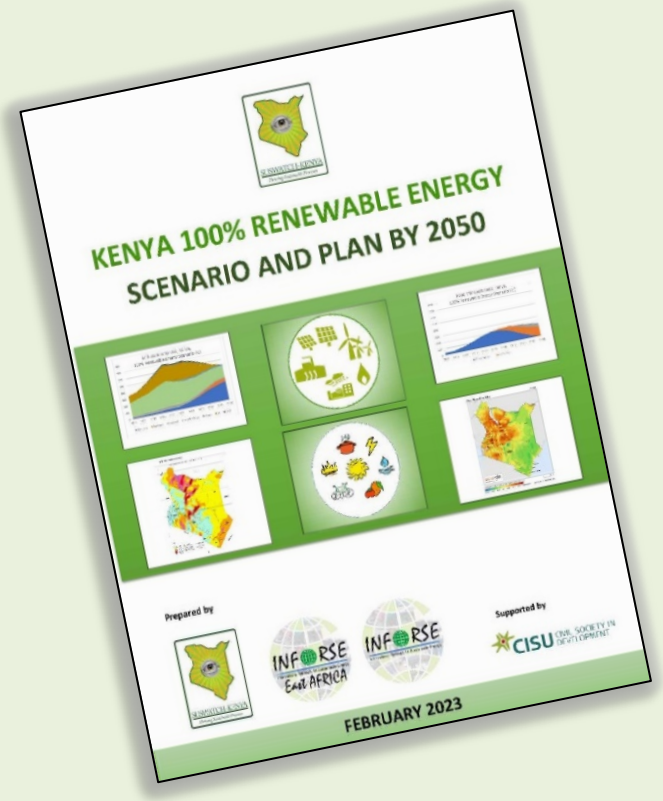
POLICY BRIEF: TOWARDS THE REALIZATION OF KENYA'S 100% RENEWABLE ENERGY BY 2050.

MARCH 2023



1.0 Introduction

This Policy Brief is based on the **second** edition of the **Kenya 100% Renewable Energy Scenario and Plan by 2050** published in February 2023. The Scenario and Plan was published by Sustainable Environmental Development Watch (SusWatch) Kenya and the International Network for Sustainable Energy (INFORSE) in the framework of a CSO cooperation project - *East African Civil Society for Sustainable Energy & Climate Action* Project (EASE & CA) in 2019-2023.

The Scenario and Plan give an **overview of the Kenyan situation** regarding energy supply and demand, and present a **scenario for how Kenya can move into a 100% renewable-energy economy until 2050.**

The Scenario and Plan focus on **how to supply the energy for Kenya's development** with renewable energy and h**ow to increase energy use with modern, energy efficient technologies.** In addition to the scenario for transition to 100% renewable energy, the Scenario and Plan also include a business-as-usual (BAU) scenario for how Kenya might develop without focus on renewable energy. A **comparison of the cost of energy supply of the two scenarios** shows an economic benefit of the renewable-energy scenario.

Lastly, the Scenario and Plan explain **specific proposals** that lead to 100% renewable-energy development. The results include strongly increased electricity production from renewables, the change of the total primary energy demand to 100% renewables, reduction of biomass use to be within sustainable levels of biomass production in Kenya, reduced emissions of CO_2, and estimates of costs of energy supply in the scenarios in 2030 and 2050.

2.0 Energy Status in Kenya

Kenya's energy mix is largely dominated by biomass (68 percent of the national energy consumption), electricity (9%) and imported petroleum (22%), others (1%) with biomass (wood fuel, charcoal, and agricultural waste) providing the basic cooking and heating energy needs of the rural communities, urban poor and the informal sector (Kenya 100% Renewable Energy Scenario and Plan by 2050).

Indigenous energy production in Kenya is biomass (wood and agricultural waste), and electricity produced from hydropower, geothermal and other renewables (wind, biomass and solar). This is complemented by imported electricity, coal, crude oil and oil products. Kenya is currently leading the way in Africa in terms of renewable energy development as it continues to invest in diverse energy technologies such as wind, geothermal and small-scale hydroelectric among others.

Currently, renewable energy sources account for 70% of Kenya's installed power capacity including large hydropower. the primary renewable energy sources in Kenya include hydropower, geothermal, bioenergy, wind and solar energy.

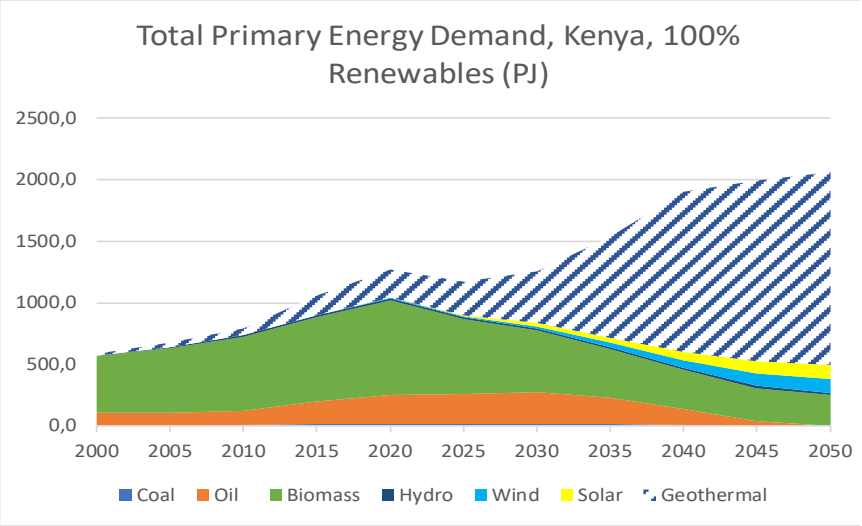
To meet the growing energy needs of its citizens, the Kenyan government actively pursues new technologies to expand and upgrade the networks as well as promote the transition to a renewable based energy system. Kenya has aggressively tried to increase access to the power grid, having more than doubled electricity access from 32% in 2013 to 75% of households in 2022. This has been achieved through a range of interventions by the government in collaboration with development partners. Kenya has an ambitious target of achieving 100% access to modern cooking services by 2030, including efficient cook stoves for wood and charcoal, household biogas, LPG stoves, and others.

3.0 Renewable Energy Existing Capacity, Potential, Energy Use Projections in Kenya

Energy Type	Existing capacity (2019)	Capacity 2030	Capacity 2050
Solar	400 MW PV incl. small +2500 m^2 solar heaters	3,330 MW PV incl. small, 2 mill. m^2 solar heaters	17,330 MW PV incl. small, 2 mill. m^2 solar heaters
Biogas /biomass	30,000 bio digesters for cooking 4.7 mill improved stoves	250,000 bio digesters for cooking, 12.6 mill. improved cookstoves	500,000 bio digesters for cooking, 15.6 mill. improved cookstoves*
Geothermal Energy	801 MW	2,931 MW	5,566 MW
Hydro power	+823 MW	1,123 MW	1,123 MW
Wind power	+350 MW	1,500 MW	9,000 MW

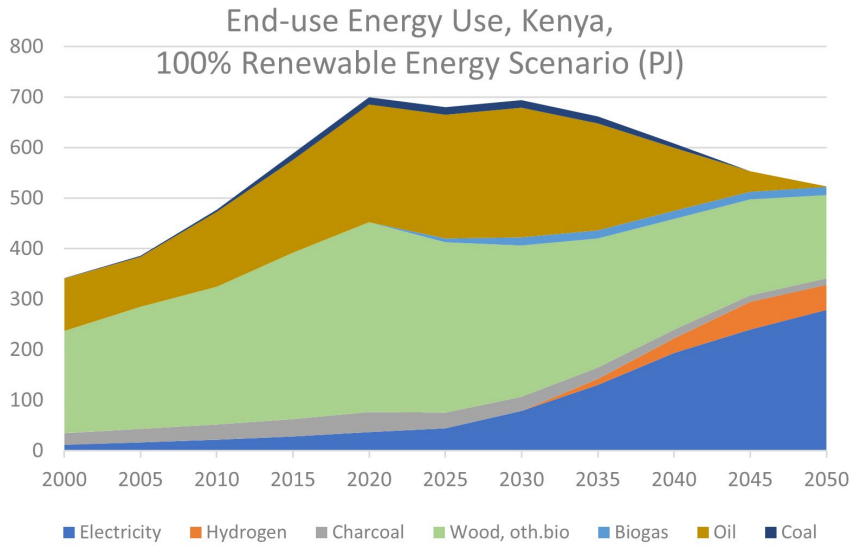
In the 100 % renewable-energy scenario, it is expected a development with an increase in wind power, solar power, and geothermal power as well as a reduction in biomass use to reach sustainable levels, and a stable hydro-power production, but with reduced contribution to total supply. Power production is increased to meet power demands while biomass production is reduced with reducing demands because of high efficiency. Energy modelling (INFORSE's spread sheet model with energy balances for each 5 years until 2050 and with the Energy Plan model for the years 2030 and 2050) was used to construct the scenarios to meet the final energy demands, and the developments of renewable energy needed to meet the demands.

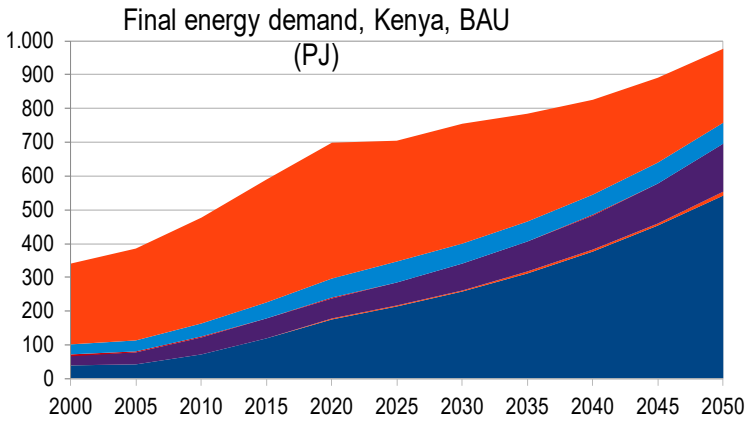
The total primary energy demand is increasing because of the increased use of geothermal power, where the efficiency from the energy in the underground steam to the electricity output is only 10%. Of the total primary energy consumption in 2050 of 2000 PJ, 1400 PJ are losses in the geothermal power production. These losses are not harmful, but this low-temperature heat is hard to use, as there is no need for the waste heat in the sites, where the geothermal power stations are located.

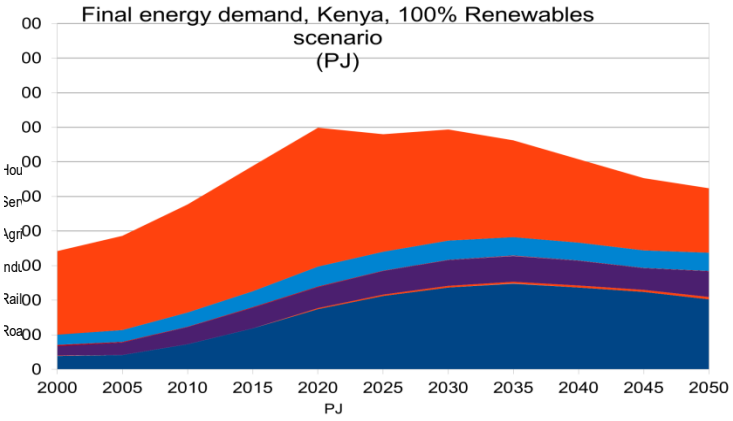


Future Energy Efficiency, Energy Demands and Use:

The basis for the scenarios in is that the demands for energy services will increase in line with population increases and with a development of Kenya from a lower middle-income country to a higher middle-income country until 2050. The analysis considered 8 main demand sectors, which are well explained and illustrated in terms of *business-as-usual (BAU) scenario* and renewable energy scenario in the *Kenya 100% Renewable Energy Scenario by 2050*.

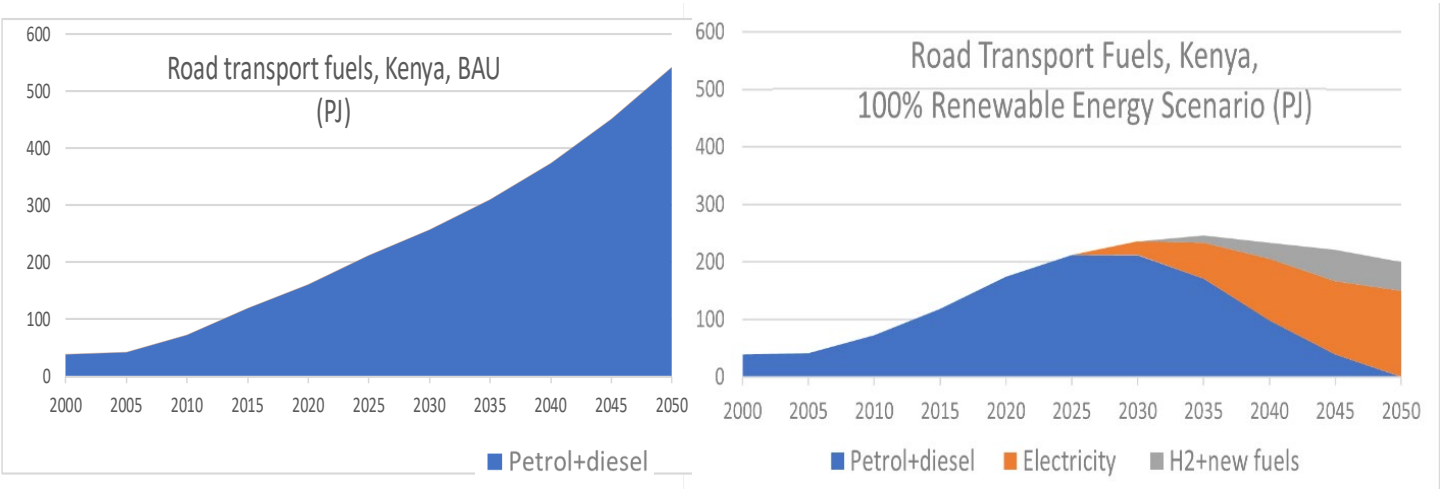




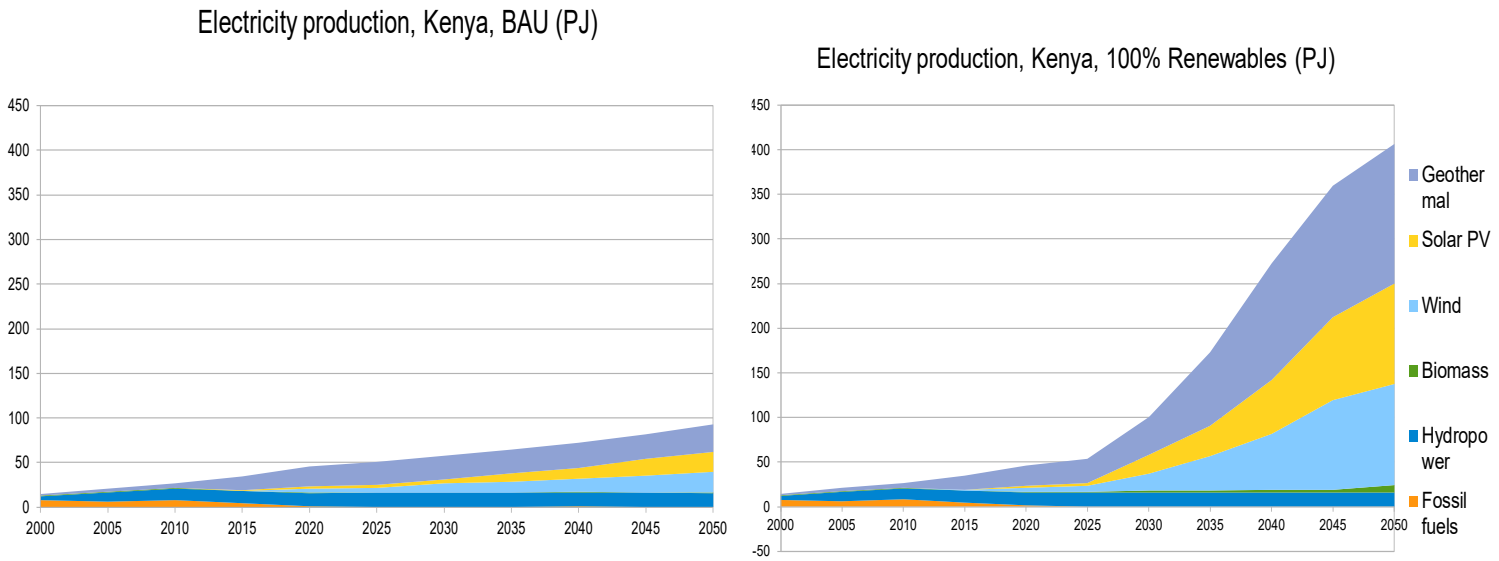


Households Service sectors Agriculture Industry Rail Road

In the transport sector the energy demand increases as much as the transport energy use. Increase in transport demand correlates well with the population increase combined with 43% of the GDP increase 2000-2020. Today the transport energy is fossil fuels in the form of diesel and petrol. In the **renewable energy scenario** this will gradually be replaced with electricity and hydrogen (H_2) and hydrogen-based alternative fuels. In the renewable energy scenario, all hydrogen is produced from renewable electricity while no hydrogen is included in the BAU scenario.

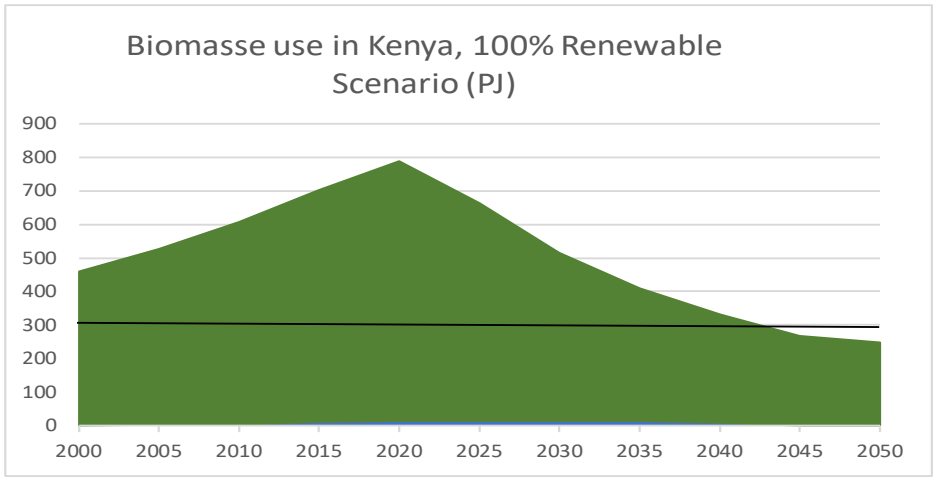


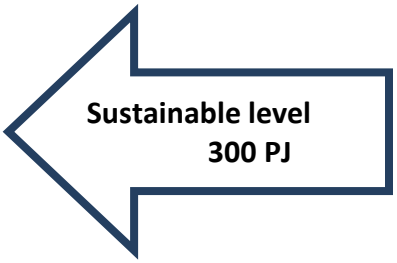
In the BAU scenario there is steady growth in the **electricity** use that easily can be met with renewable energy while in the renewable energy scenario there is a strong increase in electricity use, which can also be met without problems with the large potentials for wind, solar and geothermal power in Kenya.



4.0 Sustainable Level Biomass, Co_2 Emissions and Economy

One objective of a scenario and plan is transition to sustainable energy so as **to reduce biomass use** to a sustainable level. A potential of 300 PJ was used since the the sustainable level is not a fixed value.

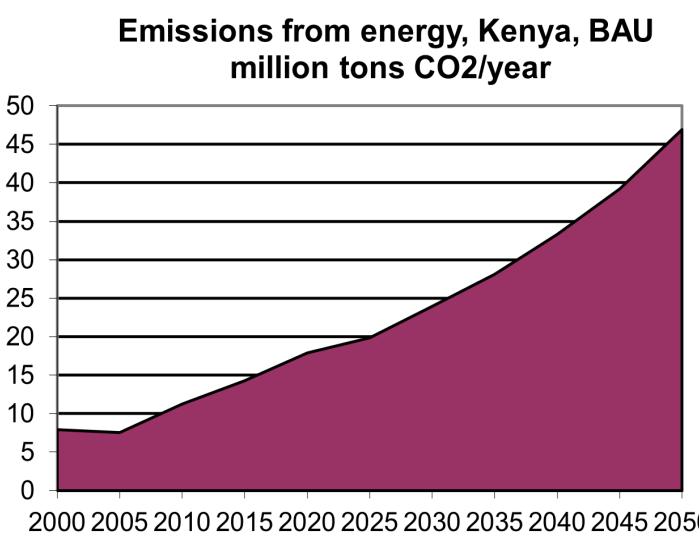


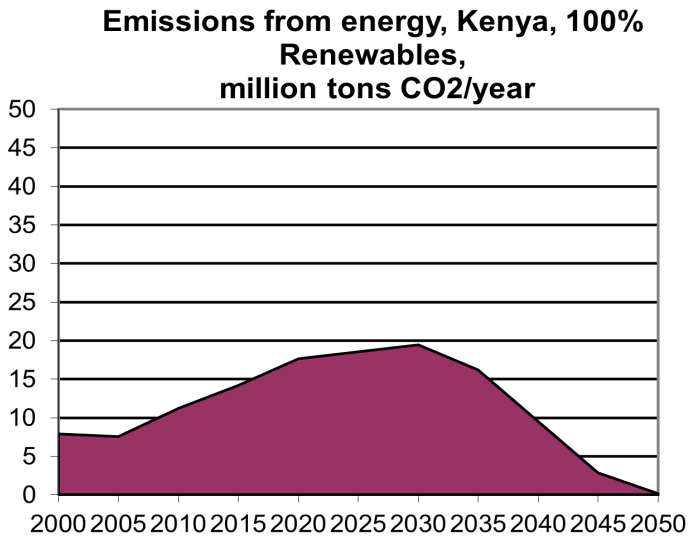


In the BAU scenario, the **CO_2 emission**s from **fossil use** will increase, but the **CO_2 emissions** from **unsustainable biomass** use will be reduced.

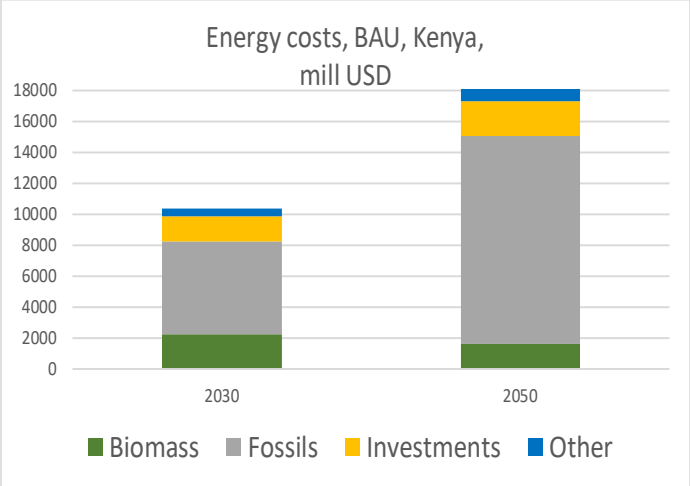
On the other hand, if the **renewable scenario** is adopted and implementation is made according to the scenario, there will be **reduced emissions as from 2025** as shown in the graphs. With this promotion of clean and sustainable energy solutions, it is likely to have zero CO_2 emissions by 2050.

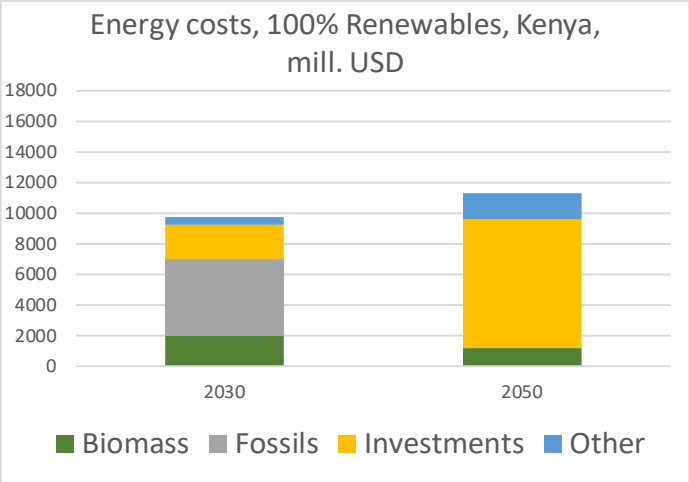
While the renewable energy scenario can lead to CO_2 neutrality from energy by 2050, it is not necessarily leading to greenhouse gas neutrality, as there are other greenhouse gases than CO_2 and as there are non-energy emissions of CO_2, for instance from agriculture.





In terms of **energy cost**, the energy supply **is cheaper in the renewable-energy scenario** compared with the BAU (Business-As-Usual) scenario. The difference is particular high for 2050, where energy supply costs in the renewable energy scenario are only 2/3 of the costs of the BAU scenario. The costs only include energy supply costs, but not end-use equipment as efficient stoves and electric vehicles. Many experts estimate that electric vehicles will have same costs as fossil fuel vehicles within a decade, but today they are more expensive. The costs also do not include costs of electric networks, except for costs of electricity losses and of investments in electric interconnectors.





4.0 Policy Recommendations

Implementation of policies and strategic choices are crucial, if Kenya is to realize the renewable energy targets. *The Following are the recommendations:*

1) Investing in **modern energy solutions** with energy efficiency and cleaner, renewable energy should be prioritized. There should be high priority on efficient cooking, but all sectors must be in the scope for increased energy efficiency which includes; e-cooking, first generation improved cook stove.
2) Diversifying the energy mix into different renewables to reduce over-reliance on finite resources like hydro-generation and petroleum sources of energy without creating new dependencies on energy imports.
3) More budget to fully finance the exploitation of clean and renewable energy sources that are locally available like geothermal, wind, solar and biogas.
4) Fully exploit **energy efficiency potentials** in all sectors with capacity building on energy efficiency, regulation, and energy audits in domestic, service, and industrial sectors. Need for policy development to guide the process.
5) Managing the cost of energy through optimal combination of energy efficiency and affordable renewable energy should be a priority. Expensive energy solutions as nuclear power should be avoided.
6) Make biomass use for energy sustainable with a combination of efficient biomass use, efficient charcoal production, increased supply with plantations etc. and change to affordable alternatives based on renewable energy as they become available. This shall include better enforcement of the legal and regulatory framework for sustainable production, distribution and marketing of biomass as well as stronger promotion of sustainable afforestation programmes.

7) Make transport energy sustainable with use of electric transport, based on renewable electricity for instance; small electric vehicles like scooters, e-bikes, 3-wheel taxis on electricity.

8) Raising public awareness of more efficient energy use, including energy efficiency measures, local use of renewable energy, and new technology developments. There is a need to raise awareness of the potentials and benefits of renewable energy, including biogas and solar energy for electricity and heat.

9) Involving local communities and county governments along the entire energy chain as well as transparent and accountable management of resources for the mutual benefit of all to reduce tensions and enhance ownership of projects.

10) Gender mainstreaming in the implementation of energy projects and programs. There is need to implement the gender and energy policy by the ministry of energy.

11) Deliberately creating local capacity on all levels in the new energy areas to create employment and reduce foreign domination of labor in the sector. This shall include increasing the expertise in Kenya in geothermal energy, wind power, solar power and biogas.

12) To actualize the Investment cost Frameworks to guide private sector investment in DREs; especially for high capital intensive like mini-grids and grid extension for rural electrification. There is also need to review the existing policies and provisions to protect the private sectors in energy sector from exploitation in energy research, innovations, production and benefits by the government as a way to facilitate sustainable partnerships.

13) Improving regulatory compliance of existing provisions as well as formulation of legal and regulatory framework of energy technologies and resources. This include regulatory compliance of natural gas and oil resources to be able to effectively manage extraction and exploitation, have clear revenue distribution, eradicate corruption, and set sunset dates in line with the Paris Agreement and the renewable energy scenario. It also includes enforcement of standards and regulations for renewable energy, in particular solar technologies, to avoid sub-standard equipment.

14) Fiscal investment in greening of the economy to reduce the impact of climate change and environmental degradation.

15) Security of the infrastructures: The sector to work closely and create liaison between the respective parastatals security, national security apparatus and local citizens to monitor the street lighting network and address arising challenges that affect the sector infrastructure. The sector to undertake automation of the street lights with a complete central monitoring system and securing memoranda of understanding and Maintenance Agreements with county governments.

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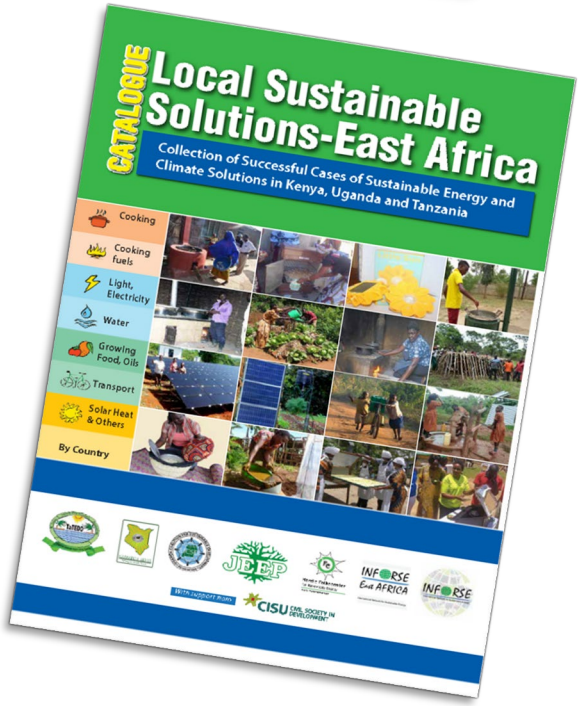

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