

# Possibilities and barriers for increasing renewable power generation in Kenya and Tanzania

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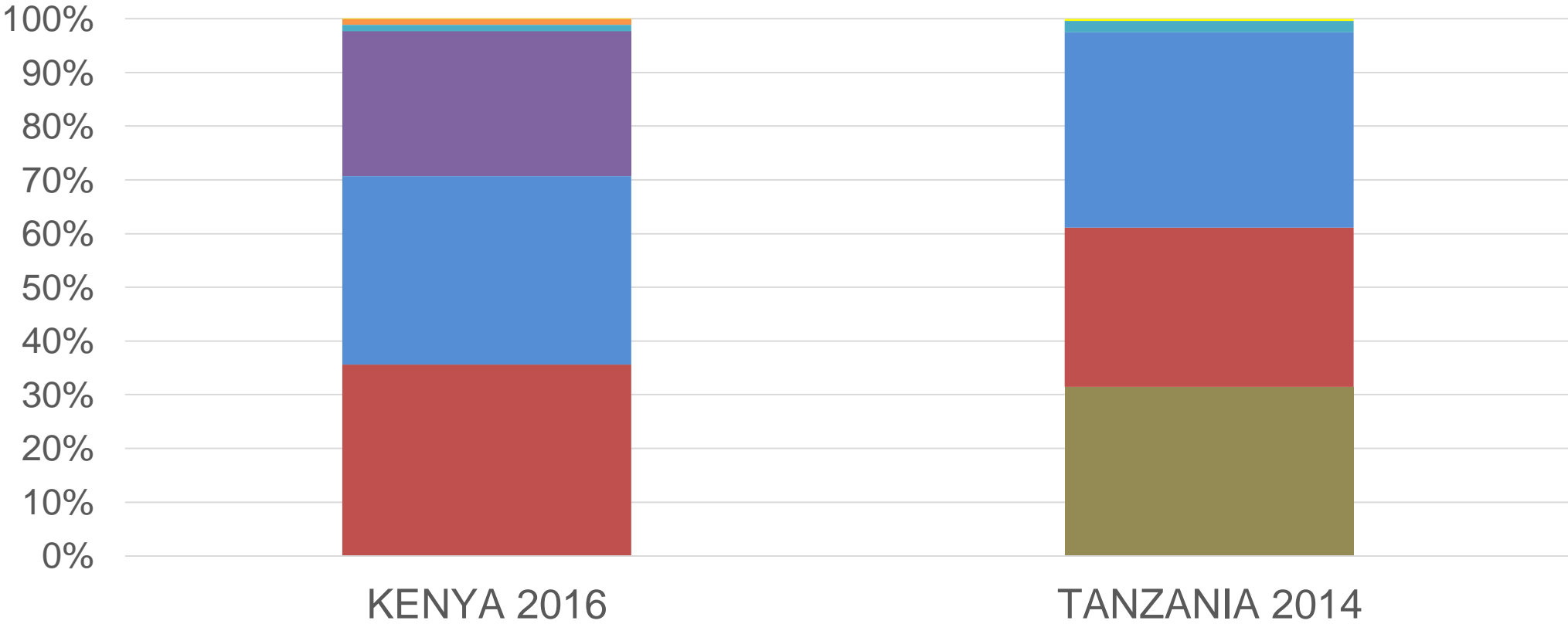
# Outline

- Background and current situation in Kenyan and Tanzanian energy systems
- RES potential and incentives
- Investment barriers
- Energy system scenarios and their impacts on CO<sub>2</sub> emissions and costs
- Conclusions

# Background

	<b>KENYA</b>	<b>TANZANIA</b>
Population (2014)	45.01 million	49.64 million
GDP per capita (2014)	US\$ 1370 (lower-middle income economy)	US\$ 930 (low income economy)
Primary energy consumption (2014)	275 TWh (biomass 68 %)	249 TWh (biomass 86 %)
Installed power generation capacity	2341 MW (June 2016)	1531 MW (June 2013)
Electricity access	55 % in 2016, target: universal access in 2020	24 % in 2014, target: 50 % by 2025

# Current power generation mix



- Natural gas
- Hydropower
- Biomass cogeneration
- Solar
- Liquid fuels (HFO/Diesel)
- Geothermal
- Wind

# RES potential and installed capacity

	KENYA		TANZANIA	
	Estimated potential	Installed (June 2016)	Estimated potential	Installed (2013)
<b>Large hydro</b>	3000 – 6000 MW	820 MW	4000 – 4700 MW	562 MW
<b>Small hydro (&lt;10 MW)</b>	3000 MW	0.814 MW	480 MW	4 MW
<b>Geothermal</b>	5000 – 10000 MW	632 MW	650 MW	-
<b>Wind</b>	Wind speed 8 – 14 m/s in certain areas	26 MW	Wind speed 9.9 m/s at Kititimo and 8.9 m/s at Makambako	-
<b>Solar</b>	Daily solar radiation 4 – 6 kWh/m <sup>2</sup>	0.6 MW	Daily solar radiation of 4 – 7 kWh/m <sup>2</sup>	6 MW
<b>Bagasse cogeneration</b>	193 MW	26 MW	500 MW	19.5 MW

# RES incentives in Kenya

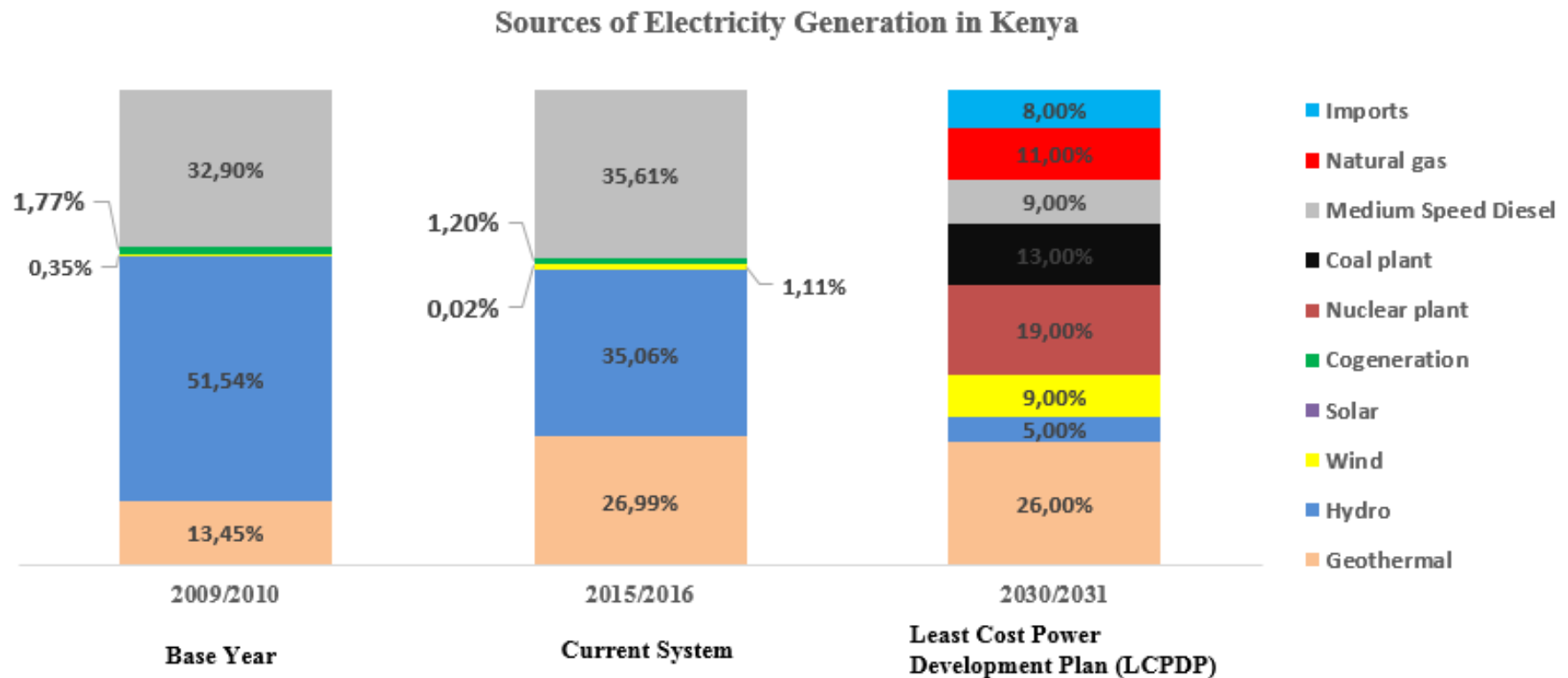
- Kenya's feed in tariff scheme was introduced in 2008 and revised in 2010 and 2012
  - supported projects: hydro (up to 20 MW), wind (upt to 50 MW), solar (grid connected up to 40 MW, off-grid 10 MW), biomass (up to 40 MW), biogas (up to 10 MW), geothermal (up to 70 MW)
  - In 2012 – 2016, about 90 MW of RES capacity has been connected to the national grid by private investors
- Kenya is planning to replace the FiT scheme with competitive auctions

# RES incentives in Tanzania

- Tanzania's RES support system was revised in 2015
- Feed in tariffs for small hydro and biomass power plants (100 kW – 10 MW)
  - tariff for 200 kW project: 0.141 US\$/kWh for hydro, 0.179 US\$/kWh for biomass,
  - tariff for 10 MW project: 0.085 US\$/kWh for hydro, 0.112 US\$/kWh for biomass
- Competitive bidding process for wind and solar projects with capacity up to 1 MW
  - Approved tariffs in 2016 auction: 0.181 US\$/kWh for plants connected to mini grids, 0.165 US\$/kWh for plants connected to the main grid

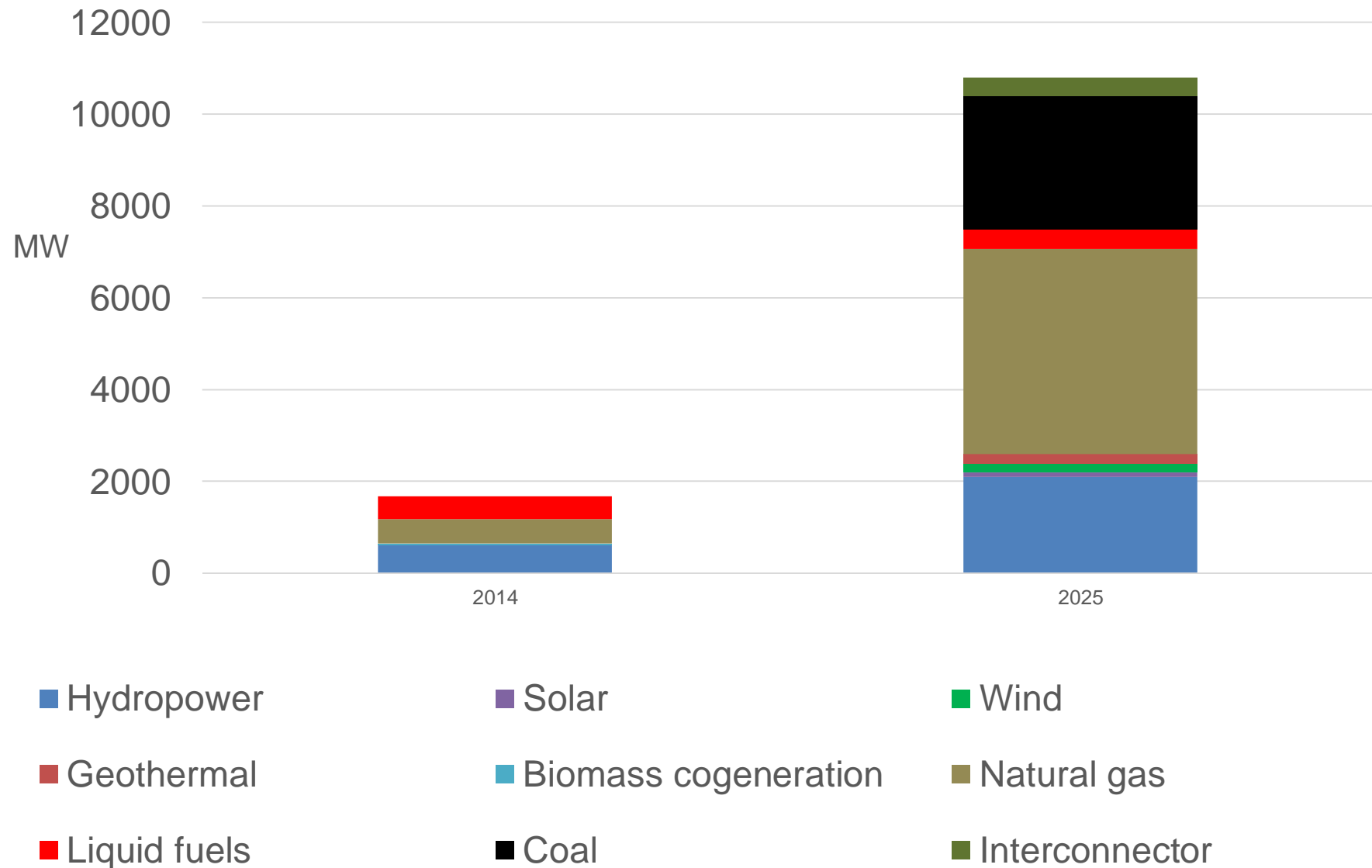
# Barriers

- Political will of the decision makers
  - Kenya's LCPDP 2011 – 2031, increases the use of fossil fuels for its electricity generation (coal resources recently discovered in Kenya)





- Tanzania's Electricity Supply Reform Strategy and Roadmap 2014–2025 aims to increase the security of supply by diversifying the sources of electricity generation



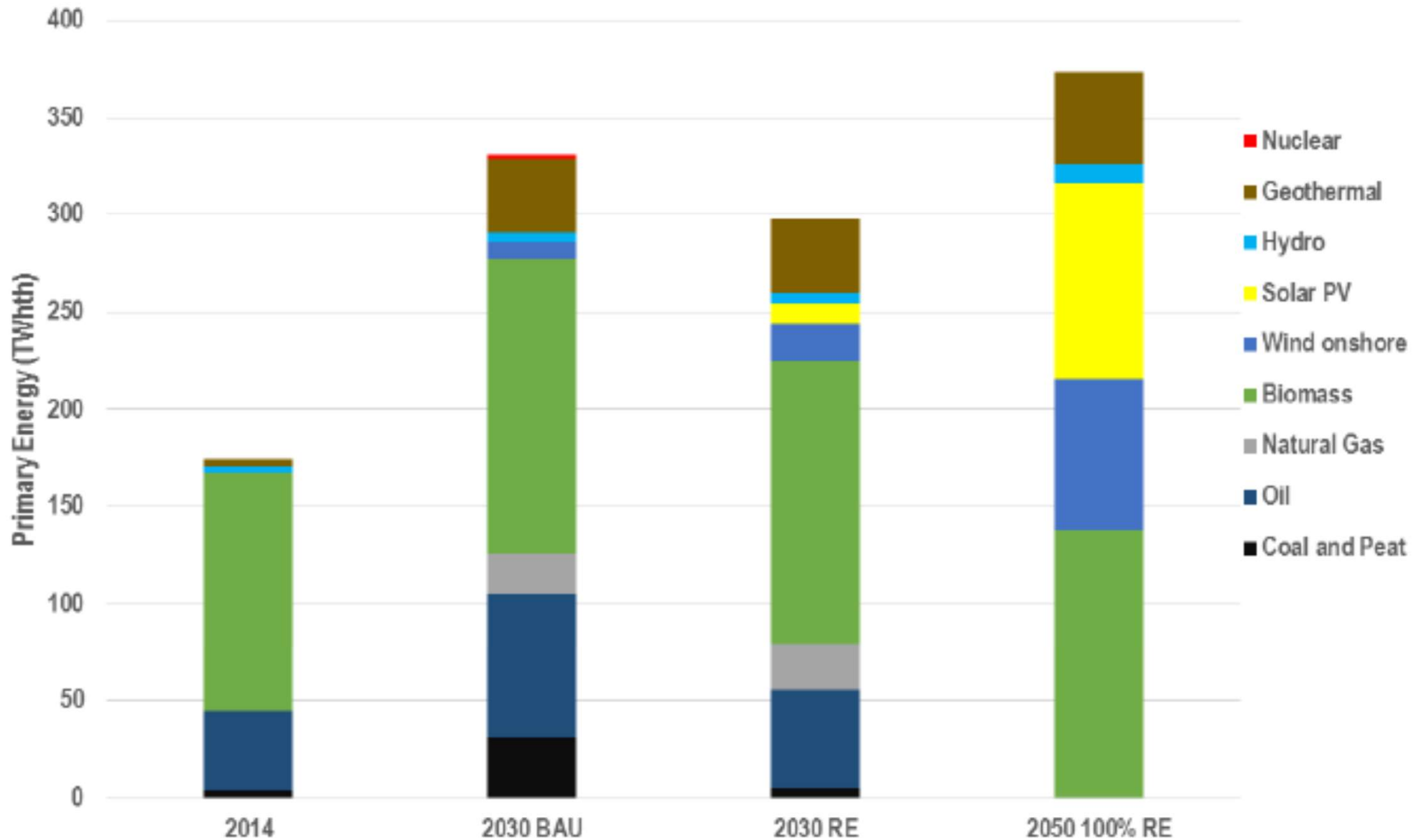
# Other barriers

- High capital cost, difficulties in finding financing
- Old transmission and distribution lines with inadequate capacity
  - Resources often far from demand centers
- Conflicting interests in land and water use, resistance from local communities
- Hydropower: vulnerability to variations in hydrology and climate change, no recent significant investments
- Geothermal: high exploration and development risks
- Biomass: legal framework does not support sustainable use
- Wind: insufficient wind regime data
- Solar: theft of solar panels

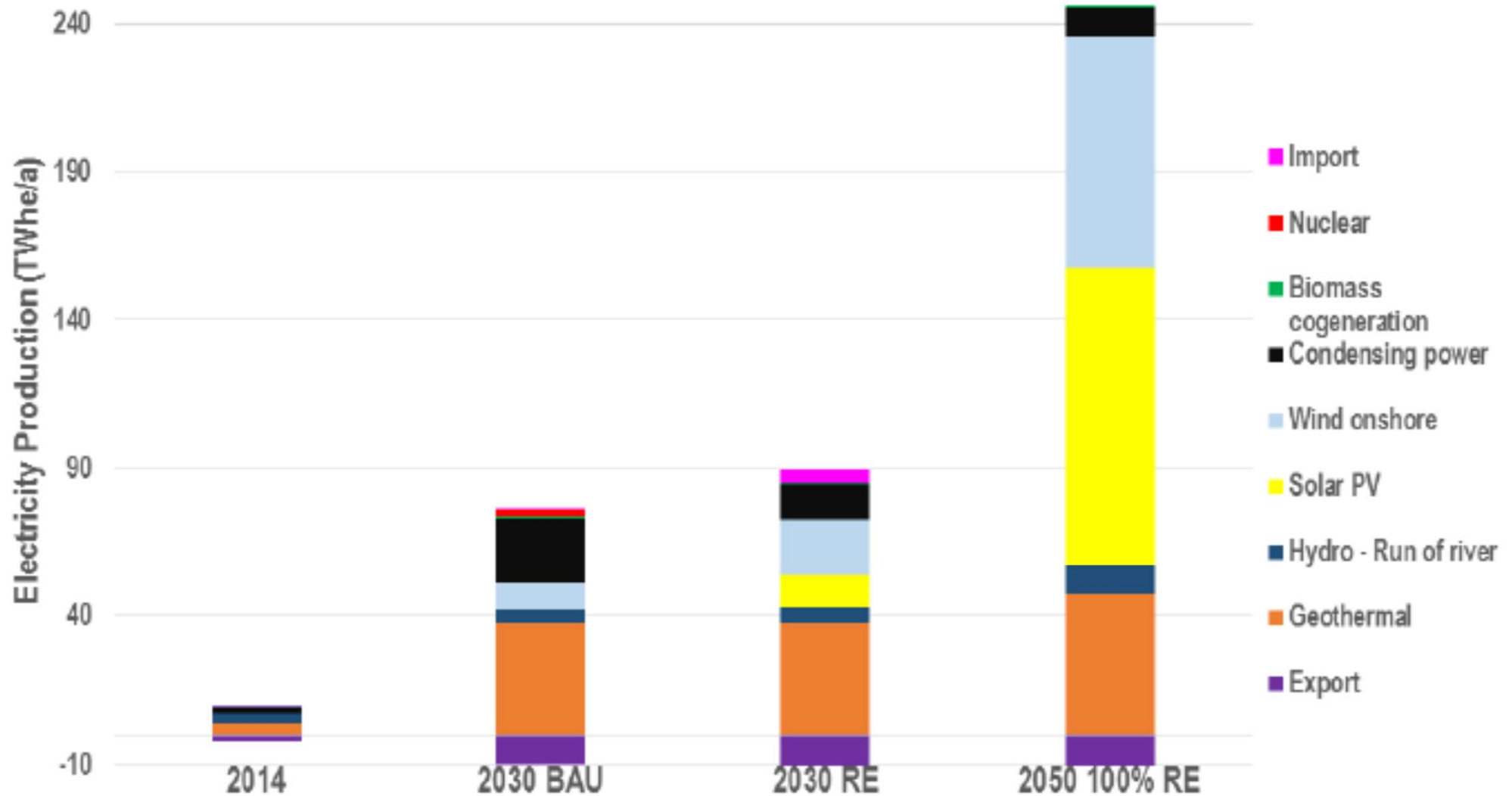
# Energy system scenarios

- 2014 reference scenario
- 2030 BAU
  - Kenya: designed based on LCPDP 2011–2031
  - Tanzania: designed based on Electricity Supply Reform Strategy and Roadmap 2014–2025
- 2030 RE
  - Reduction in coal consumption and increase in RE utilization
  - Final energy consumption about the same as in 2030 BAU
- 2050 100% RE
  - inefficient use of traditional biomass in residential sector replaced by alternatives such as solar cookers, improved biomass cooking stoves
  - coal and oil use in the industrial sector replaced by synthetic grid gas and sustainable biomass
  - transportation sector uses electric vehicles (90%) and biofuels

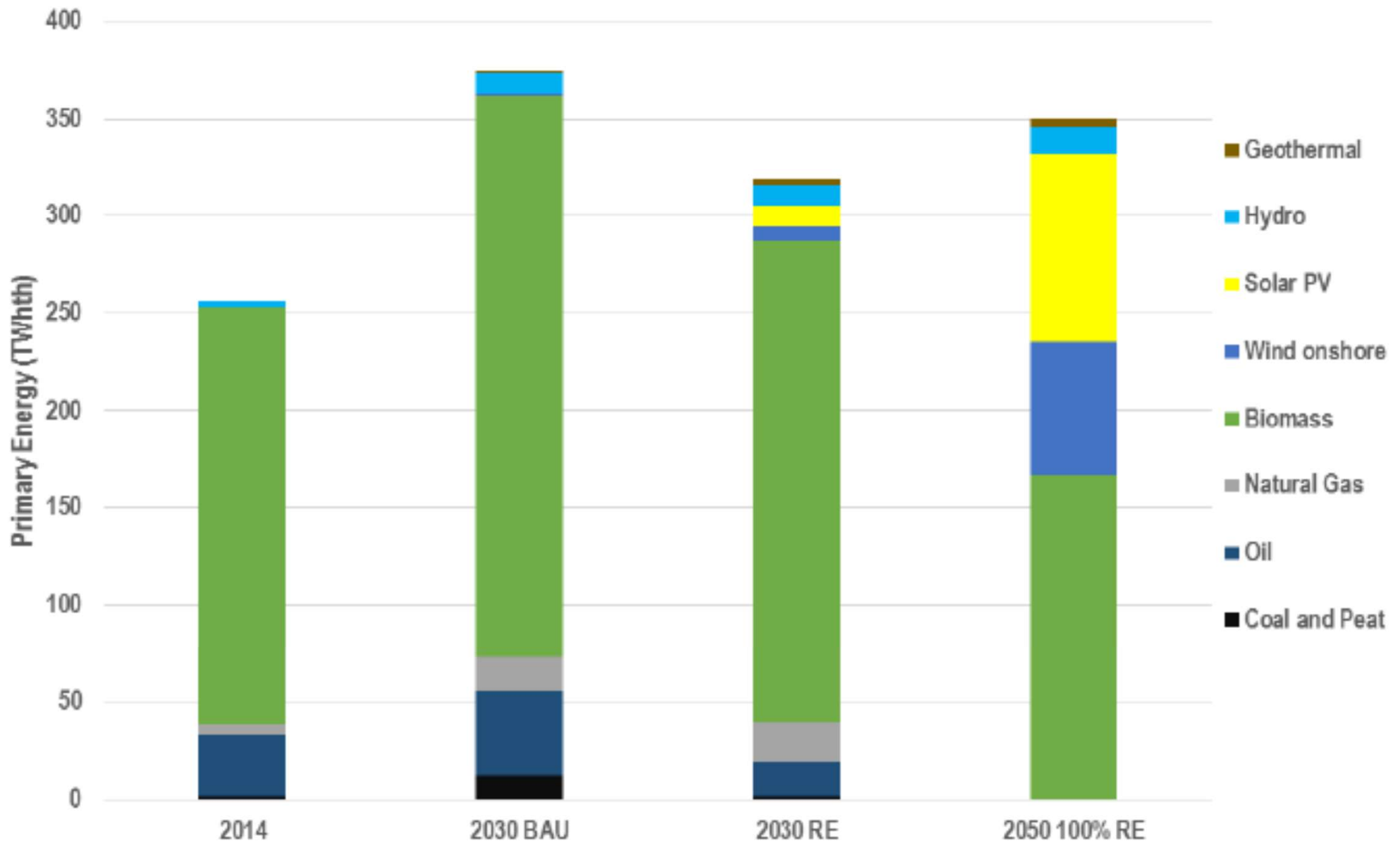
# Total primary energy supply, Kenya



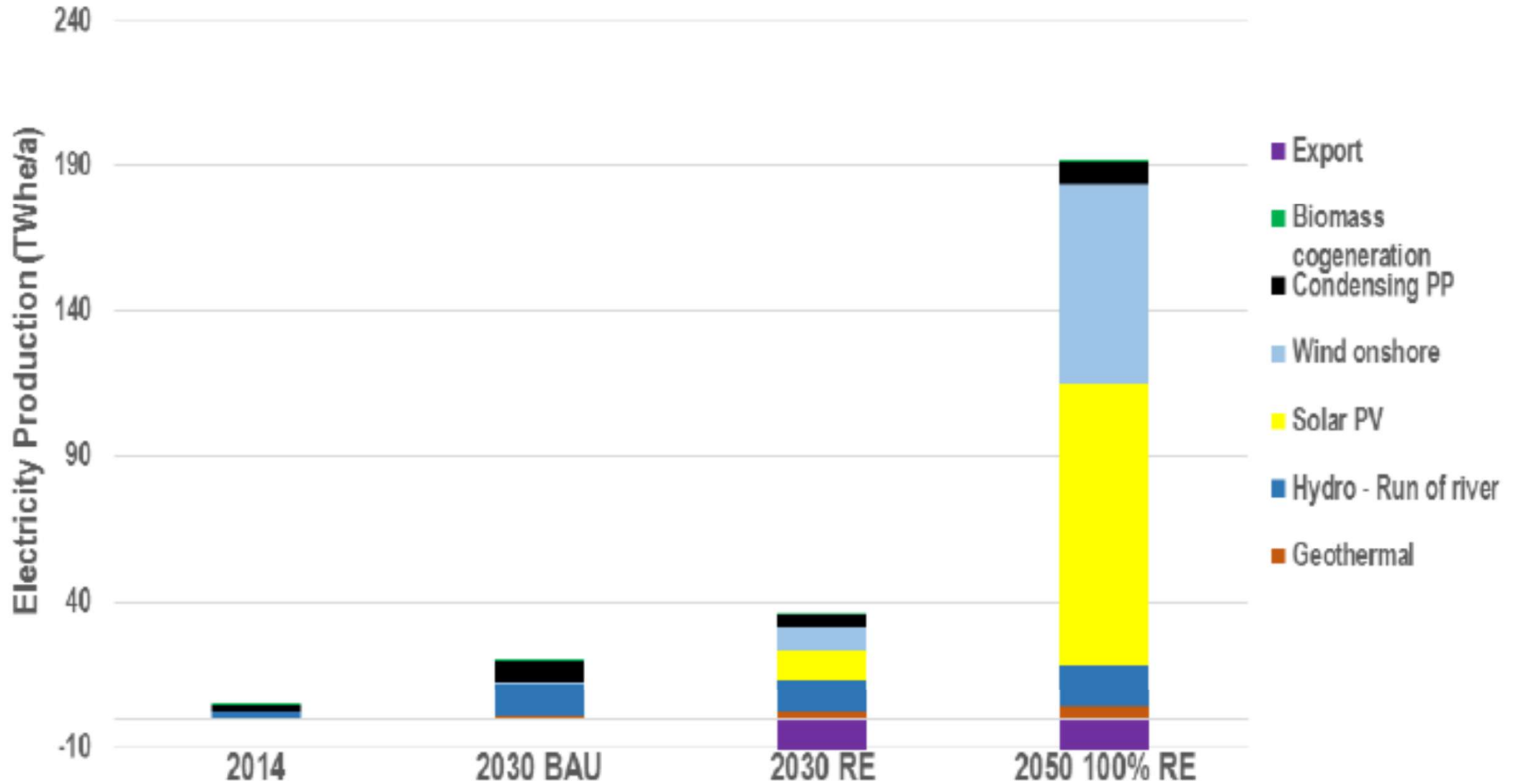
# Total electricity production, Kenya



# Total primary energy supply, Tanzania



# Total electricity production, Tanzania

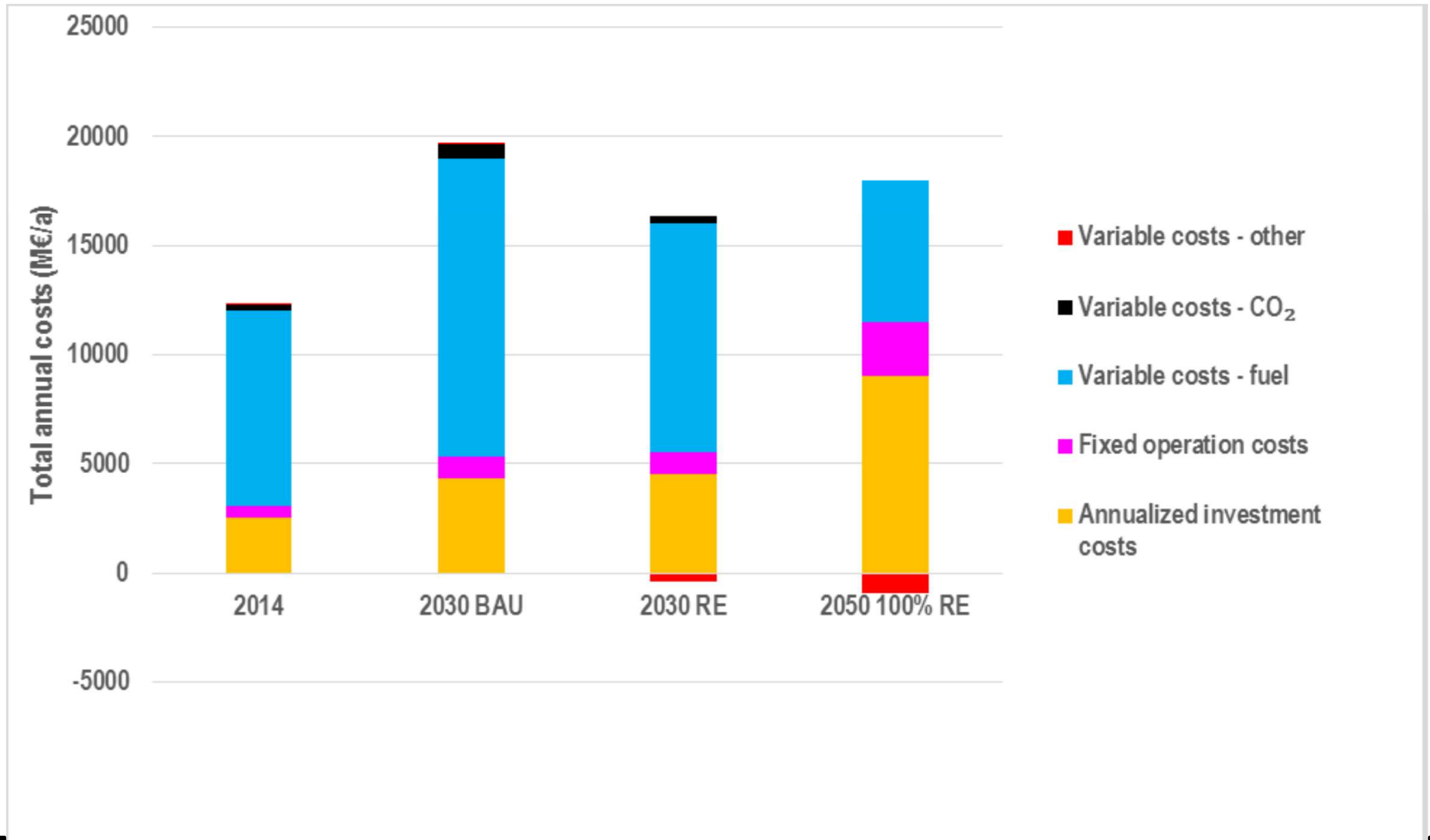


# CO2 emissions (Mt)

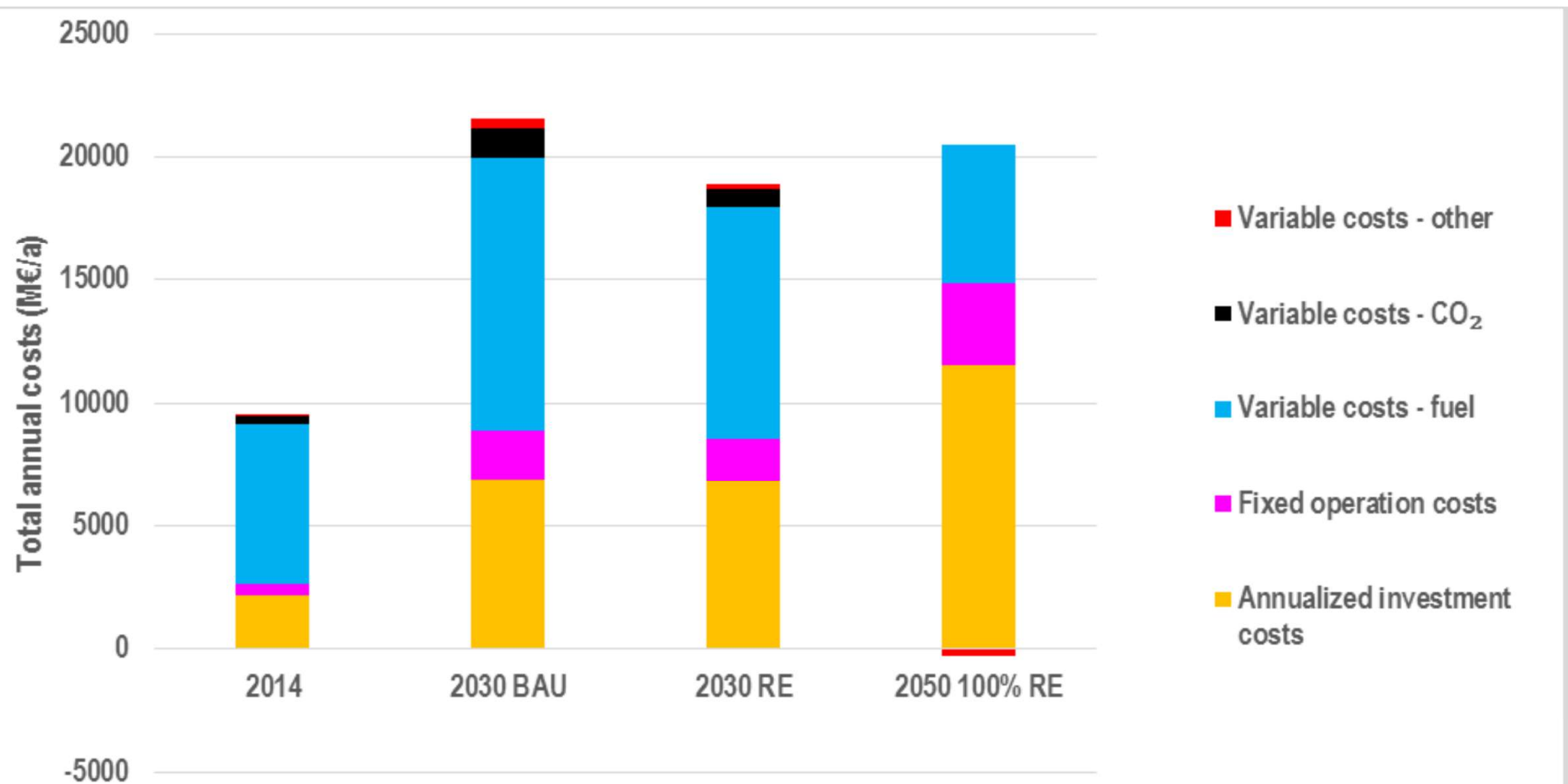
	<b>KENYA</b>	<b>TANZANIA</b>
2014 reference scenario	12.20	10.01
2030 BAU	34.58	19.27
2030 RE	20.10	9.38
2050 100% RE	0	0



# Total annual costs, Tanzania



# Total annual costs, Kenya



# Conclusions/Summary

- Significant renewable energy potential in both countries but also indigenous fossil fuel resources
- Policy focus on least cost options for improving access to energy and improving security of supply
- Simulations show that renewables based system would help meeting the increasing demand while reducing CO<sub>2</sub> emissions and would be cost effective in the long run

An aerial photograph of a vast, flat landscape, possibly a salt flat or a desert. The ground is a uniform, light brown color. In the foreground, there is a large, dark, irregularly shaped mound or structure. The sky is bright and hazy, with a gradient from light blue to white. The overall scene is desolate and expansive.

**Thank you**