

Market design in Multi-sectoral Energy Communities, with a focus on Mobility

DIFFELS Noé

PhD Student in co-supervision between UMONS and ULiège, Belgium (EFES funding)
noe.diffels@student.uliege.be

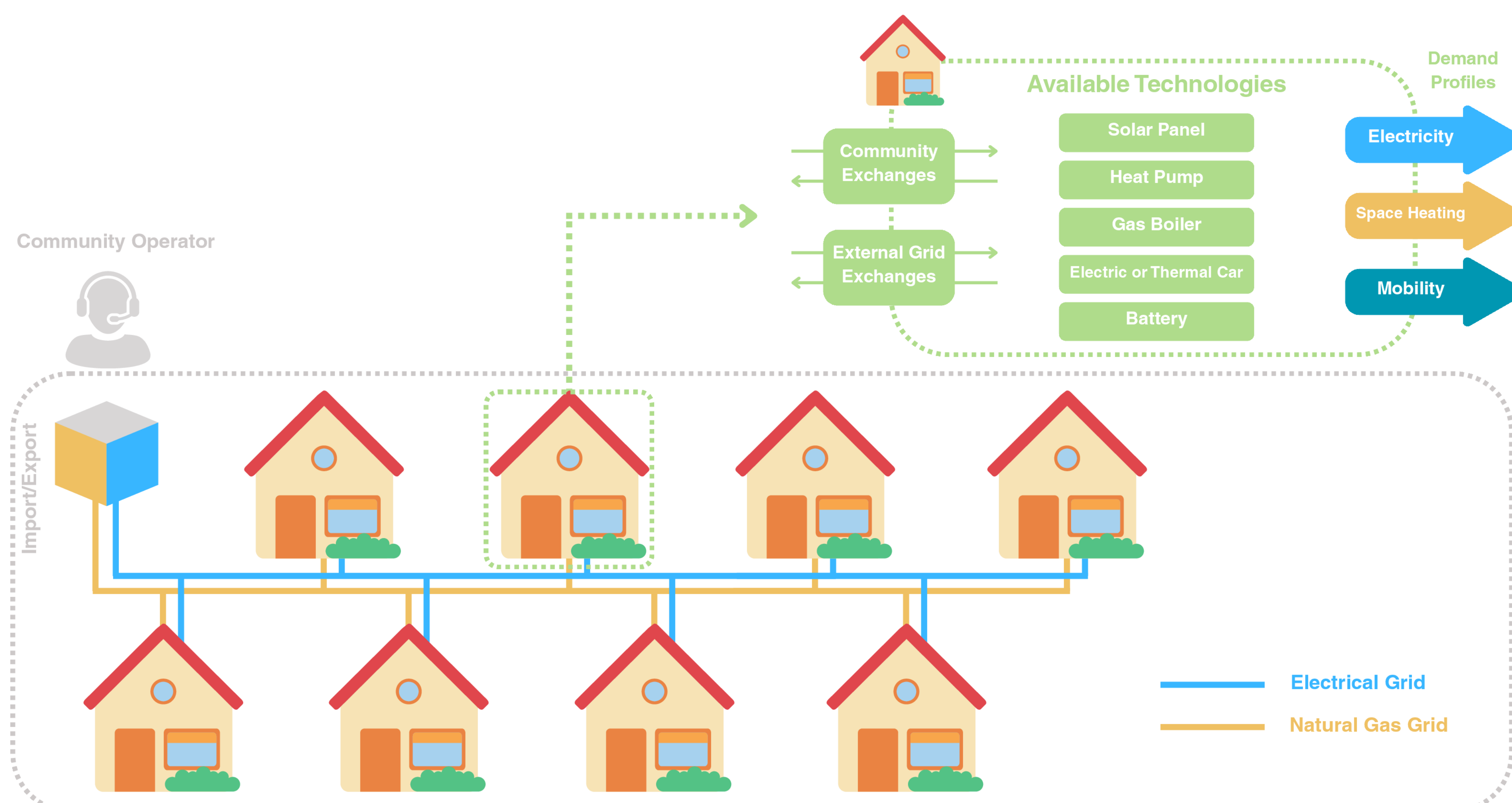


Context of this thesis

This PhD thesis will focus on designing market mechanisms for multi-sectoral local Energy Communities (ECs), with special attention to mobility demand. It aims to develop internal exchange and pricing strategies for fairness and stability, and models interactions with grid operators and wholesale markets to enhance societal benefits. Additionally, the optimal investments of the personal and shared assets within the EC (as photovoltaic panels (PV), heat pumps (HP), batteries, etc.) are considered. Emphasis is placed on the integration of Electric Vehicles (EVs) and Vehicle-to-Grid (V2G) technologies as key flexible assets, supporting peak shaving, renewable energy integration, and economic optimization.

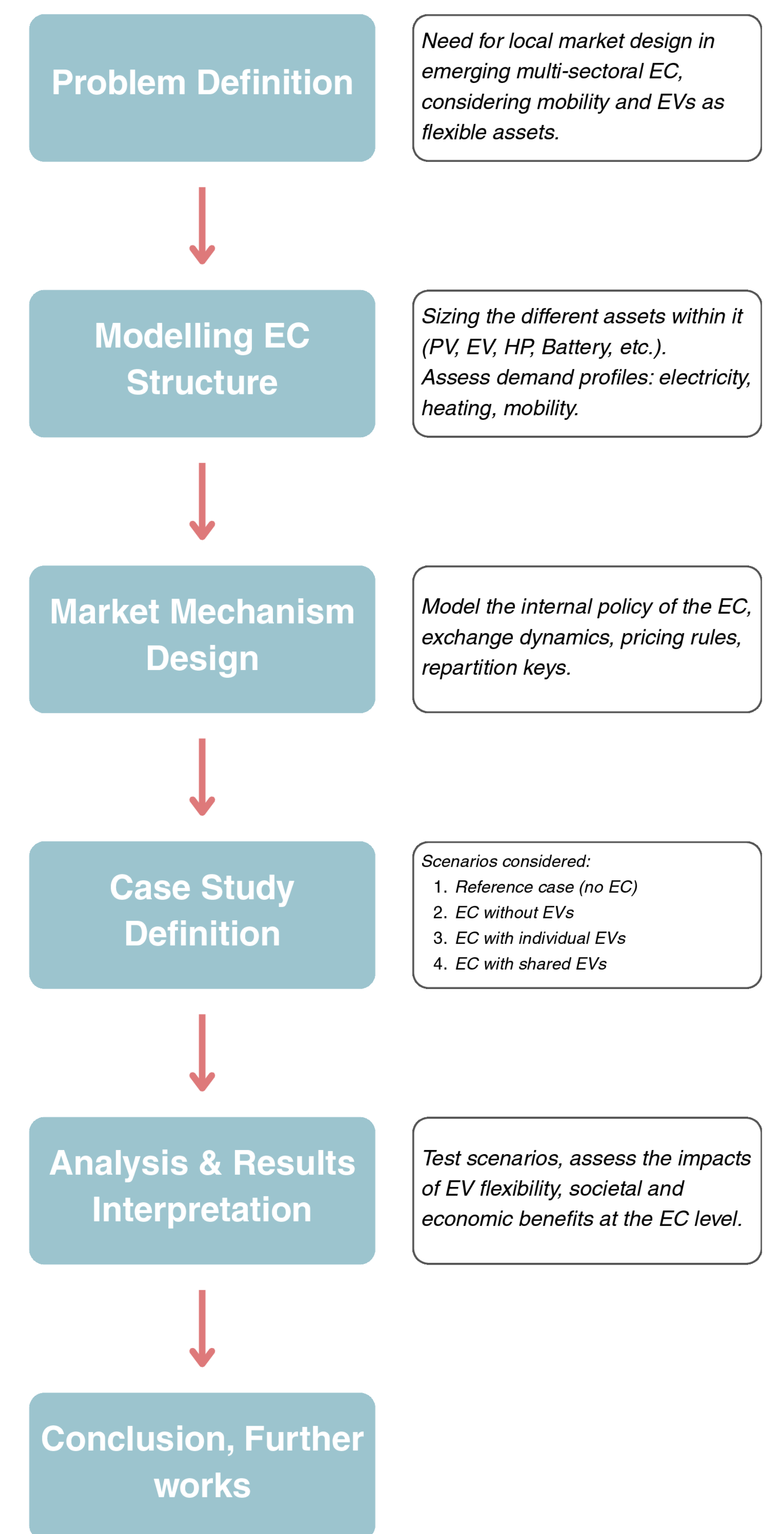
Community Design

Multi-sectoral EC Structure, Community and Building levels:



Methodology

The following approach will be used:



Two Key Problems

This research would tackle two key challenges in Energy Communities:

Sizing Problem
at the community level

Identify optimal capacities of personal and shared assets (EVs, PV, batteries, heat pumps, etc.) to fulfil energy and mobility demands efficiently.

Market Design
within the community

Develop fair and stable internal pricing and exchange mechanisms to coordinate members and incentivise investment in renewable assets.

Key Contributions & Open Questions

Main contributions of this research include:

Joint modeling:
Energy - Mobility
in multi-sectoral EC

Integration of V2G
technologies, shared EVs as
flexible community assets

Some questions remain open:

Inflexibility on mobility demand?

How to ensure fairness in internal energy and mobility exchanges?

How robust will the results be to the inherent uncertainties of these problems?

What incentives are needed to promote shared EV use?

Considered Resources

Key resources to be considered:

- Demand profiles**: electricity, heating, and mobility.
- Technology models**: PV, EV, batteries, HP.
- Pricing data**: heat and electricity tariffs.
- Others**: policy framework, optimization tools, and raw data from ULiège's mobility project.

My LinkedIn

Do not hesitate to scan the QR code for contacting me on *LinkedIn*.

