ETH zürich

Center for Sustainable Future Mobility (CSFM)

E-Mobility versus Synfuels in economically developing nations' road transport (ESYN)

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1 Background and Overview

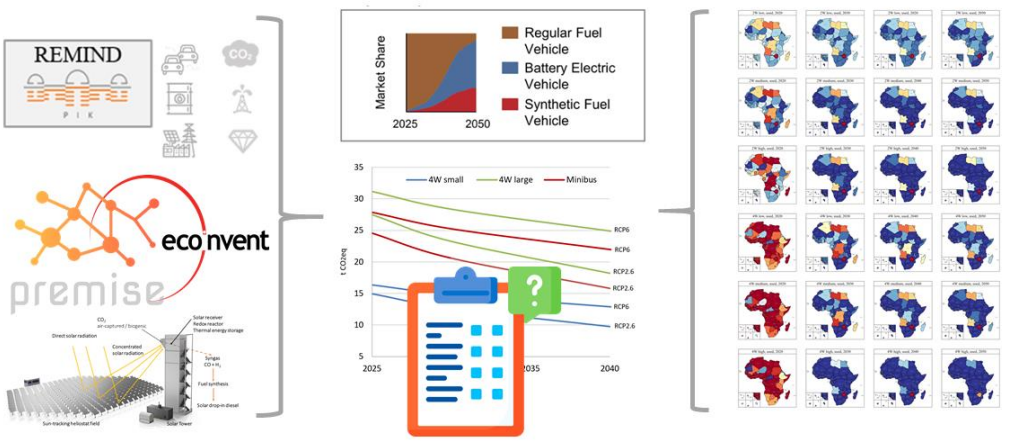
This project explores the role of electric vehicles and synthetic fuels in replacing fossil diesel and gasoline in passenger road transportation in Africa. The analysis will take into account:

- Existing vehicle stocks and the influx of new/used vehicles including cars, motorbikes and minibuses.
- Specifics of African countries, e.g. electricity supply mix, renewable electricity generation potential, electricity access, vehicle import policies, financing.
- Environmental impacts associated with various fuel supply pathways and vehicle technologies.
- The impact of policy interventions and user preferences on transitional pathways.

2 Techno-economic assessment of technology competition

The techno-economic assessment is based on a cost comparison of vehicle technologies under different underlying development/cost scenarios and a system dynamics model [1] that captures import/export flows and global used vehicle market dynamics + decision-making logic. The key outcomes will be:

- Total cost of ownership (TCO) comparisons give insights into the relevance of niche drive-technologies across countries with respective financing risks.
- Simulation of policy interventions with recommendations for instruments in specific regions could effectively advance the deployment of new drive technologies.



Simplified workflow of the ESYN project to model future African road transport

3 Life-cycle environmental impacts

The future environmental impacts will be modelled via the innovative life cycle assessment (LCA) framework "premise" that allows the generation of prospective life-cycle data according to future economic projections and climate policies [2].

Based on location- or region-specific boundary conditions, examples of future environmental impacts modelled will be those caused by producing and supplying:

- future battery electric vehicles sold in Africa;
- synthetic fuels with emerging technologies;

4 Technological regime development and preference analysis

- The adoption of an emerging technology is influenced by multiple factors. For this reason, we use a multi-level perspective (MLP) to scrutinize the dynamic relationships determining socio-technical transitions.
- This includes:
  - Empirical fieldwork in Africa
  - Surveys
  - Case studies

5 Outlook and key stakeholders

- Project duration: January 2024 to December 2027 (36 months).
- Key stakeholders: AMAG, national and regional governments, R&D institutes and industrial developers in the area of electric vehicles and fuels for transportation with respective businesses, future adopters in Africa, international organizations (IEA, ICCT, ITF, OECD).

References

1. Noll, B., Steffen, B. & Schmidt, T. S. The effects of local interventions on global technological change through spillovers: A modeling framework and application to the road-freight sector. Proc. Natl. Acad. Sci. 120, e2215684120 (2023).
2. Sacchi, Romain, et al. "Prospective Environmental Impact Assessment (premise): A streamlined approach to producing databases for prospective life cycle assessment using integrated assessment models." Renewable and Sustainable Energy Reviews 160 (2022): 112311.

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