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Exploring energy efficiency pathways for the Nigerian energy transition plan

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1. Context

- Use of inefficient appliances has added to the insecurity in the power sector
- Energy efficiency has potential to both reduce electricity demand and emissions
- No significant EE pathway in NREEEP and the Energy Transition Plan (ETP).[1,2]
- EE could be significant in Energy Transition Plan and NDCs but has yet to be explored.[3]

2. Aims

- Model energy savings associated with energy efficiency improvements
- Model emissions reduction potential due to energy efficiency and reduced demand
- Identify appropriate policy insights[4] to enhance the Nigerian Energy Transition Plan

Figure 1. Map of Nigeria.

3. Methods & Scenarios

- The least cost system optimization model in OSeMOSYS[5,6] to explore energy efficiency in the Energy Transition Plan and NDCs
- The study assumed the use of several levels of energy efficiency appliances towards the ETP and NDCs
- **BAU/Inefficient Future:** No investment in energy efficiency; ONLY investing in standard efficiency appliances
- **Least Cost**: Unconstrained model/ model without constraint
- **Efficient future:** No investment in standard efficiency appliances; ONLY investment in good and deep appliances

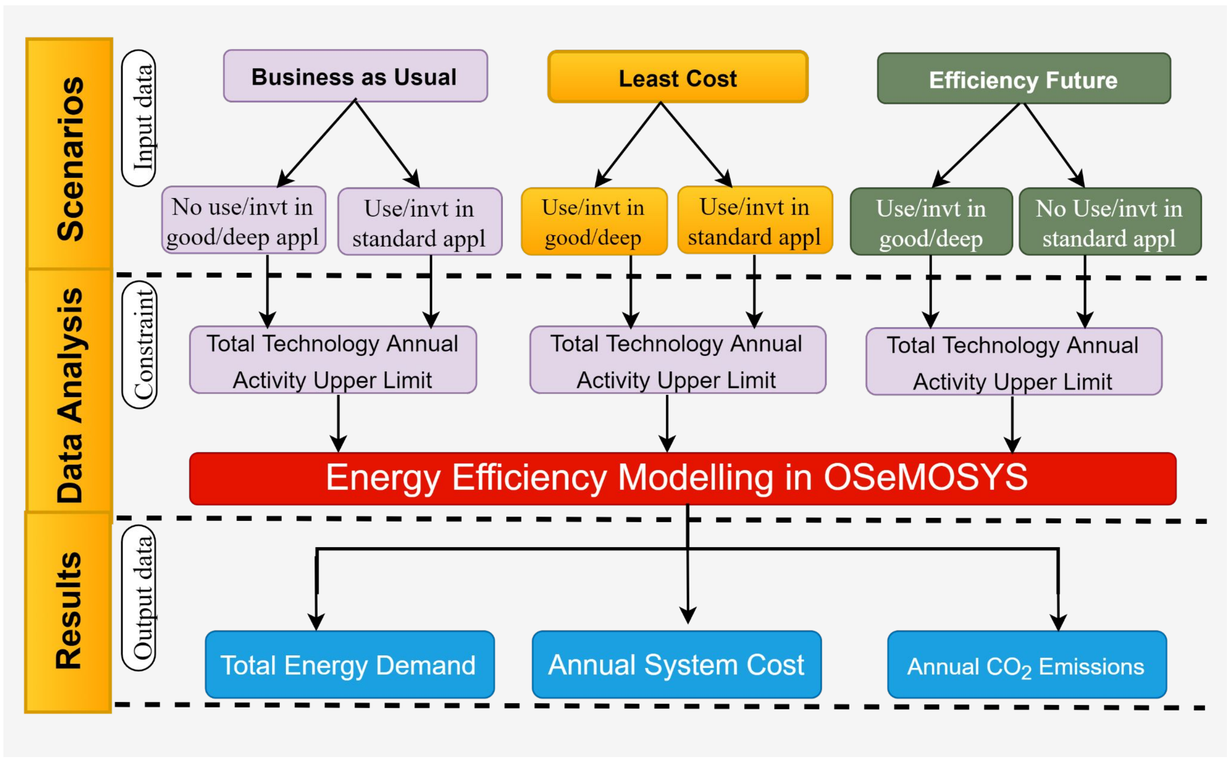
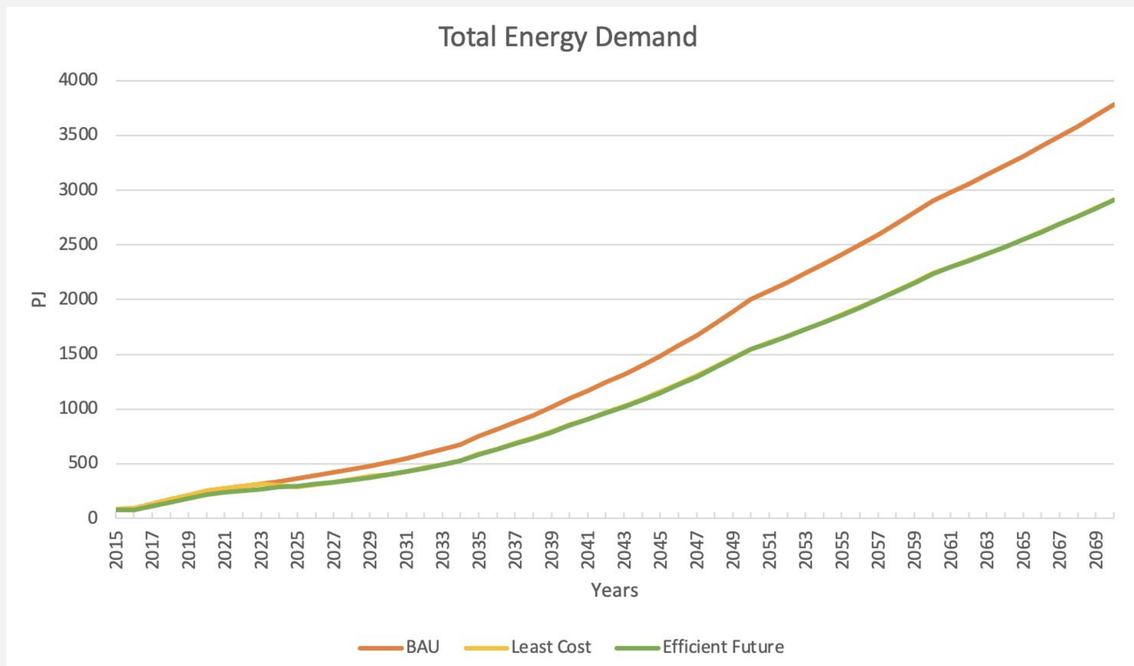
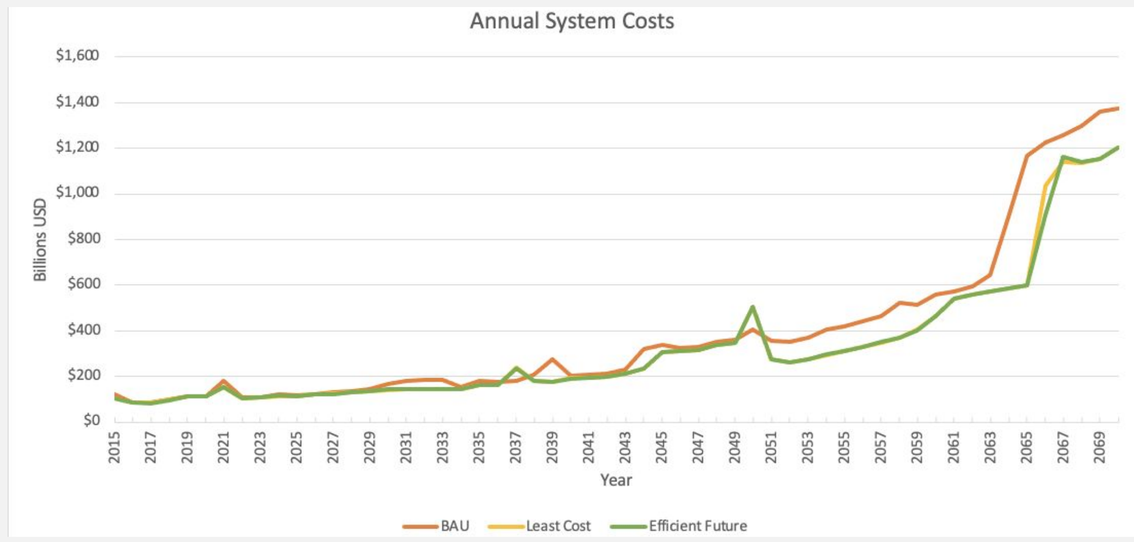
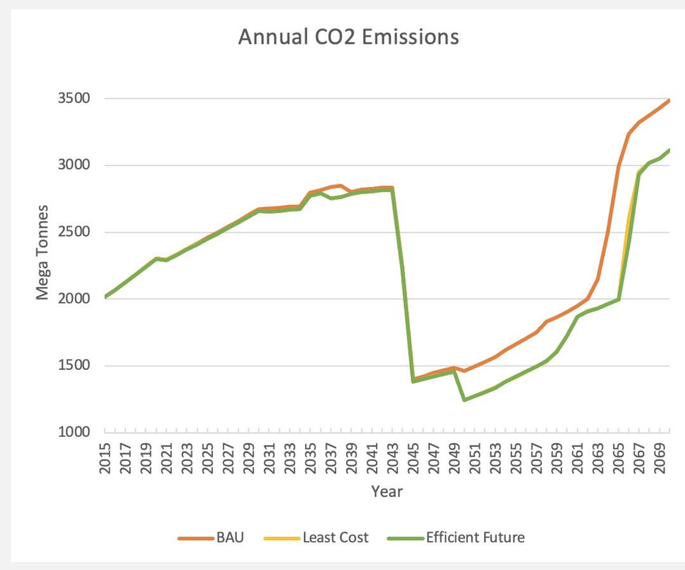


Figure 2. Energy modelling flowchart and study framework (source: Authors)

4. Results







Demand

- Cumulative demand over the modelling period is **19,000 PJ** and **600 GW** lower in the **Least Cost** and **Efficient Future** scenarios.
- **468 PJ** lower in **Efficient Future** vs **Least Cost**.

Costs

- Cumulative costs are 1.4 Trillion USD less in the Least Cost scenario versus the BAU scenario and 3.1 Trillion USD more in the Efficient Future scenario in present terms.

Emissions

- The **Least Cost** and **Efficient Future** scenarios ultimately produce savings of **72 and 75 billion tonnes of CO2**, respectively.

5. Policy insights and conclusions

Conclusions

OSeMOSYS was used to investigate the impacts of investment in energy efficiency on total energy demand, cost and final CO2 emissions in all sectors in the Nigerian power system. Results show that energy efficiency reduces the amount of energy demanded across all sectors, reduces emissions, and is a vital part of a low-cost energy mix.

It is assumed that these improvements will also support business competitiveness in the nation and make more energy available for supply to other parts of the country. Reducing electricity demand also minimizes the urgency for new power stations, creating room for a gradual but systematic transition to a sustainable energy future.

Policy Insights

- The government should promote investment in energy efficiency in all sectors of the economy.
- Policymakers need to mainstream and enforce standardization of energy appliance standards and codes for energy efficient technologies.
- To facilitate the above, the government must also invest in appropriate energy pricing, smart metering, billing mechanisms, and energy efficiency awareness.
- While these policies are outlined in the Energy Master Plan, their implementation needs strengthening.[7]

Future Work

Adding another layer of analysis in FlexTool would show the potential flexibility benefits of reducing peak demand.

6. References

[1] Federal Government of Nigeria. National Renewable Energy and Energy Efficiency Policy. Published online 2015.
[2] Federal Government of Nigeria. Nigerian Energy Transition Plan. 2021.
[3] Federal Government of Nigeria. Nigeria's Nationally Determined Contribution – 2021 Update.; 2021.
[4] Howells M, Quiros-Tortos J, Morrison R, et al. Energy System Analytics and Good Governance -U4RIA Goals of Energy Modelling for Policy Support. In Review; 2021. doi:10.21203/rs.3.rs-311311/v1
[5] Cannone C, Allington L, de Wet N, et al. ClicSAND for OSeMOSYS: A User-Friendly Interface Using Open-Source Optimisation Software for Energy System Modelling Analysis. In Review; 2022. doi:10.21203/rs.3.rs-1338761/v1
[6] Allington L, Cannone C, Pappis I, et al. Selected 'Starter Kit' energy system modelling data for Nigeria (#CCG). Published online May 3, 2021:13. doi:10.21203/rs.3.rs-480085/v2
[7] Federal Government of Nigeria. National Energy Master Plan. 2014.

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