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Energy T&S in Kenya

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Kenya

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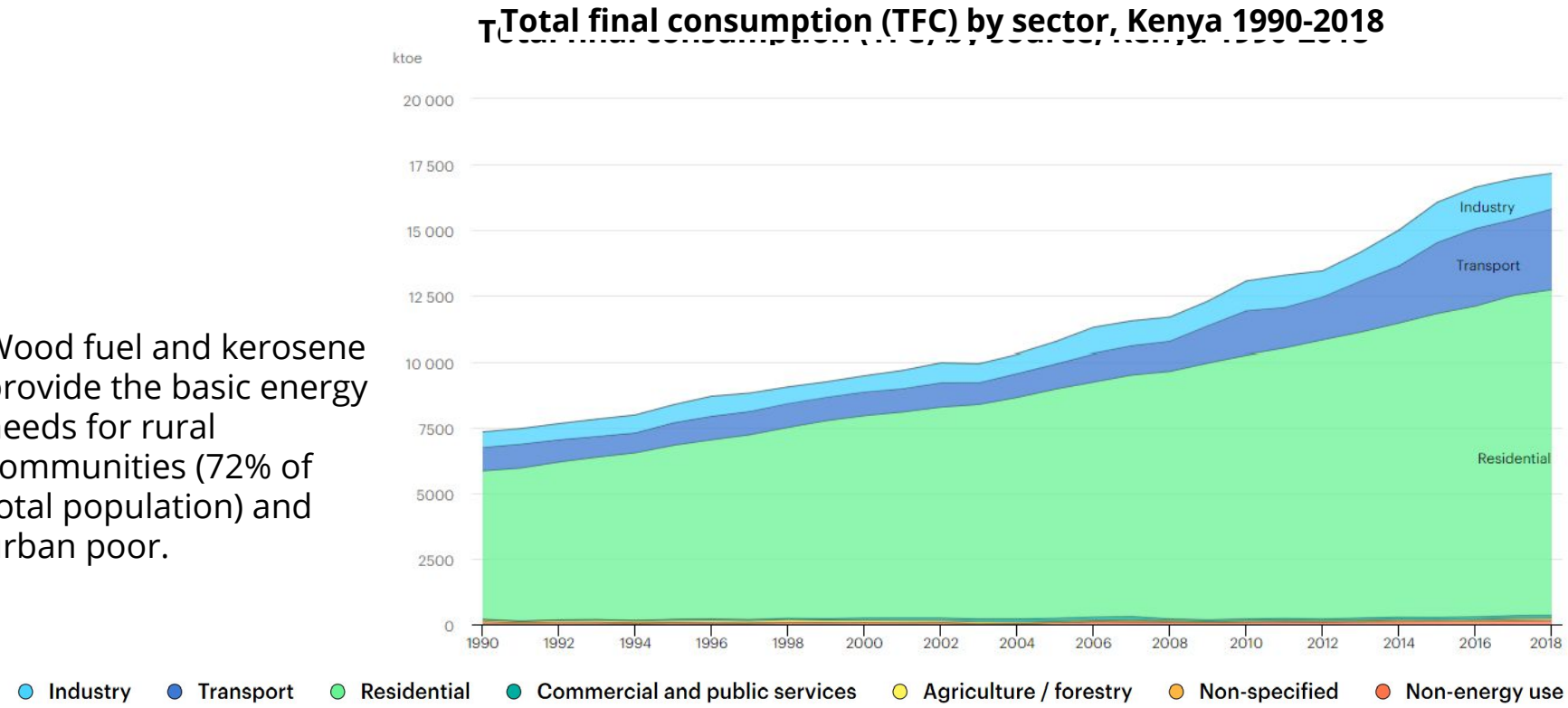
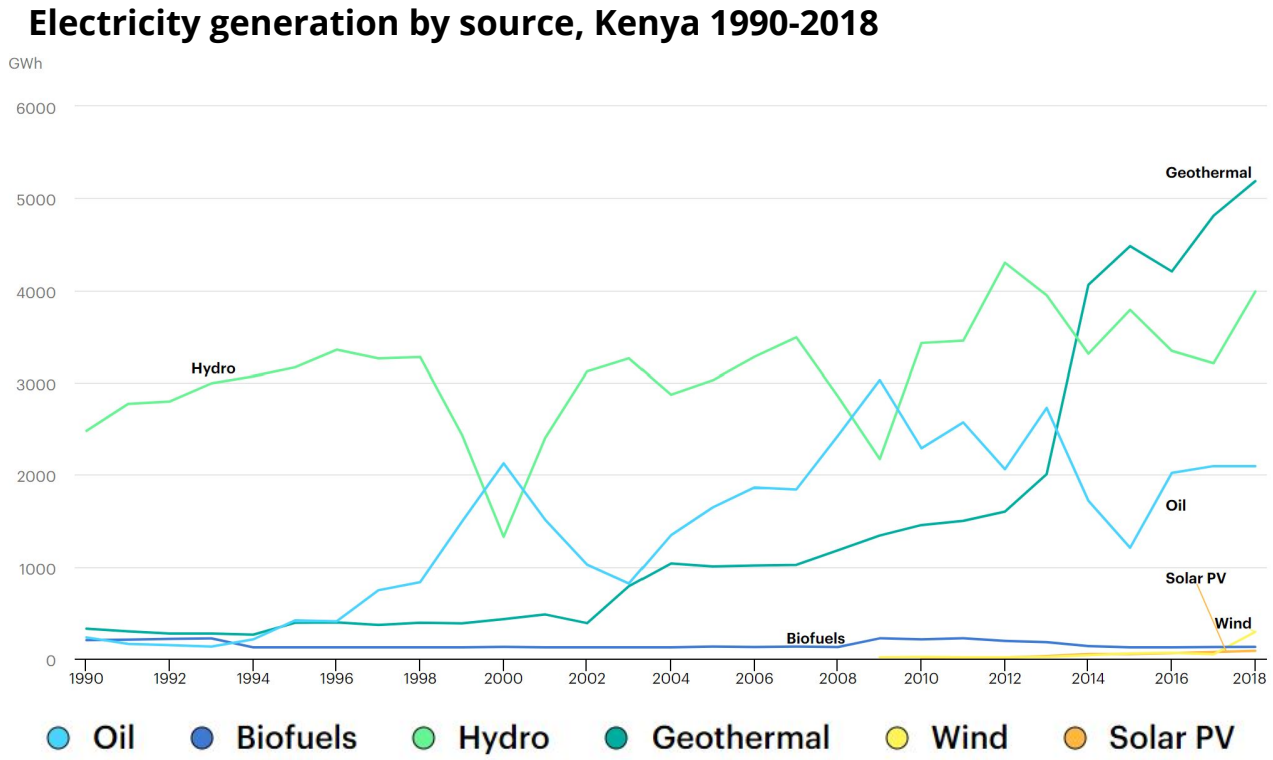
Energy Resources

Wood fuel and kerosene provide the basic energy needs for rural communities (72% of total population) and urban poor.



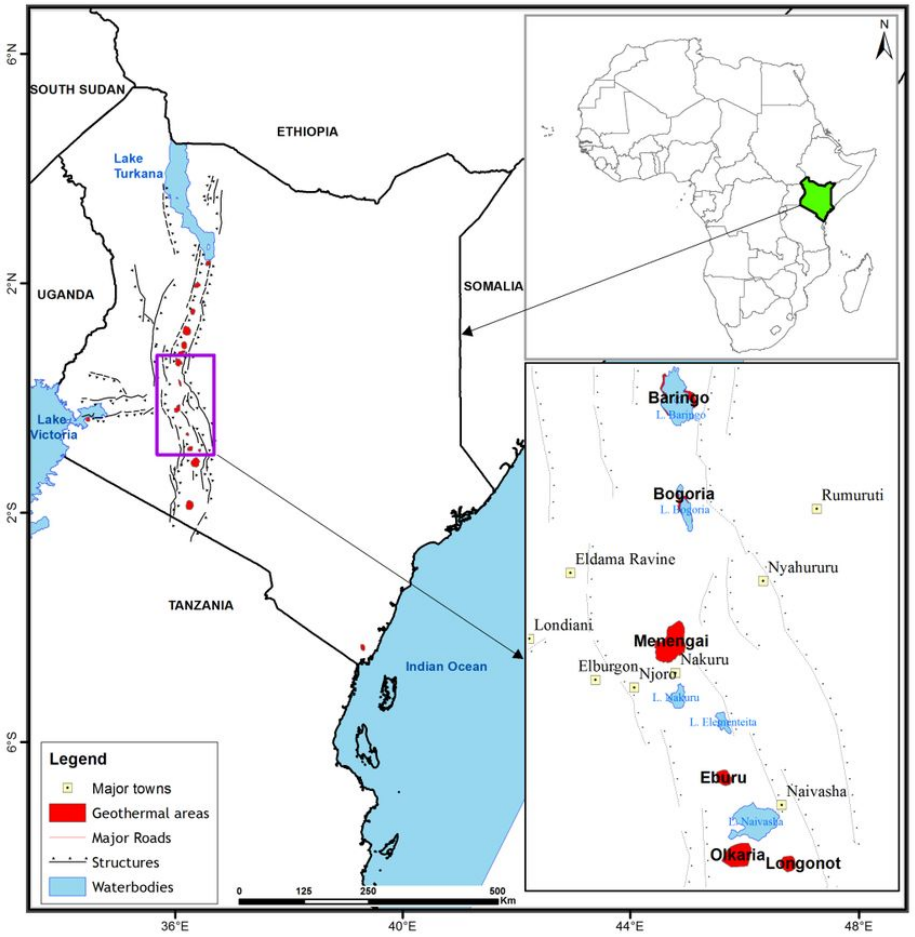
Energy Resources

Installed capacity:
2,351 MW



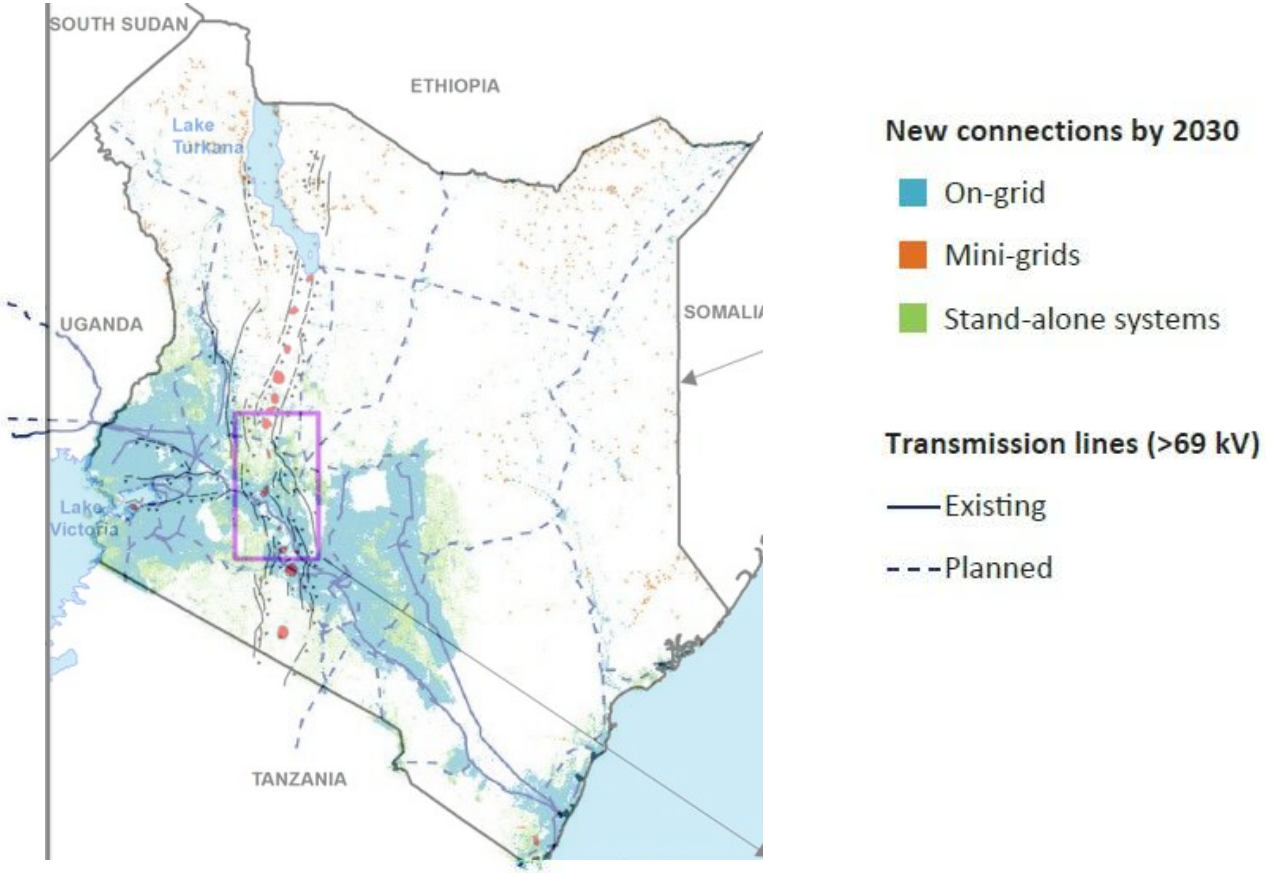
Energy Resources: Geothermal

Installed geothermal capacity: **690 MW**



The Grid

Installed capacity connected to the grid:
1429 MW

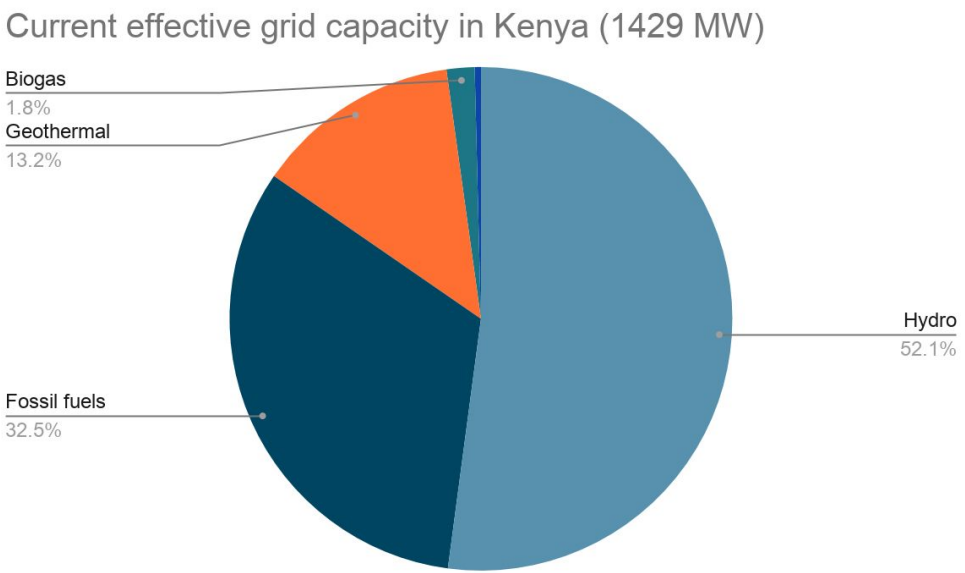


Current demographics

Kenya transitioned from primary biomass-based country to using fossil fuels to renewable energy!

Programme for Infrastructure Development in Africa:
Kenya's share of 13,852 MW of planned peak demand by 2038 (increase of 11000 MW over the 20 year period)

Comparatively higher costs pose a major obstacle to provide low-income households and small businesses



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Infrastructure Overview in Kenya

Olkaria I-V Geothermal Plants (727 MW)

Gitaru Hydroelectric Plant (225 MW)

Lamu Coal plant (960 MW)

Planned: Lake Turkana Wind Farm (310 MW), Largest in Africa

Planned: Garissa Solar Farm (55 MW), Largest in Kenya

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Policy Overview in Kenya

Major threats to Kenya's policies

- Stagnating residential demand
- Rise of captive power
- Poor reliability
- High pricing
- Corruption
- Uncertainty in Regulation

Policies in Kenya

- Energy Act 2006 planned to fulfill Kenya's vision of emerging as a newly industrialized nation
- Energy Regulatory Commission (ERC) was established in 2006 for economic and technical regulation of electric power & renewable energy
- New Energy Policy, drafted in 2015, to ensure provision of adequate, quality, cost-effective, affordable supply of energy with environmental consideration

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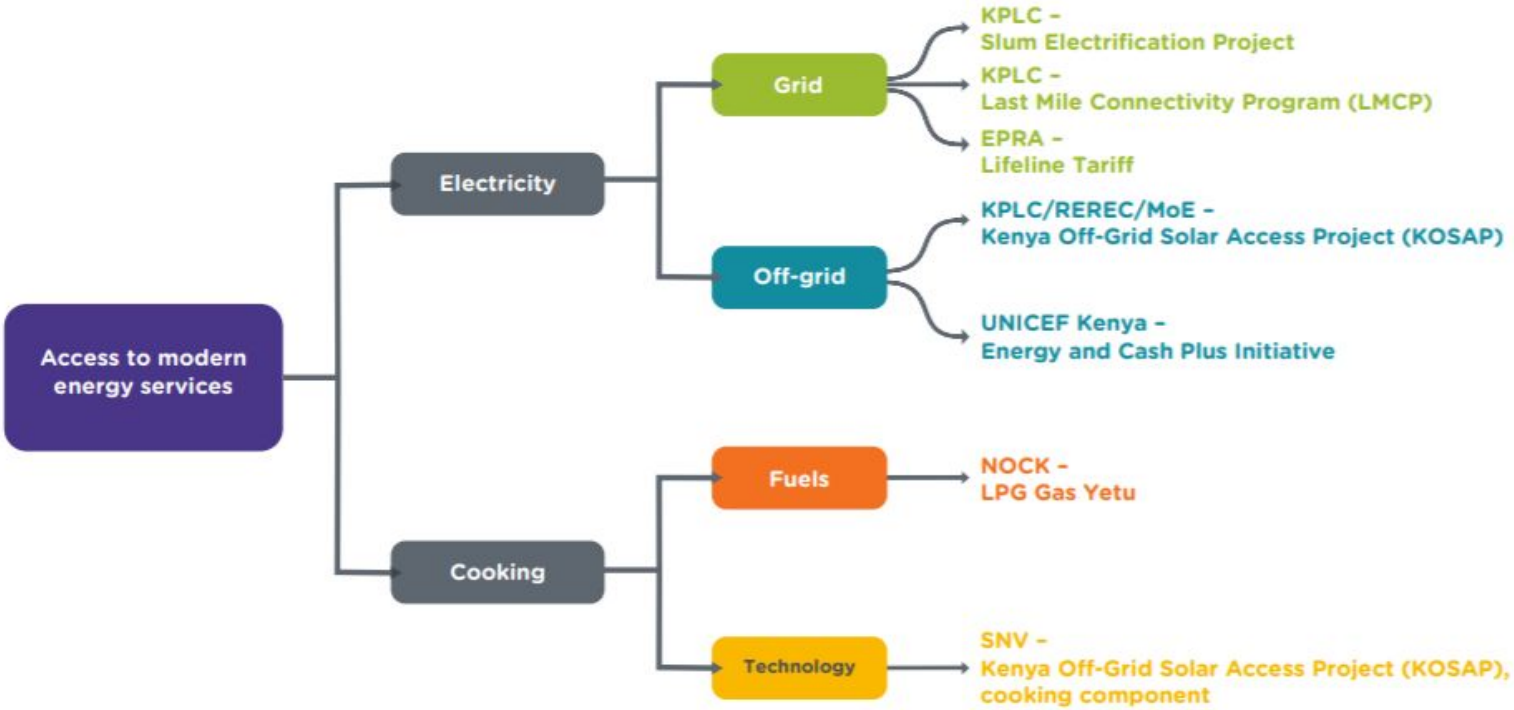
Initiatives for Electrification in Kenya



Source: EED Advisory (https://www.seforall.org/system/files/2020-02/ESN_Kenya-SEforALL.pdf)

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Proposed Methods of Analysis

Case I: Use Homer to input existing power plants and existing grid capacity to model energy demand and supply in a business as usual scenario

Case II: Project what the future of Kenya's energy systems may be if the goal was to reduce emissions by 50%

a) Replace coal plants with renewable energy

- i) geothermal
- ii) hydro
- iii) PV solar

b) Optimize the levelized cost of electricity

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Thank you! Questions?

References

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3. Kenya Geothermal Map: https://www.researchgate.net/publication/305659183_Stable_Isotopic_Composition_of_Geothermal_Fields_in_Kenya_The_Relationship_Between_Geothermal_Fields_and_Kenya_Rift_Lakes_Waters
4. Kenya Grid: https://www.iea.org/articles/kenya-energy-outlook
5. https://energypedia.info/wiki/Kenya_Energy_Situation#Geothermal_Energy
6. https://www.nationalgeographic.com/environment/2018/10/geothermal-energy-kenya-photography/

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Business Case #1: No major change in business

Future needs:	Challenges:	Shortfall:
• Growing demand for electricity and rapid industrialization • Urbanization would further cause increase in demand • Require a reliant grid to accommodate the growing demand • Development of new power plants or scale-up of existing plants	• Rural and low-income households are yet to use grid electricity • Low demand is compounded by high price • Due to rise of captive power, some customers are migrating off the grid citing high prices • Not including such factors will lead to overly rosy projections of demand	• Stagnant demand might lead to longer time of investments • Non-diversification of resources might lead to grid failure due to unexpected mishap • Reliance on hydro-power could be met with environmental changes and policy changes

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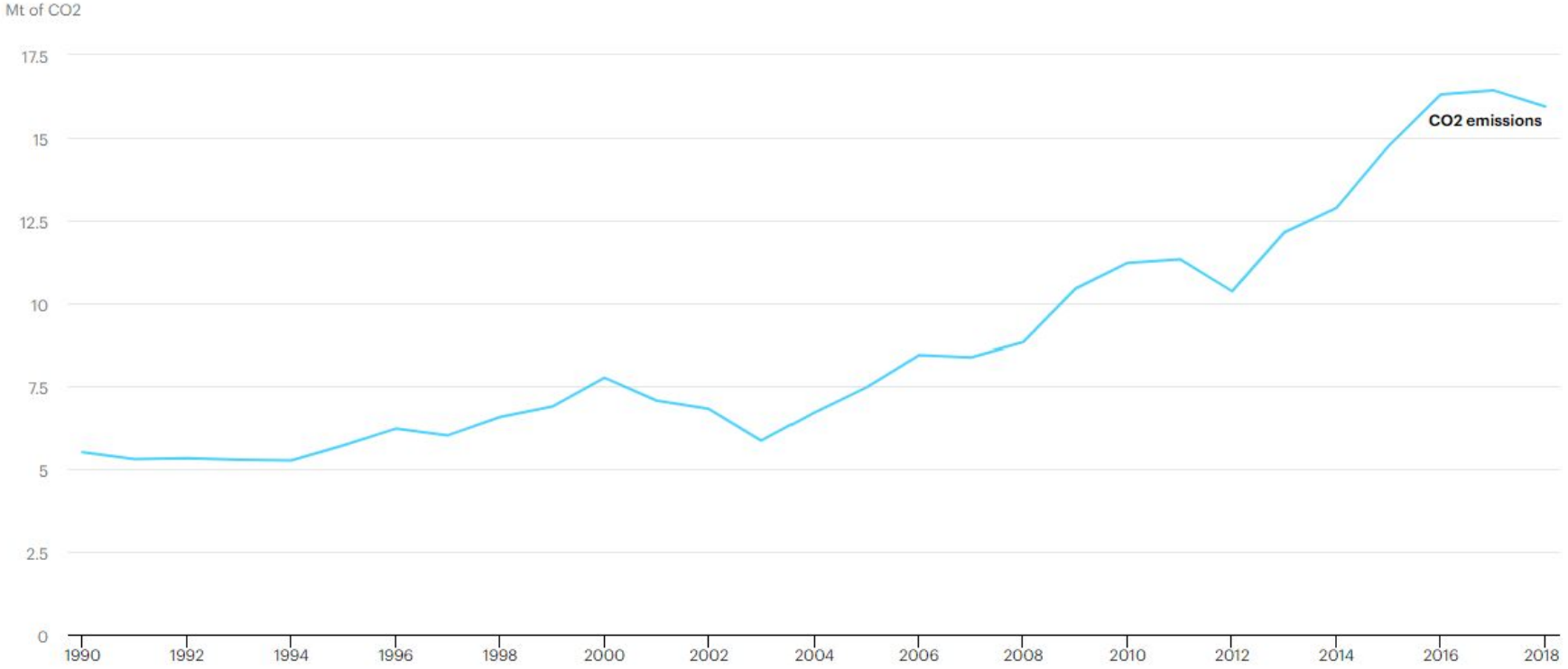
Total CO_2 emissions (millions of tonnes)



Objectives

- Analysis of distribution of Energy Resources (Renewables vs Non-Renewables)-A
- Review of current infrastructure in Kenya-A
- Proposed future developments and policies-Y
    - Apparently Kenya wants to build a coal plant using imports of coal and eventually domestic coal however Kenya's overall coal use is very small and every time I try to google "Kenya's coal source" I get articles about this proposed Lamu Coal Plant.
- Energy Modeling using HomerPro/Excel-Y
- Business Case I vs II
    - I →
    - II → I think we can use Homer to model some geothermal plants and figure out a way to get the lowest levelized cost of electricity, and figure out what configuration will make the cost of electricity low enough to be attractive to the people of Kenya.

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