
10.1.5	Improved research	
<p>Noting the impacts that climate variability and climate change will have upon the water resources of the Athi basin, together with the need to support ongoing development, there will be an ongoing need to develop innovative solutions to the ongoing challenges of water resource management and development. Research towards finding these innovative approaches and technologies will become increasingly important. Developing the network of supporting research institutions will be an important step together with providing the appropriate communication and engagement channels that enables exchange of information. A key challenge has always been ensuring that the research agenda is supportive of the challenges that the sector is experiencing, and so the need to ensure ongoing exchange is critical.</p>		
10.1.6	Innovative financing	
<p>Ensuring adequate financial resources to support integrated water resources management at the basin level is a significant challenge evidenced by the financial hurdles for catchment-based institutions such as the WRA ROs and SROs, the former CAACs and forums. Embracing innovative internal and external resource mobilisation strategies is needed. This needs to factor in new entities in the sector such as the County Governments and other water sector institutions. The private sector provides opportunities for innovative financing for water resources management and should therefore be explored to complement the budget allocated for water resources management from the national fiscus. Internal and external resource mobilisation strategies will be implemented concurrently because of the very crucial role financing plays as a key enabler for IWRM implementation.</p>		

5 Key outcomes

5.1 Introduction

This section establishes a link between the findings and outcomes of the basin planning process and the effective implementation of the recommended strategies within the framework of IWRM and with specific relevance to **mining and energy**. It contextualises the basin plans and recommends specific themes and interventions along with cost estimates for implementation of actions related to energy and mining in the respective basins.

Over the past decade, Kenya's has struggled with the challenge of unreliable, costly and unsuitable energy due to aging infrastructure that can no longer support the country's modern day developed blueprint, the Kenya Vision 2030. Kenya's domestic energy requirements is currently going through a unique development phase and recent discoveries of gas, oil and coal deposits can significantly impact the structure of the economy, which poses a challenge for policy makers, the private sector and energy users.

Following recent discoveries of minerals and hydrocarbons, as well announcements on the availability of deposits of oil, gas, coal, iron ore and rare earth minerals across the country, the GoK is attempting to attract increased local and foreign investment into extractive industries. The new legislative and regulatory framework through the Mining Act of 2016, aims to address gaps in previously outdated legislation and align the mining sector to the latest global trends.

The recent introduction of decentralised governance system in Kenya provides an opportunity for sustainable management of mineral resources because the national constitution has ensured that the interests and rights of local communities are considered within all the economic sectors. The potential implications of increased mining developments on environmental and human rights issues however cannot be underestimated.

The main challenges associated with water resources development and management in Kenya vary across the country and include water quality, the spatial and temporal variability of water, assurance of supply, impacts of climate change, the expected growth in water demand linked to population growth and socio-economic and irrigation development, challenges associated with the successful implementation of large-scale water resources and related infrastructure, inadequate planning, etc. These challenges are exacerbated by various management and institutional issues. Furthermore, environmental sustainability needs to form an integral part of the decision-making processes during development of Kenya's water resources.

5.2 Context

Within a global context, the adoption of the United Nations Sustainable Development Goals (SDGs) (UN, 2015) is an opportunity to enact an integrated approach to water resources management. Consequently, the Key Strategic Areas (KSAs) which lie at the heart of the six Basin Plans provide various synergies with the SDGs. Furthermore, it is important to note that the successful implementation of the Basin Plans will depend on the degree to which concurrent and future planning in each basin, at various levels, is aligned with the proposed development plans for the water sector. The development plans for **mining and energy sector** will also need to be aligned with the basin plans.

5.2.1 Linkages with Basin Plans

The six Basin Plans which were developed as part of KWSCR-1 are key deliverables toward the overall objective of the KWSCR, namely to strengthen WRA's capacity in terms of tools, skills and infrastructure to deliver on its mandate for water resources regulation in the country. It constitutes IWRM

and Development Plans for the six river basins, which consider the environmental, social and economic aspects of each basin, address the key issues and challenges, and ensure that these aspects are integrated into overall management strategies. The Basin Plans aim to achieve a sustainable balance between the utilisation, development and protection of water resources and provide a clear pathway for the sustainable utilisation and development of the water resources of Kenya. It is also important to remember that the Plans are “living documents”, which should accommodate adjustments and/or updates. Ideally the Basin Plan should be reviewed and updated every five years.

The purpose of this Sectoral Integration Plan with regard to the **energy and mining sectors** in Kenya, is to ensure that the key findings and outputs from the six Basin Plans which were developed under KWSCR-1 are properly integrated at sectoral level - in each of the six basins as well as in the country as a whole.

5.2.2 Linkages with the UN sustainable development goals

Since adoption of the UN 2030 Agenda for Sustainable Development, the Government of Kenya, as a member of the United Nations, has committed to the integration of the SDGs into national and county policy and planning frameworks. The UN 2030 Agenda is based on global sustainable development goals and covers the five critical pillars: people, planet, prosperity, peace and partnerships. It contains 17 goals and 169 targets that provide broad guidelines for sustainable development. The 17 Goals are all interconnected, and the aim is that these should be achieved by 2030. Although SDG 6 is directly related to water, under IWRM all the SDGs are considered important. This six Basin Plans include actions that not only address specific issues associated with each KSA, but also integrate measures to achieve a number of SDGs. Figure 5-1 shows the Integration of the SDGs into the six Basin Plans.

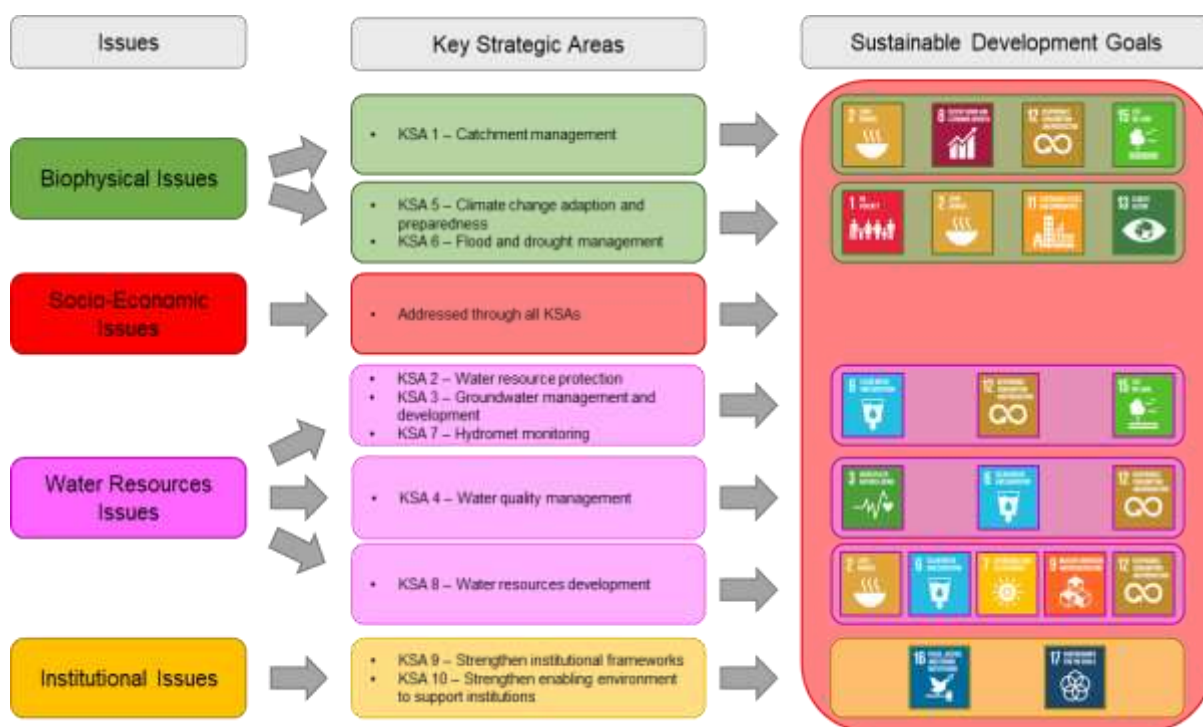


Figure 5-1 Integration of the SDGs into the six Basin Plans

5.2.3 Linkages with other existing plans

The Basin Plans provide a vision and framework for the development and management of the water and related land resources of Kenya’s six river basins. Essentially the plans reinforce the Catchment Management Strategies (2015-2022), supplement the NWMP 2030 and act as a source of information

for the development of Sub-Catchment Management Plans (SCMPs), which Water User Associations (WRUAs) will implement. Whereas the basin plans contextualise the SCMPs, the SCMPs remain the resource mobilisation tools that WRUAs will use to source implementation funds and other resources. County governments are also involved in implementation activities, and as such will be required to review the basin plans and SCMPs to ensure that the County Integrated Development Plans (CIDPs) are linked and synchronised with the overall basin planning initiatives. Relevant Regional Development Authorities as well as Water Works Development Agencies also need to review their proposed and existing projects to align with the investment plan as presented in the basin Plans.

5.3 Key Strategic Areas, Themes and Budgets

Under the Themes and Strategies which were formulated for the ten Key Strategic Areas (KSAs), prioritised implementation / action plans were prepared for each of the six river basins in Kenya.

Awareness of the interconnectivity of the ten KSAs within the context of IWRM is important to guide the systematic and integrated implementation of actions emanating from the various KSAs. The interrelatedness of the KSAs are depicted schematically in Figure 5-2. The interconnectivity ranges from direct impacts or benefits, such as the construction of a dam (KSA 8) which can improve flood control (KSA 6), to multi-dimensional impacts or benefits, such as creating a stone check dam to reduce soil erosion (KSA 1), which also reduces runoff (KSA 6) and improves water quality (KSA 4). These relationships, both direct and indirect, are important to note during implementation. Addressing one issue in a specific area through implementation of an activity may create further issues that were not predicted or could provide additional benefits.

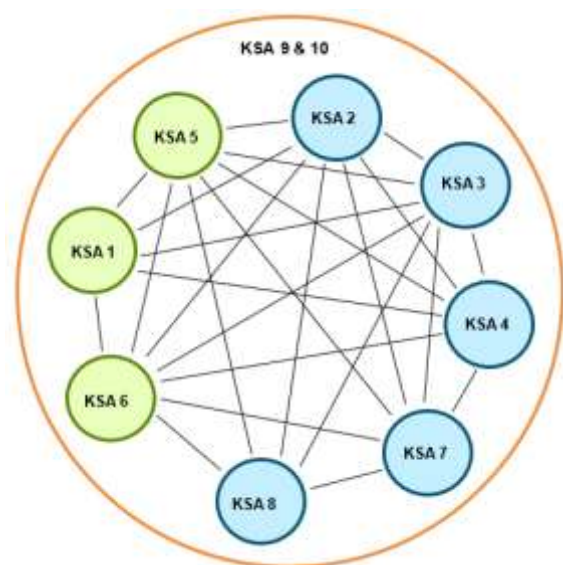


Figure 5-2 Interconnectivity of the KSAs

Table 5-1 presents key themes under each KSA which are relevant to energy and mining, along with estimated implementation budgets, per basin, up to the planning horizon of 2040.

The national estimated budget which is required for implementation of integrated water resources management and development activities up to 2040 in all basins and across all KSAs equals about **29 billion USD**. The energy and mining sectors are linked to about **4 billion USD** of the National Budget as shown in Table 5-1, which summarises the proposed implementation budgets from all six Basin Plans up to a planning horizon of 2040, for activities that are relevant to the energy and mining sectors. The KSAs that demand the largest expenditure from a energy and mining sector perspective are KSA8: Water resources development and KSA4: Water quality management.

It is important to ensure that the implementation of the KSA actions emanating from the Basin Plans are aligned with relevant legislative, policy and institutional principles and guided by internationally accepted standards for good practice to attain the goals of social acceptability, economic viability and technical sustainability.

5.4 Roadmap for the Sector

In order to ensure the successful implementation of the strategies and actions from the six Basin Plans and National Plan as they relate to energy and mining, a Roadmap for Implementation is proposed. This Roadmap proposes that before any actions identified under the KSA implementation plans are implemented, there are preceding critical activities. These are as follows (Figure 5-3):

1. Immediate KSA activities
 - a. Strengthening of institutional capacity and coordination;
 - b. Imminent infrastructure feasibility and impact assessments;
 - c. Expand on the basin plan knowledge base
2. Financial Resource Mobilisation for the KSA activities
3. Implementation of the short to long-term KSA activities
4. Monitoring and Evaluation of the KSA activities

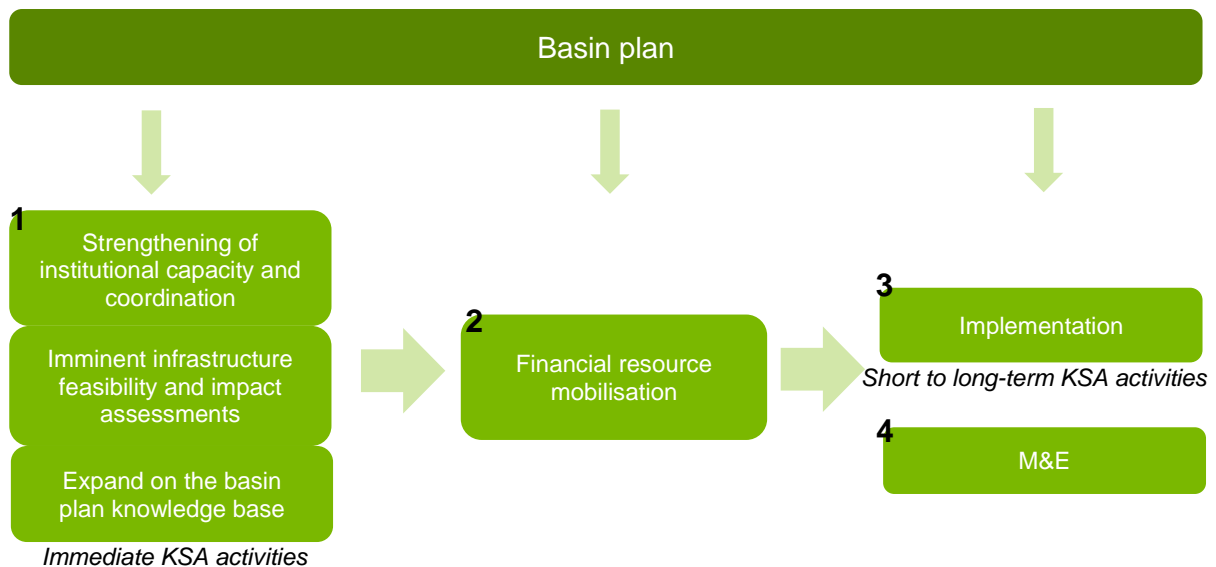


Figure 5-3 Roadmap for implementation of the Basin Plans

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Table 5-1 Summarised IWRM budget for implementation activities linked to energy and mining under specific Key Strategic Areas

Key Strategic Areas and Themes		Budget (USD million)						Total
		Athi	Tana	LVS	LVN	ENN	RV	
KSA 1	Catchment management							
	Promote improved and sustainable catchment management							
	Sustainable water and land use and management practices	112	110	79	87	90	85	563
	Natural resources management for protection & sustainable use Rehabilitation of degraded environments							
KSA 2	Water resources protection							
	Classification of water resources							
	Reserve determination	5	5	5	5	5	5	28
	Determine Resource Quality Objectives Conserve and protect ecological infrastructure							
KSA 3	Groundwater management and development							
	Groundwater resource assessment, allocation and regulation							
	Groundwater development	20	22	138	20	22	19	240
	Groundwater asset management Conservation and protection of groundwater							
KSA 4	Water quality management							
	Effective data collection, information generation, dissemination, knowledge management	240	239	187	212	188	187	1253
	Promote sound water quality management governance Efficient and effective management of point and nonpoint sources of water pollution							
KSA 5	Climate change adaptation and preparedness							
	Understand impacts of climate change on water resources at appropriate spatial scales	39	39	32	35	33	33	210
	Climate change mitigation Climate change adaptation							
KSA 6	Flood and drought management							
	Flood management Drought management	60	54	43	51	54	52	314

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Key Strategic Areas and Themes		Budget (USD million)						Total
		Athi	Tana	LVS	LVN	ENN	RV	
KSA 7	Hydromet monitoring							
	Improved monitoring network	29	29	31	28	28	29	172
	Improved information management							
KSA 8	Water resources development							
	Groundwater development	20	260	626	350	7	2	1265
	Hydropower development							
KSA 10	Strengthen enabling environment to support institutions							
	Develop institutional capacities to support improved IWRM&D	6	25	25	25	25	25	129
Total		529	782	1165	812	450	436	4174

5.4.1 Immediate actions

5.4.1.1 Strengthening of institutional capacity and coordination

Strong institutions are necessary for effective governance. Not only must they be strong, but they must be well linked with partner institutions. On a national scale, there are many role players working in similar areas, and poor coordination can result in the duplication of efforts and failure of implementation. It is therefore not surprising that effective implementation must be rooted in strong institutions and partnerships.

Having strong institutions also provides invaluable benefits for securing external financing. When completing a risk assessment, strong institutions with good coordination mechanisms will have a much lower risk profile than their counterparts, making them an attractive investment opportunity for both development partners and the private sector.

IWRM requires the integration of various activities for the equitable and efficient management and sustainable use of water. There are many role players involved, at different scales (i.e. national to local scale), and before any activity is initiated it is critical to ensure that there are platforms in place for engagement.

The KSAs can also be used as a planning tool for key role players, without these institutions needing to sit in the same room. For example, should KFS want to implement a reforestation program, they can refer to the Basin Plans for information on which institutions and organisations they should collaborate with, and over what timelines implementation should take place.

The key role players in the mining and energy sectors are MoE, MoPM, MoEF, NEMA, KWTA, KFS and the county government (Table 5-2).

Table 5-2 Energy and mining implementation plan key role players

		KSA1	KSA4	KSA5	KSA8	KSA9	KSA10
National	MoEn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoEF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoTW	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoWSI	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	MoALF	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NEMA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	KWTA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KFS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KWS	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	AFFA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WRA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	KMD	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NDMA	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NDOC	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	CETRAD	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KPLCO	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KENGEN	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoLPP	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoTIHUDPW	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NWHSA	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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	KENHA	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KURA	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Basin	BWRC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	CETRAD	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WWDA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local	WRUA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	CG	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Other	CFA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WWDA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WSP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NGO	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5.4.1.2 Immediate implementation activities

The timelines of the KSAs have been developed in such a way as to stagger the activity implementation across four planning horizons: immediate (2020 – 2022), short-term (2022 – 2025), medium-term (2025 – 2030) and long-term (2030 – 2040). The ‘immediate’ time-frame has specifically been developed to provide direction on which activities will be most beneficial to institutional strengthening.

These ‘immediate’ activities will also require funding, and the key role players and other relevant partners should develop strategies for generating financing. However, it is likely that the financing may have to come from the institutions themselves. This can be considered as a long-term investment – by investing now in strengthening institutional capacity, finances will be more easily mobilised for future activities. These immediate activities are also relatively cheap in comparison to larger catchment size activities, or infrastructure activities.

Error! Reference source not found. presents the ‘immediate’ activities under the most important KSAs which are relevant to the energy and mining sectors.

Table 5-3 Immediate implementation activities

Priority activities (immediate) per KSA
KSA 1 Catchment Management
<ul style="list-style-type: none"> - Increase awareness of sustainable catchment management with relevant ministries, WRUAs, CGs etc. through training, brochures, social media, internet, factsheets, forums and workshops. - Devolve ownership of catchment management activities to WRUAs through SCMP development. - Embed catchment-based water conservation and management activities related to crop and livestock production in SCMPs - Embed catchment-based soil conservation and management activities related to crop and livestock production in SCMPs - Embed conservation agriculture and improved farm management activities related to crop and livestock production in SCMPs - Coordinate approach to forestry management – roles, responsibilities and mandates
KSA 4 Water quality management
<ul style="list-style-type: none"> - Advocate for alignment of strategies to serve a common purpose of rehabilitating urban rivers and streams - Establish a coordination and cooperation mechanism to ensure there is alignment of actions to address water pollution management - Embed water quality management activities related to domestic water use, crop and livestock production in SCMPs
KSA 5 Climate change adaptation and preparedness
<ul style="list-style-type: none"> - Quantify climate change impacts (rainfall & temperature) on surface water and groundwater resources and demands at appropriate scales for planning and management - Assess potential social impacts: flooding; droughts; human conflict; migration; vulnerable groups; ocean acidification; agriculture; food production

Priority activities (immediate) per KSA	
<ul style="list-style-type: none"> - Assess potential environmental impacts: droughts; sea temperature; rising sea levels; ocean acidification; desertification; land degradation; loss of biodiversity; deforestation; forest degradation - Assess potential economic impacts: irrigation water requirements; crop type and yield; GDP; public Infrastructure; hydropower; coastal assets; livelihoods and income generation. - Incorporate flexible adaptation infrastructure principles in infrastructure planning and investment plans 	
KSA 8 Water Resources Development	
<ul style="list-style-type: none"> - Investigate possibility of retrofitting existing dams with hydroelectric power generation capabilities - Assess potential for the development of small-scale hydropower plants 	
KSA 9 Strengthen the Institutional Frameworks	
<ul style="list-style-type: none"> - Separate regulatory and management functions of the Authority and provide different reporting lines for these. Parallel improvement and strengthening of the regulatory approaches utilised by the WRA. - Updating WRA's standards, policies and regulations in line with the WA2016 - Develop tools and systems to support implementation of the new legislative instruments - Hold stakeholder consultations for developing legislative instruments and implementation tools - Translate lessons learnt from CAACs into improved operational modalities. - Provision of secretariat services through ROs and SROs. - Appropriate channels formed for recommendations from BWRCs to be taken on board by WRA. - Clarify roles and responsibilities. - Undertake training and capacity building for the new legislative instruments - Introduce more structured strategic planning and operational engagement. - Develop a basin or sub-basin level platform for engagement with county government. - Strengthen linkages between county governments and WRUAs. - Develop a Policy on Transboundary Waters incorporating relevant elements of Treaty obligations - Updating WRA's standards, policies and regulations in line with the WA2016 - Complete the development of a National Policy for the Protection of Groundwater with all key stakeholders involved. - Review cross-sector policies, legislation and regulations relating to wastewater; streamline/clarify the roles of the Line Ministries, WRA, NEMA, the Counties and Water Service Providers (WSPs) in relation to wastewater, to eliminate the dual mandates that the WRA and NEMA currently operate under in relation to 'polluter pays' and these agencies' revenue - Develop / Update Guidelines on: <ul style="list-style-type: none"> - Relevant Codes of Practice for Water Resources Planning and Management - Develop / Update National Manuals relevant to WRPM 	
KSA 10 Strengthen the enabling environment to support institutions	
<ul style="list-style-type: none"> - Development of technical and management capacity through focused training, continuous professional development, bursary schemes, audits, incentive schemes - Develop a partnerships framework - Identify potential partners - Strengthen existing partnerships, particularly on a local level - Undertake stakeholder consultations - Undertake awareness creation and information dissemination activities - Develop and strengthen guidelines for MOU Final Drafting and development - Develop a basin-wide stakeholder engagement framework - Undertake stakeholder analysis - Implement the stakeholder engagement framework - Strengthen stakeholder engagement platforms i.e. forums - Strengthen links with tertiary education / research institutions - Incorporate R&D into WRM planning and decision making - Establish a network of supporting research institutions - Develop strategic partnerships for R&D - Promote innovative financing for basin level institutions (BWRCs, WRUAs, forums) - Develop internal resource mobilization strategies - Develop external resource mobilization strategies - Exploring private sector financing channels - Strategic partnerships for resource mobilization 	

5.4.2 Financial resource mobilisation

Resource mobilisation refers to the various activities involved in making better use of existing resources to maximum benefit, whilst ensuring the ongoing acquisition of additional resources to ensure the achievement of organisational intent. These resources include financial resources, but also include human resources and their organisational management, equipment, services, and technical

cooperation. The range of these resources and their impact is outlined in the resource mobilisation position paper.

Section 5.4.1. outlined the importance of developing strong institutions for financing. Part of this strengthening refers to developing the human and organisational resources. While this is a vital component, financial resources are needed to strengthen these other resources, as well as implement projects.

A review of successive WRA performance reports reflects the challenges that WRA has faced financially, and shows successive funding gaps (WRA, 2017). These have considerable institutional implications for the WRA that require consideration in developing an approach to not only strengthen the WRA, but to also underpin this with a sustained funding regime. Without this strategic intent to coherently develop the business model together with resource mobilization, the overall sustainability of the institution is at risk.

There are numerous forms of external financing, each with their own type of stakeholders and investment mechanisms.

- Innovative financing avenues can include philanthropic and public, water funds and facilitates, payment for ecosystem services, effluent charges, climate change funding schemes, carbon finance, corporate grants, impact investments and conservation finance.
- The key stakeholders and partners for these avenues can include development agencies, governments, multilateral development banks, public private partnerships, private or state banks, private sector, NGOs, asset managers and international councils and secretariats.
- The investment mechanisms can include grants, subsidies, guarantees, soft/hard loans, guaranteed philanthropy, result based payments, equity, loans, environmental impact bonds and microfinance.

It is important to note that different KSA activities will require different levels of partnership and will therefore have to tap into different financing avenue. Using the resource mobilization strategy as a base, it will be necessary for the WRA or the key implementing agency (as outlined in the KSA) to develop a resource mobilization and financier engagement strategy that is applicable to each specific activity.

The energy and mining sectors will need to engage with WRA to ensure that Financial Mobilisation is shared according to aligned objectives.

Error! Reference source not found. summarises IWRM budgets for implementation activities linked to energy and mining under specific Key Strategic Areas for different planning horizons up to 2040.

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Table 5-4 Summarised IWRM budget for implementation activities linked to energy and mining sectors under specific Key Strategic Areas up to 2040

Key Strategic Areas and Themes		Budget (USD Million)				
		2020-2022	2022-2025	2025-2030	2030-2040	Total
KSA 1	Catchment management					
	Promote improved and sustainable catchment management					
	Sustainable water and land use and management practices					
	Natural resources management for protection & sustainable use					
	Rehabilitation of degraded environments	21	214	185	144	563
KSA 2	Water resources protection					
	Classification of water resources					
	Reserve determination					
	Determine Resource Quality Objectives					
	Conserve and protect ecological infrastructure	2	5	11	11	28
KSA 3	Groundwater management and development					
	Groundwater resource assessment, allocation and regulation					
	Groundwater development					
	Groundwater asset management					
	Conservation and protection of groundwater	26	90	60	64	240
KSA 4	Water quality management					
	Effective data collection, information generation, dissemination, knowledge management					
	Promote sound water quality management governance					
	Efficient and effective management of point and nonpoint sources of water pollution					
		6	154	470	623	1,253
KSA 5	Climate change adaptation and preparedness					
	Understand impacts of climate change on water resources at appropriate spatial scales					
	Climate change mitigation					
	Climate change adaptation	21	70	72	46	210
KSA 6	Flood and drought management					
	Flood management					
	Drought management					
		42	212	22	39	314

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KSA 7	Hydromet monitoring Improved monitoring network Improved information management	9	77	53	33	172
KSA 8	Water resources development Groundwater development Hydropower development	4	58	739	464	1,265
KSA 10	Strengthen enabling environment to support institutions Develop institutional capacities to support improved IWRM&D	28	48	22	30	129
Total		159	928	1,634	1,454	4,174

5.4.3 Stakeholder engagement

During the National workshop on the 13th and 14th October 2020 stakeholders were given the opportunity to discuss the roadmap for sector integration. They provided inputs for step 1-4 for the energy and mining sector. The main outcomes are presented in **Annexure A**. The main outcomes from the session are that it is not clear how communities and the local/national government can work together for successful implementation, M&E by both the implementing agency and external party is key and the implementing agency needs to be involved for the purpose of ownership, auditing should be done by an external party to raise accountability. Licencing should be centralised instead of moving from institution to institution. This would make feasibility studies and implementation easier.

5.4.4 Monitoring and evaluation

Monitoring and evaluation (M&E) is essential to ensure that plan implementation is on track, to measure short and long-term impacts and to evaluate the impacts in order to modify the plan or its implementation (if necessary) (Global Water Partnership, 2006). M&E systems can be costly and often require significant human, data and financial resources. However, the cost of no M&E may be considerably higher when Basin Plan implementation is inefficient and ineffective. It is therefore necessary to develop an efficient, effective and sustainable M&E system, which can be implemented within existing or planned for resources and line functions. Interpreting and acting on the data is as important as data collection.

It is extremely important that the KSAs are monitored and evaluated on a regular basis. How often, and when, monitoring is carried out will be dictated by what is being measured (i.e. environmental improvements will have different timescales to budget expenditure). M&E will also provide an indication of where delays or diversions are being experienced. Monitoring also provides an evidence base to show funders that their money is being used effectively, to identify where more funding is required to tackle new issues or try new actions where stubborn problems remain. Formal monitoring results are often shared with wider stakeholders and funders, whilst informal monitoring will be restricted to those managing the process.

Lastly, and most importantly, the KSAs and Plans are “living documents” and should not stay static, as circumstances are not static. M&E allows for timely adjustments and/or updates.

6 Conclusion

Integrated Water Resources Management is based on the equitable and efficient management and sustainable use of water. It recognises that water is an integral part of the ecosystem, a natural resource, and a social and economic good, whose quantity and quality determine the nature of its utilisation (Global Water Partnership, 2006). This emphasises the importance of an integrated approach towards water resources planning, development and management – focusing on an enabling environment, institutional framework and setting up the management instruments required by institutions to understand mandates, roles and responsibilities to effectively and seamlessly do their job.

The basin planning process provides a status quo of the current water resources management situation and a plan for future management. There is no correct administrative model to ensure successful implementation. However, the principles of IWRM allow for selecting, adjusting and applying a mix of tools for a given situation and agreeing on milestones and timeframes is critical for success.

The Sectoral Integration Plans can be used to implement activities outlined in the Key Strategic Areas of the Basin Plans, particularly where the responsibilities are for sector-specific role players or institutions. Some activities should be implemented sector-wide rather than basin-wide as implementing

via a sectoral-wide approach will enable implementation across the country and will not be limited to the hydrological boundaries. It is recommended for WRA to plan for the activities of which responsibility will be given to another institution, as well as how WRA will manage that partnership, such as receiving monthly reports or conducting regular meetings. At the same time, WRA will need to decide whether full responsibility is given to another institution or how and where WRA should maintain involvement. The detailed implementation tables in the Basin Plans provide key role players for each activity, which should guide these decisions.

This Sectoral Integration Plan for the energy and mining sectors is a key deliverable towards the overall objective of the KWSCRIP namely to strengthen the Water Resources Authority as it relates to water resource management and planning through the development of tools, skills and infrastructure to deliver on its mandate. The outcome will be a stronger WRA institution that has strengthened capacity to carry out its core functions with regard to integrated basin management and planning in a manner that is based on extensive knowledge-driven analysis and that meets the expectations of key stakeholders.

7 References

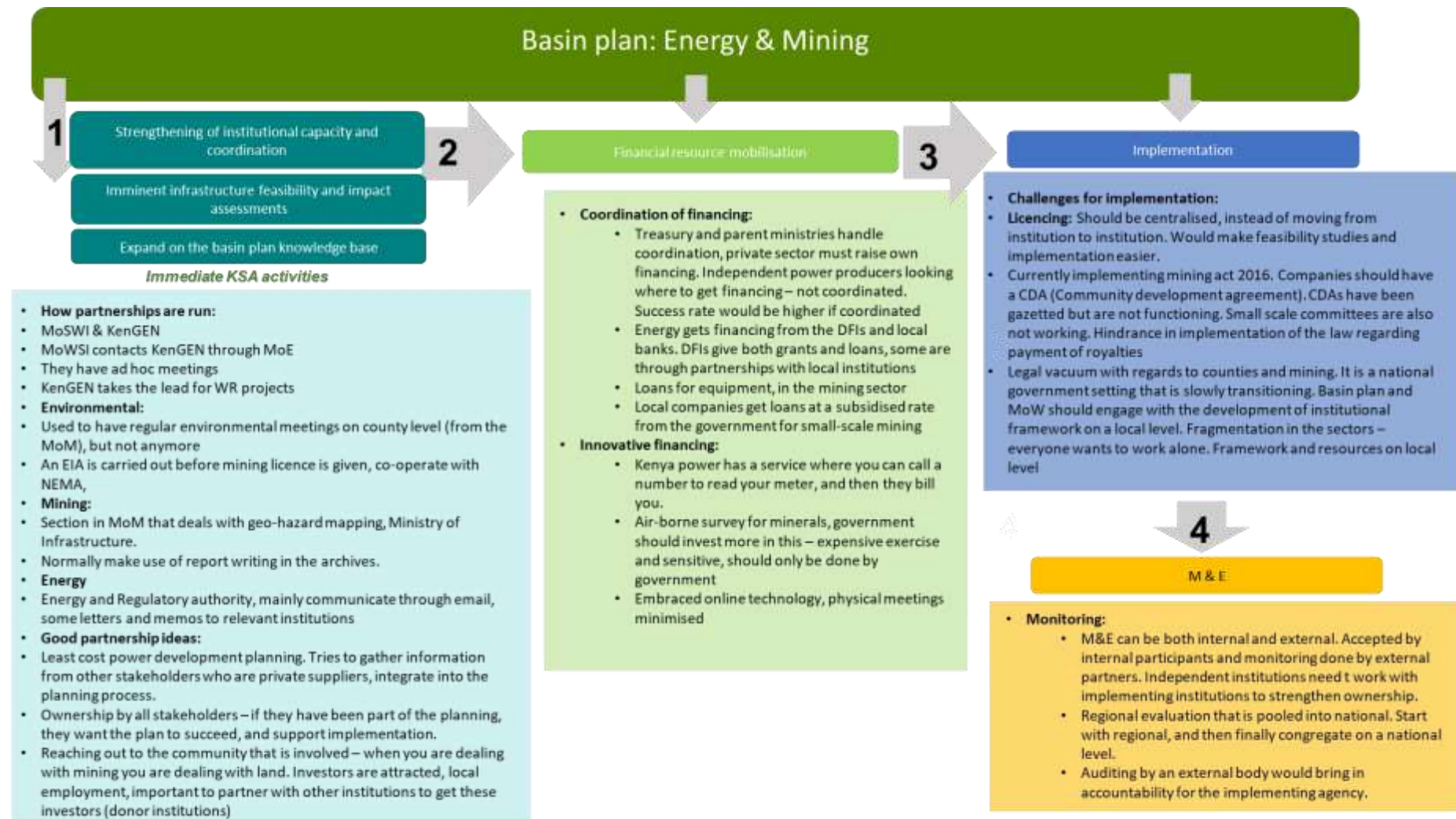
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Annexure A: Stakeholder engagement



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