



2018 Seminar On Water Resource's Management & Small Hydropower
Development for countries along the Belt and Road

Kenya Country Report

Small Hydropower Development

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Presented By
Eng. Rose Ngure,
Deputy Director,
Ministry of Water and Sanitation



Kenyan Participants

1. Eng. Rose Ngure-Ministry of Water and Sanitation
2. Omar Mohammed- Ministry of Water and Sanitation.
3. Phillip Mugwima-Nyeri County
4. James Githige-Mathira Water Co.
5. Calvin Ngunjiri-PTSL
6. Purity Ngunjiri-PTSL
7. John J. Ngunjiri-PTSL



PRESENTATION OUTLINE



1. Country Overview.
2. Condition of Water Resources.
3. General condition of energy and power of the country.
4. Condition of hydropower development.
5. Hydropower projects to be constructed and rehabilitated with installed capacity of under 50MW.
6. Difficulties and barriers in water resources management and small hydropower development.
7. Conclusion and way forward.

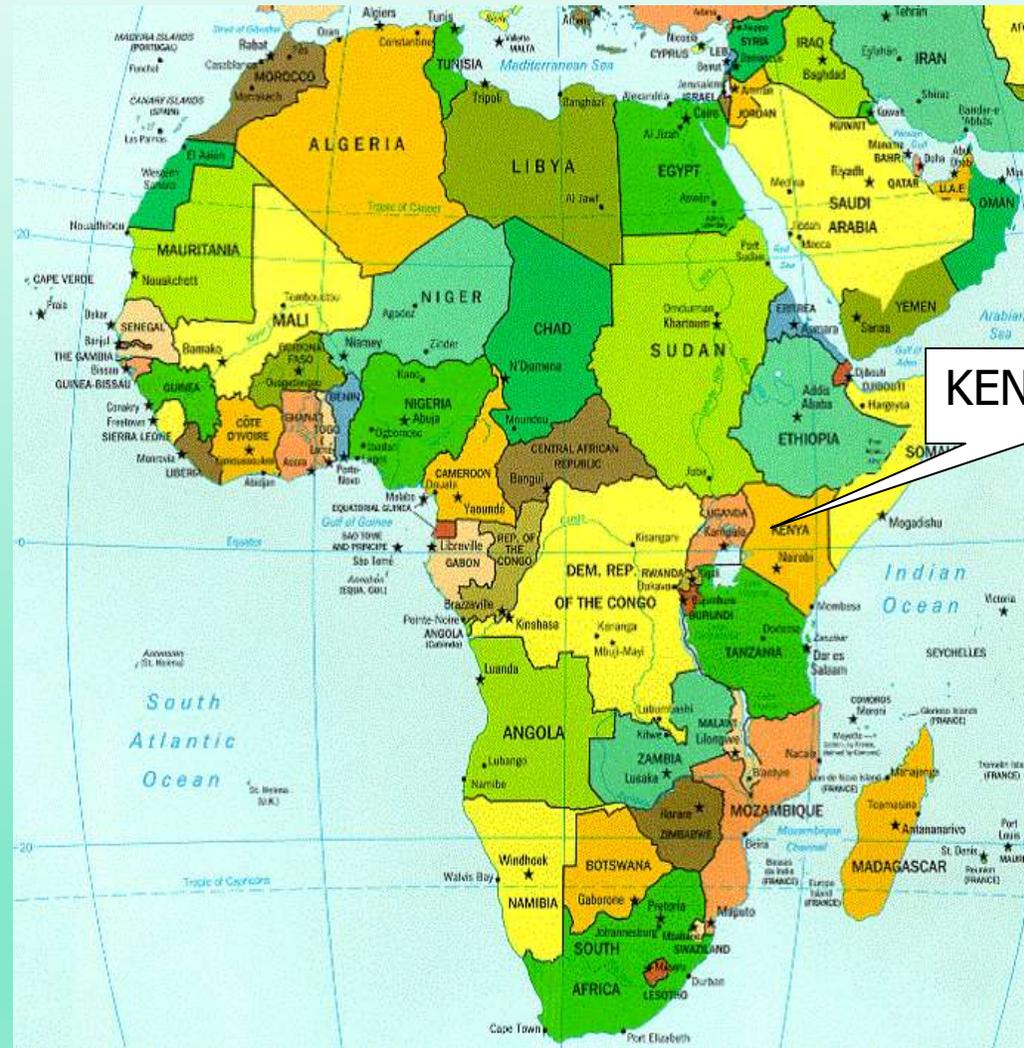
Country Overview

Country Overview



Statistics:

- ❑ Area: 582, 646 sq.km
- ❑ Water 11,230 sq.km
- ❑ Population: 48m
- ❑ Female: 50.29% Male: 49.71%
- ❑ GDP \$ 77.5 Billion, growth 5%
- ❑ Literacy 78%
- ❑ Pop growth 2.5%
- ❑ Rainfall 200mm-2000mm
- ❑ Water Resources: Rivers, lakes, snow, groundwater: total 8.4 BCM
- ❑ Per capita water: <647 litres
- ❑ Economy: Agriculture, Tourism, others



....Country Overview

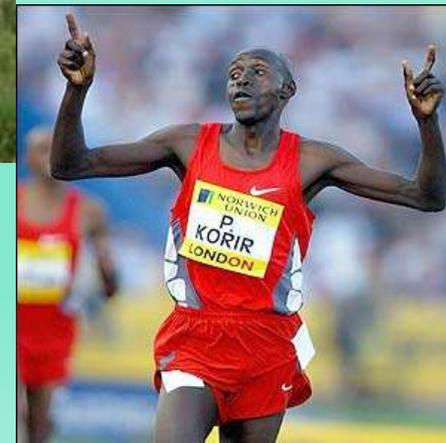


DIVERSE PEOPLE AND CULTURES



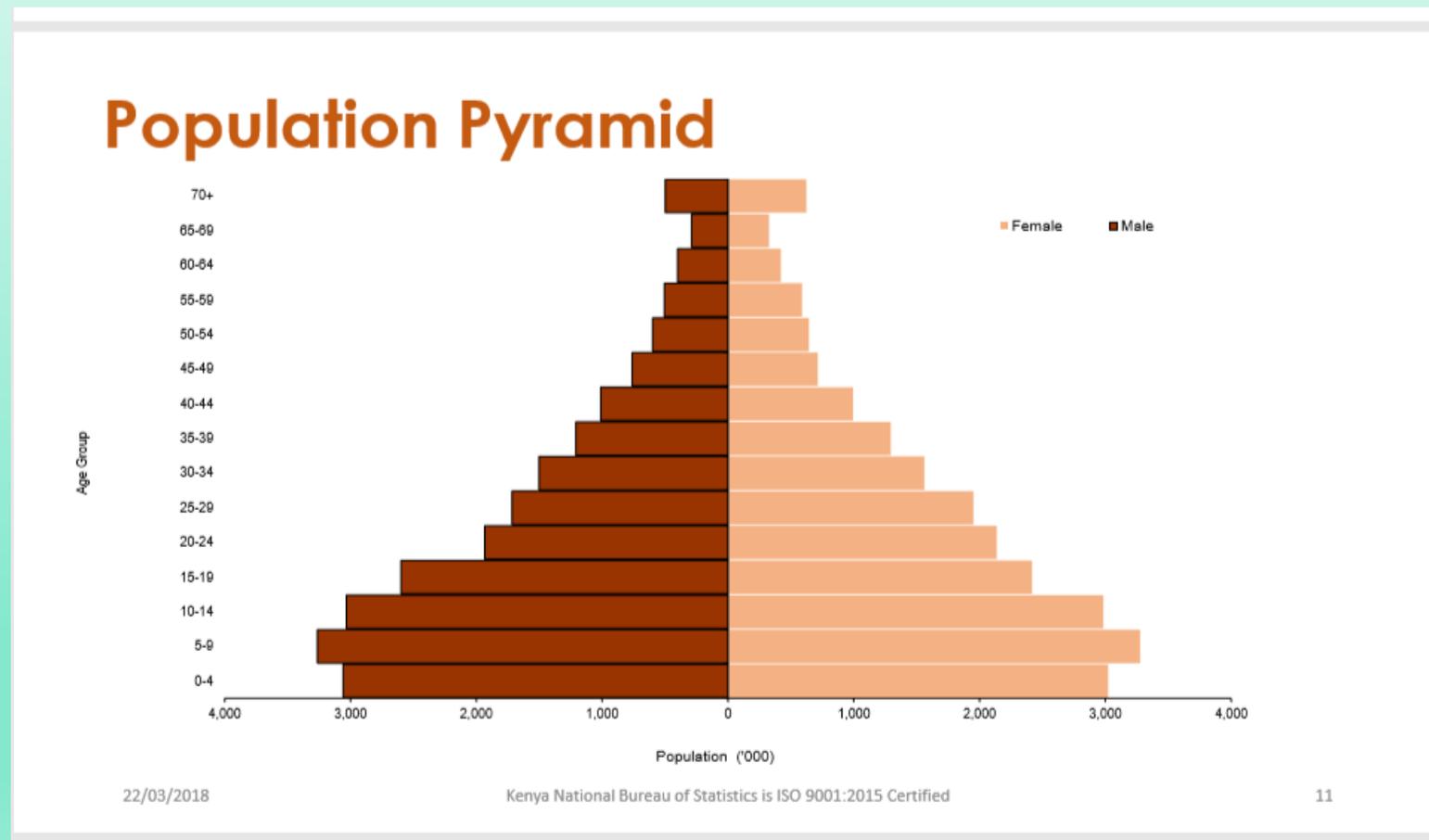
RICH WILDLIFE AND TOURISM

RECORD BREAKING ATHLETES

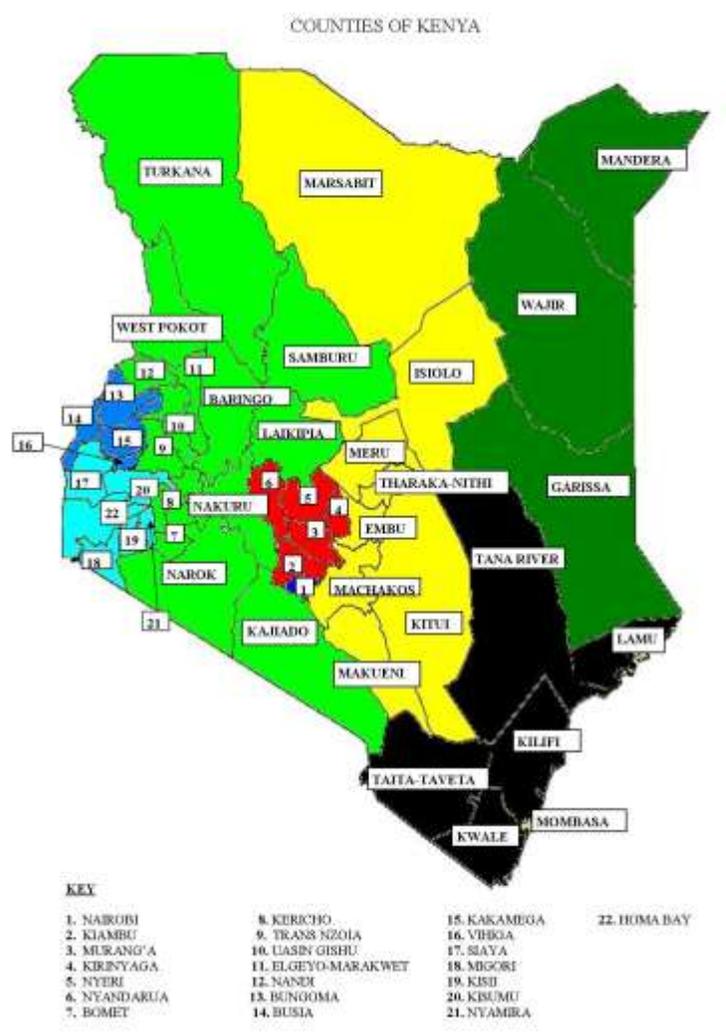
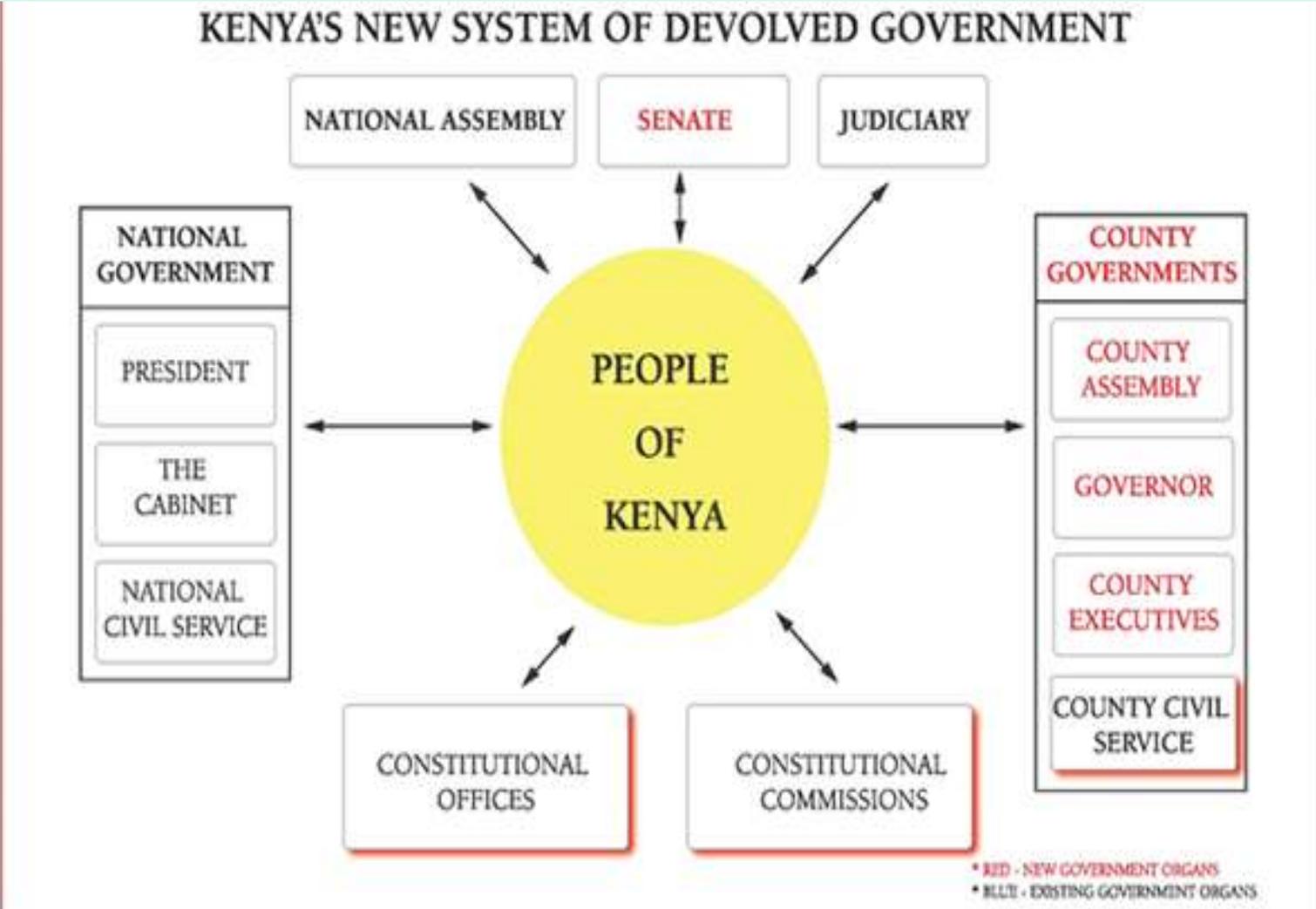




....Country Overview



Devolved Government



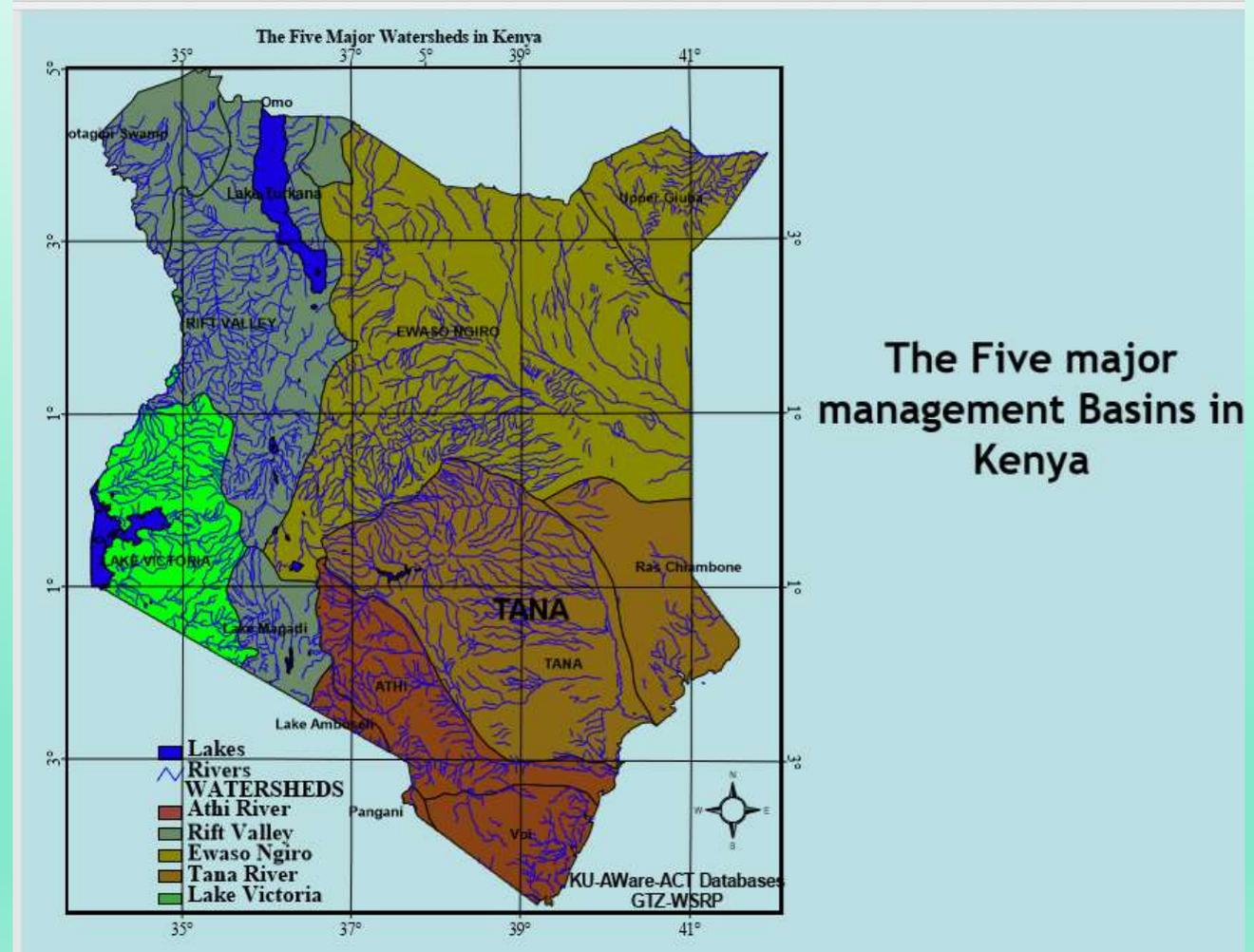
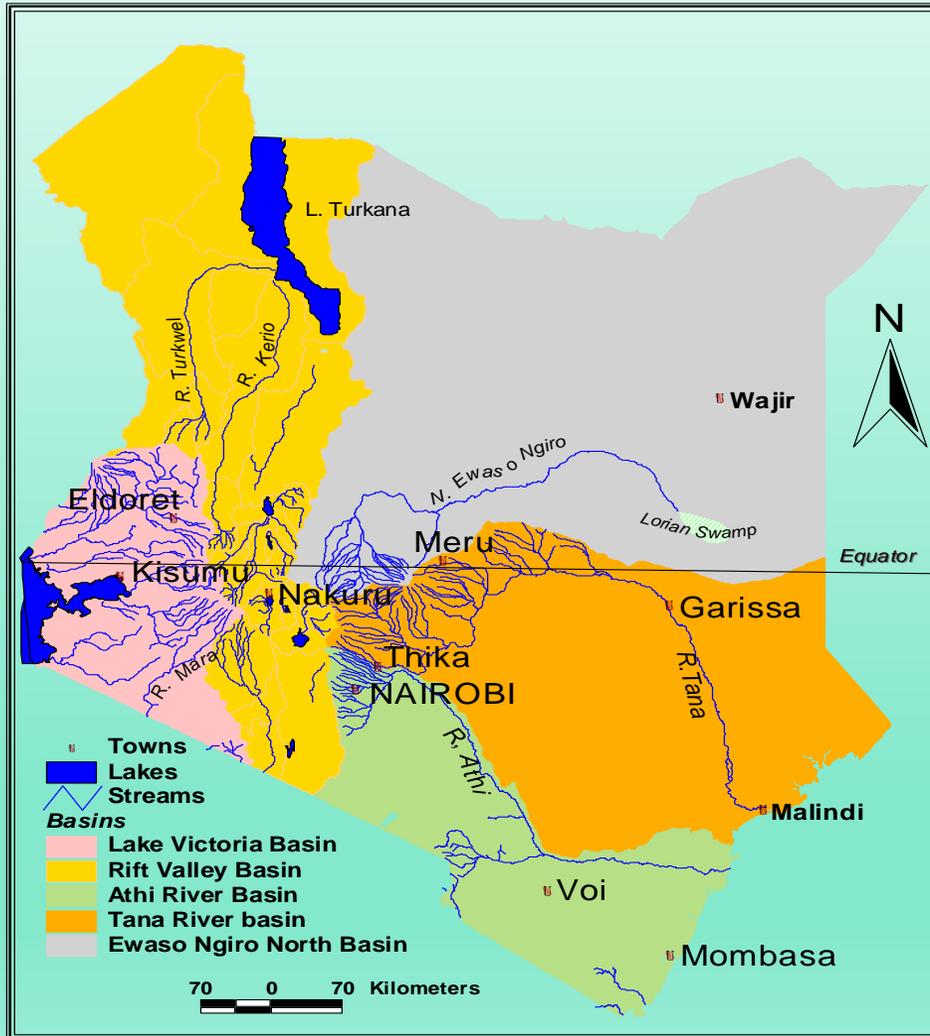
WATER RESOURCES



Climate

- Kenya's drainage system consists of five major basins: Lake Victoria ; Rift Valley; Athi River; Tana River; and Ewaso Ng'iro River basins.
- Bimodal rainfall ranging from 200mm-2000mm.
- Long rains March-May, short rains October-December.
- 60% arid and semi-arid.

The main drainage basins in Kenya

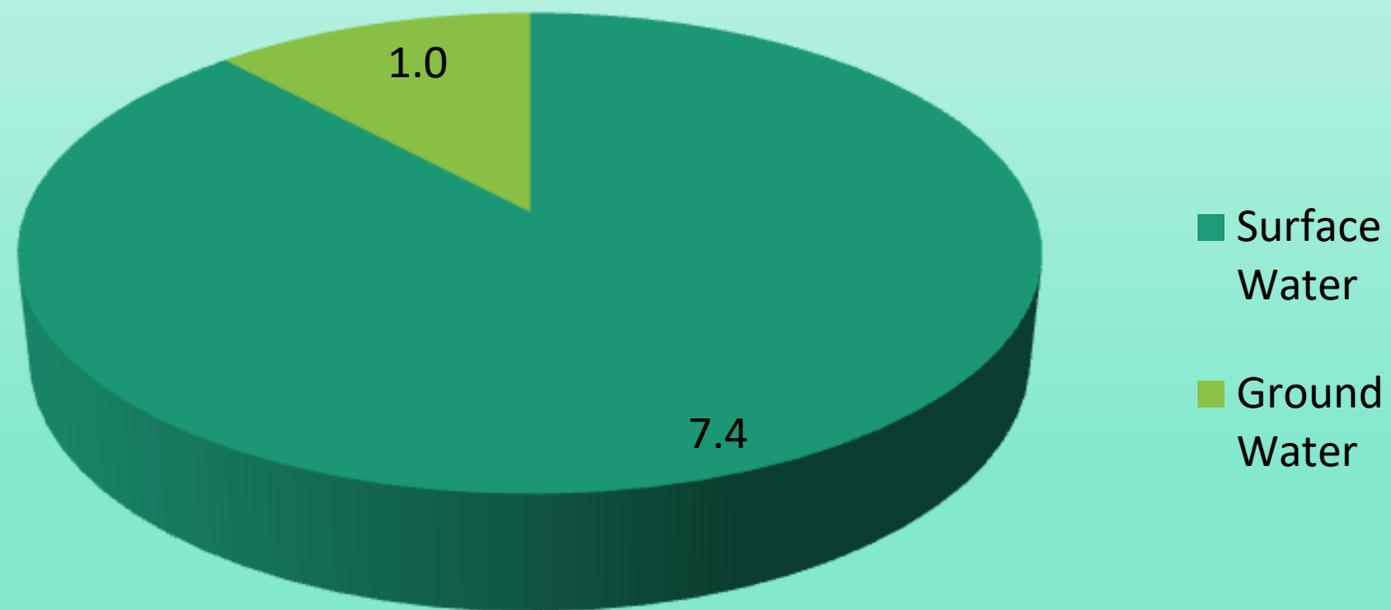


The Five major management Basins in Kenya



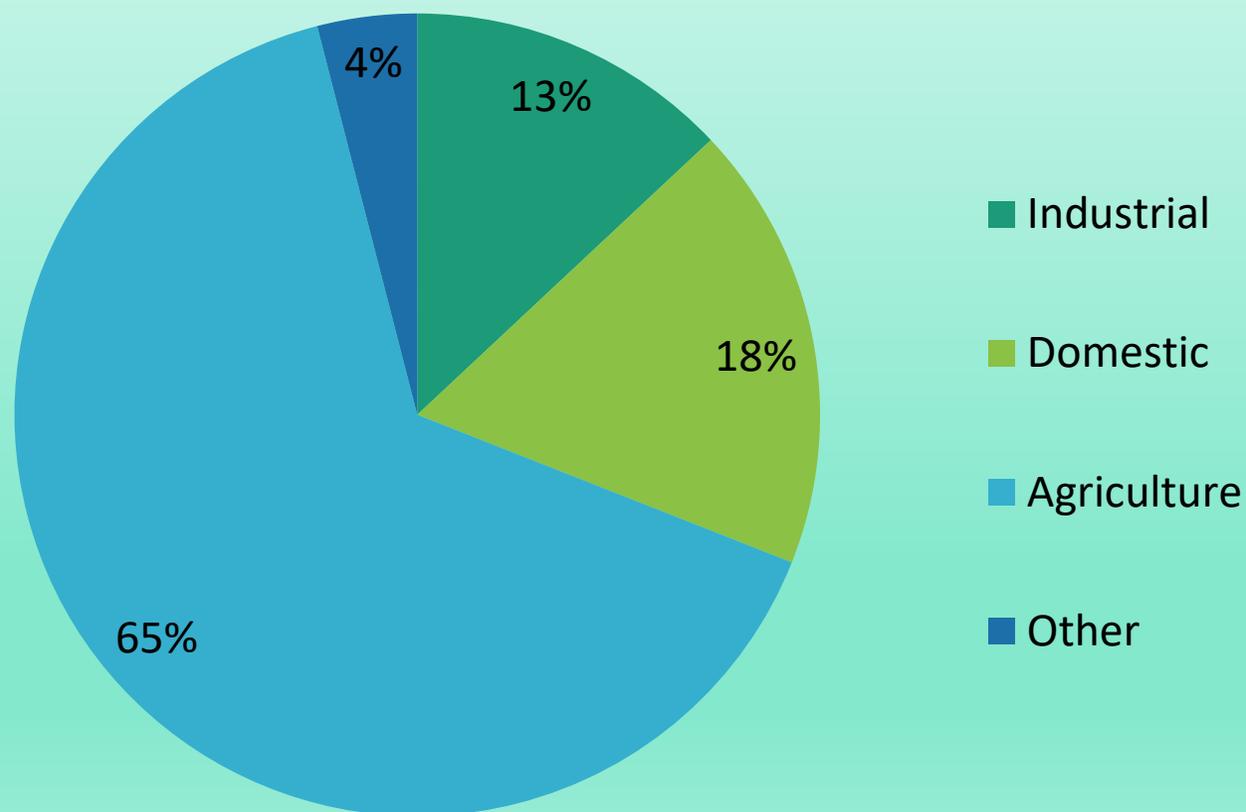
National Safe Yield(BCM)

BCM/year





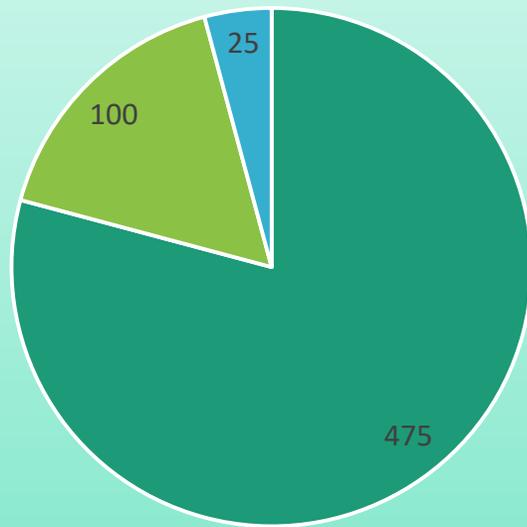
National Water Demand



Hydrological stations

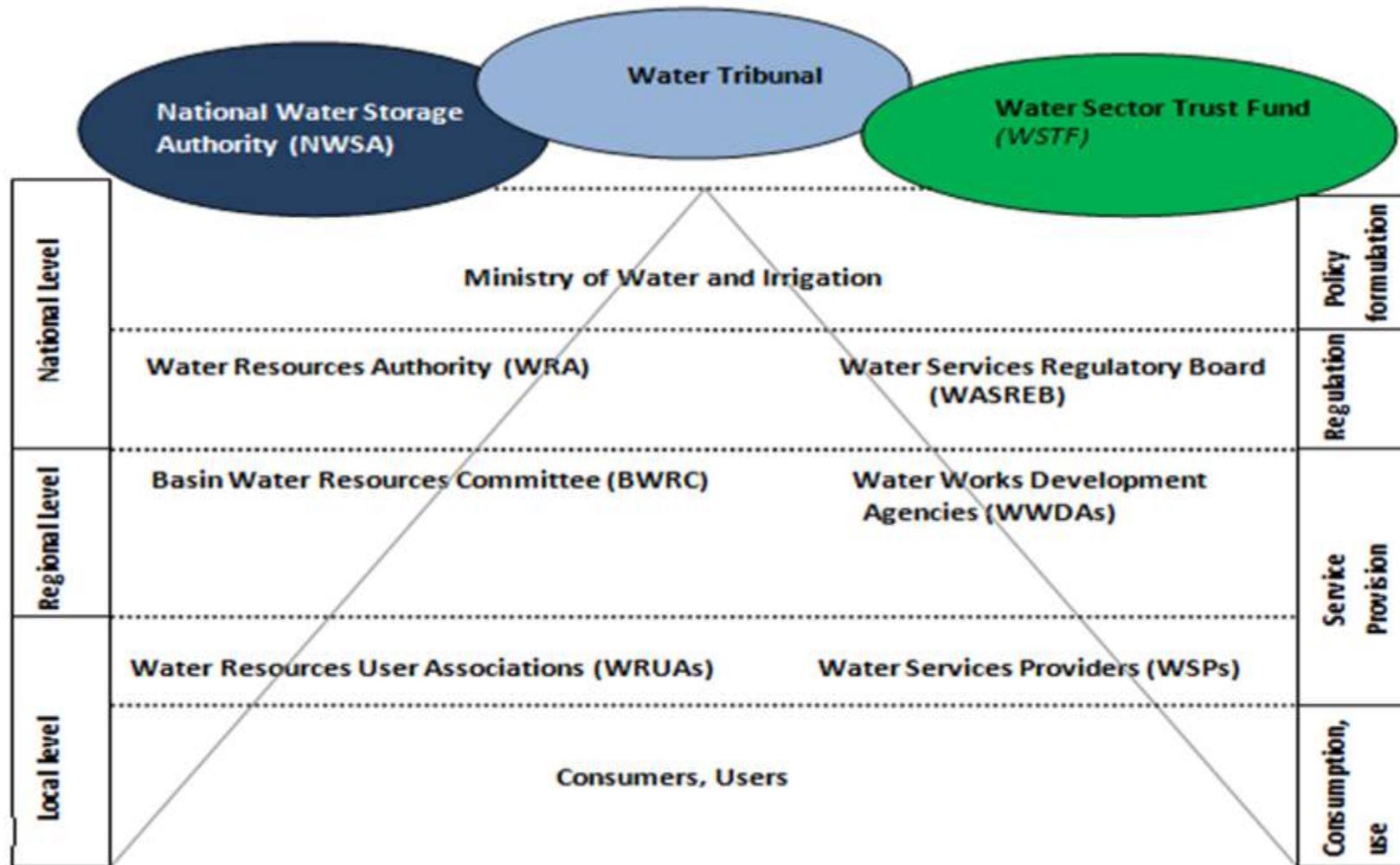


No and Type of Hydrological stations



Manual Automatic telemetric





HYDROPOWER

History of Hydropower Development in Kenya



- Hydropower was one of the earliest recognized national resources dating back to early 1920s.
- The early systems were all small hydropower schemes comprising of micro hydros and mini hydros.
- Most of these power systems were used for maize milling, water pumping and in a few cases saw milling
- The Tana River's seven forks falls was identified in 1914 as an area of promising potential for power development (11 station).
- The first five were developed between 1968 and 1988 while the remaining six are awaiting implementation.



Institutions in the Hydropower Management

- **Ministry of Energy and Petroleum-** -Energy and petroleum policy
- **Energy Regulatory Commission(ERC)-** economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors, tariff setting, review, licensing, enforcement, dispute settlement and approval of power purchase and network service contracts.
- **Energy Tribunal** -This quasi-judicial body was established under section 108 of the Energy Act, 2006. It hears appeals against the decisions of ERC.
- **Kenya Power and Lighting Company Limited (KPLC)** -KPLC is a State Corporation. It purchases electrical energy in bulk from KenGen and other power producers and carries out transmission, distribution, supply and retail of electric power.
- **Kenya Electricity Generating Company Limited (KenGen)** -KenGen is a State Corporation mandated to generate electric power, currently producing the bulk of electricity consumed in the country.
- **Rural Electrification Authority (REA)** was established under section 66 of the Energy Act of 2006 as a body corporate with the principal mandate of extending electricity supply to rural areas, managing the rural electrification fund, mobilizing resources for rural electrification and promoting the development and use of renewable energy.
- **Kenya Electricity Transmission Company Limited (KETRACO)** A Government of Kenya wholly owned company established to be responsible for the development, maintenance and operation of the national transmission grid network.
- **Independent Power Producers (IPPs)** are private companies which generate power and sell electricity in bulk to KPLC.



National Hydropower Classification

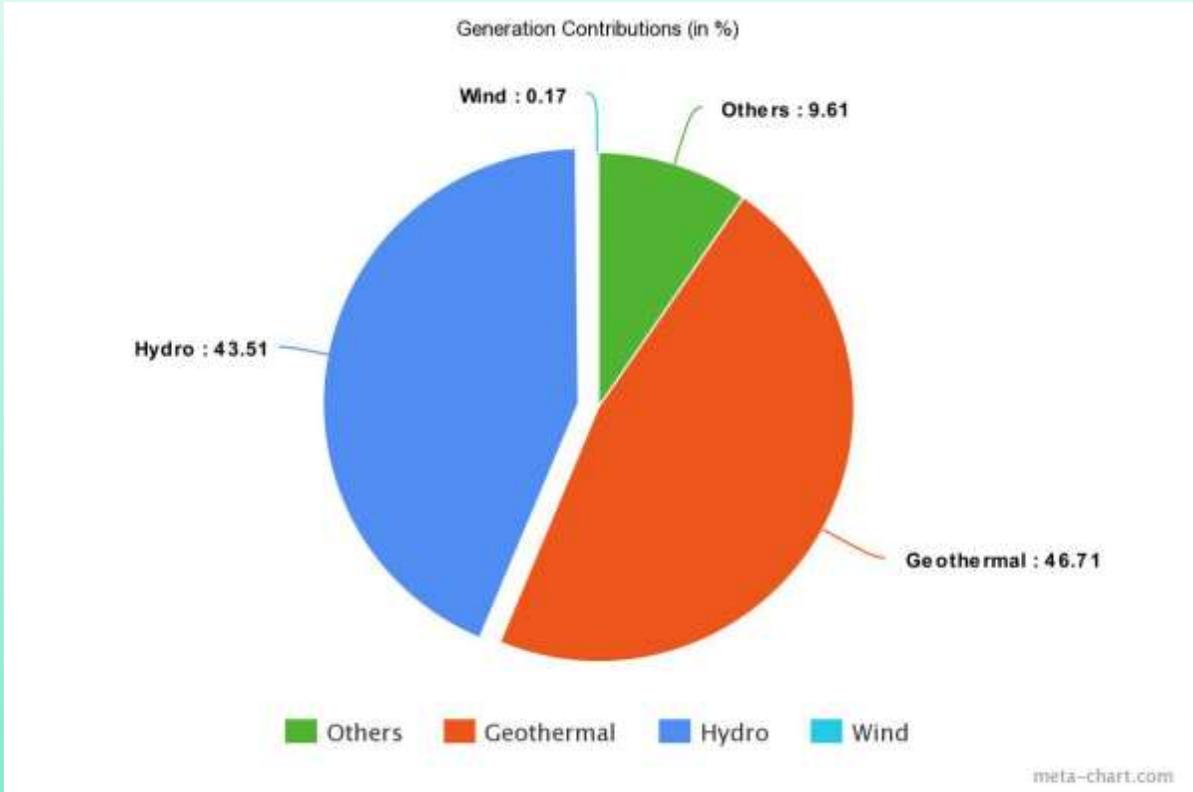
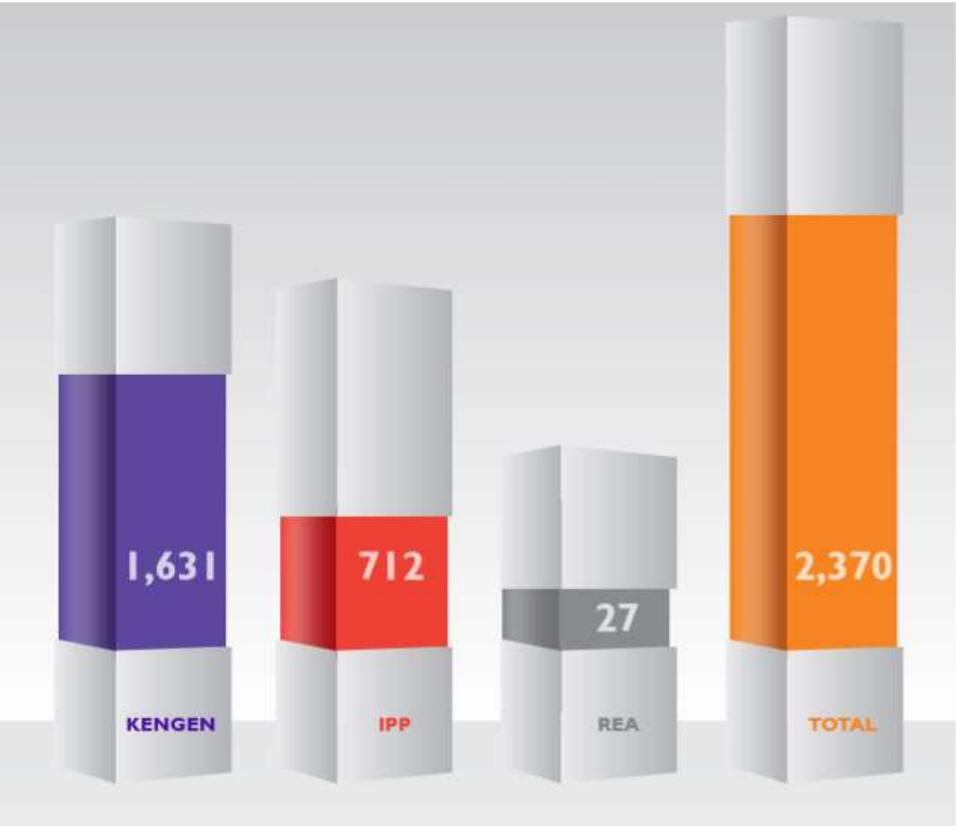
Category

Power Range

- Pico Hydros < 5kW
- Micro Hydro +5kW – 100 kW
- Mini Hydros +100 kW – 1000 kW
- Small Hydros +1000 kW – 3000 kW
- Medium Hydros + 3000 kW– 30000 kW
- Large Size Hydros +30,000 kW



Installed capacity







General Conditions of Hydropower

- Total hydropower potential is about **7,812.70 MW**.
- Installed hydropower capacity is **819.9MW** out of the total **2370MW**.
- Potential for small, mini and micro-hydro system is estimated at **3,000MW**

HYDROPOWER STATIONS

1. GITARU POWER STATION – 225MW

- Biggest station in terms of installed and effective capacity.
- The highest recorded combined output was 222MW
- Three installed units, producing a total capacity of 225 MW which is the biggest hydro in E. Africa.



2. KIAMBERE POWER STATION - 168MW



- Commissioned in 1988
- Two Vertical Kaplan Turbines upgraded from 72 to 84 MW each
- Water released from the power station is returned to the Tana via a 1.4 km long tailrace tunnel
- Work on third unit is ongoing.



3. KINDARUMA POWER STATION - 72MW

- Commissioned in 1968
- 1st major power station in independent Kenya.
- Designed with a provision of three turbine generator units with 72MW
- The spillway has three vertical gates and the dam is equipped with an emergency spillway in case of excessively high floods.



4. KAMBURU POWER STATION - 90MW



- Commissioned in 1974
- 2nd major power station in independent Kenya
- Has three installed vertical Francis turbines (each 31MW)
- The spillway has three radial gates and one flap gate.
- Its reservoir capacity (F.S.L) is 123 million cubic metres.



5. MASINGA POWER STATION - 40MW

- The power station was conceived after the commissioning of Kindaruma power station in 1968.
- Masinda dam is the main reservoir in the seven folks cascade with a capacity of 1.56 cubic metres, covering 120sq. km
- Two vertical Kaplan turbines drive two generators capable of generating 40 MW of power.
- The reservoir occupies a surface area of 120 sq. km.

6.GOGO POWER STATION, 2MW



- Commissioned in 1957
- Two Kaplan Turbine type units.
- Rating is 1000kw per Unit
- Maximum potential 60MW peak operation.



Masinga dam, located on the border of Machakos and Embu, is the prime water reservoir for Kenya's main hydropower.



7. MESCO POWER STATION, 0.43MW

- This is the smallest power station in the system
- It has one (1) horizontal Francis turbine, driving one (1) generator.
- The machines were commissioned in 1930's, with an installed capacity of 0.38mw.
- The station draws water, for generation from Maragua River.

8. SAGANA FALLS POWER STATION, 1.5MW

- The station is located along river Sagana
- It has three (2) horizontal Francis turbines driving three (3) generators.
- The machines were commissioned in 1956, with an installed capacity of 1.5 mw.

9. NDULA POWER STATION, 2MW

- Commissioned in 1924
- Draws water from Thika river.
- Two horizontal Francis Turbines, with twin runners both driving two generators.

10. SONDU/MIRIU HYDROPOWER STATION - 60MW



- Unlike other stations, it does not have a major dam and associated large reservoir
- Relies on the flow in the river with only a small storage capacity at the intake. (run-of-river- hydroelectric system)
- Water is diverted from the Sondu River at the Intake through a 6.2 km long tunnel. A surface mounted penstock takes the water down the Nyakach escarpment to the Power Station below.
- In the Powerhouse, harnessing the water and the head, the turbines are turned to generate the electricity.
- The water is then returned to the Sondu river approximately 13km downstream of the intake via a 4.7km long outlet channel.

11. TANA POWER STATION - 20MW

- Upgraded from 14.4MW installed in early 1930's and 1950's to the current 20 MW to meet the rising power demand

12. TURKWEL POWER STATION - 106MW



- One of the major hydro-electric power stations in Kenya.
- Situated in north-western Kenya
- The station was conceived as a multi purpose project comprising hydro-power, agricultural, fisheries and tourism development.
- Turkwel Power Station has the capacity of 106MW.





13. WANJII POWER STATION, 7.4MW

- Has four (4) horizontal Francis turbines driving four (4) generators.
- The machines were commissioned between 1952 and 1954, with an installed capacity of 7.4 MW.
- The station draws water, for generation, from Mathioya and Maragua rivers

15. SANGORO HYDROPOWER STATION 20MW.

14. SOSIANI POWER STATION, 0.4MW

- Sosiani Power station is located on River Sosiani.
- The station was commissioned in 1955 and named after its White Settler owner 'Selby' Gilbert.
- Has two Horizontal Pelton Wheel type Units with a total installed capacity of 400KW.
- A small dam constructed on river Sosiani allows diversion of water to the plant via a headrace Channel, Head pond and Surface Steel Penstock.

Hydropower Project Planned (<50MW) Project

Potential Hydropower Projects



- Feasibility studies confirmed the viability of the seven folks cascade hydropower with a potential of eleven(11) power plants.
Masinga, kamburu, Gitaru, Kindaruma, Kiambere, Karura, Mutonga, Low grandfalls, Usheni, Adamson Falls and Kora.
- Potential for small, mini and micro-hydro system is estimated at 3,000MW
- Planned projects for less than 50MW include:

Name	MW	Name	MW
Nzoia Multi-purpose Dam-Nzoia river	16	Oletukat Multipurpose	36
Embobut Multipurpose	45	Munyu Multipurpose	40

**THANK YOU
FOR
LISTENING**

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