

Segmenting Households, Industry, and Communities to Tailor Sector Coupling Business Models

Theme 1, sub-topic 1c); Theme 4, sub-topic 4c)

“Academic contribution”

“Policy/practice contribution”

Marco A. Ortiz^{1*}, Anton Gerits² and Kris Kessels¹

1: Vlaamse Instelling voor Technologische Onderzoek (VITO)/EnergyVille
Boeretang 200, 2400 Mol, Belgium
e-mail: marco.ortizsanchez@vito.be, kris.kessels@vito.be.

2: REScoop.Vlaanderen
Posthoflei 3 bus 3, 2600 Berchem, Belgium
e-mail: anton.gerits@rescoopv.be

Keywords: Business models, User profiling, Sector Coupling, Tailoring

- INTRODUCTION

Achieving Europe’s climate neutrality by 2050 will require coordinated decarbonization across all sectors of society [1]. This requires ramping up renewable electricity generation and fostering sector coupling: the integration of energy uses in transport, buildings, and industry- to leverage technologies like EVs, PV, heat pumps, and battery storage in a unified system [1], [2]. Sector coupling entails linking renewable power with other energy sectors to create an efficient, interconnected system [3], and electrification of end uses is widely seen as a cost-effective decarbonization route across sectors[2] .

Despite the need for an integrated transition, public policies are often designed as “one-size-fits-all,” failing to account for the heterogeneous motivations and constraints of different actors. Citizens, businesses, and community energy initiatives exhibit diverse readiness levels and behavioral drivers, meaning uniform policies risk misalignment with on-the-ground realities. Recent research underlines that the effectiveness of energy interventions “depends on the diversity of the target audience,” and that simplistic segmentations (e.g. by income or usage) are insufficient to capture the complex technological and behavioral context of the energy transition [4] . To address this, a survey was designed, distributed, and responses were analyzed by applying a latent class analysis, a statistical method to identify hidden subgroups based on response patterns, across three domains: energy communities, industrial firms, and households, in Belgium. The aim is to uncover distinct archetypes in each domain, providing early insights into how different groups respond to energy transition policies and business model incentives. By identifying these archetypes, policymakers and business developers can tailor interventions (financial incentives, communication strategies, co-created programs) to better support sector coupling services and technology adoption within each group.

It should be noted that the findings presented here are preliminary. They form part of an ongoing mixed- method study in Belgium, wherein we triangulate quantitative LCA results with qualitative data (stakeholder interviews and literature) to refine our understanding of each segment. The full results, including integration of interview insights and detailed, co-designed business model archetypes for each segment, will be published in a forthcoming journal article. This extended abstract thus focuses on the initial class structures that emerged from the survey analysis, which will later be enriched by the interview layer and validated against real-world business model logic.



- **METHODOLOGY**

One survey per domain was developed and distributed. We collected survey data from three groups in Belgium (25 energy community members, 10 industry stakeholders, 10 households) and applied LCA to each dataset to identify latent classes. Three archetypes per domain were identified. The surveys covered factors such as investment readiness, perceived barriers, technology preferences, and trust. Given the small samples and complex behaviours, these quantitative results will later be triangulated with qualitative insights (interviews) to validate and enrich the profiles [4].

- **PRELIMINARY RESULTS**

Three distinct segments emerged for energy communities: EC1 large, mature initiatives with structured governance (frustrated by regulatory complexity and engaging via formal channels). EC2 small experimental pioneers (pursuing peer-to-peer microgrids and novel models, often wary of incumbent utilities). Finally EC3 grassroots cooperatives (socially motivated, deploying diverse tech, pragmatic with policy and high in community trust).

Three segments were identified among industrial firms; IND1's support gradual decarbonization via mechanisms like CfDs/PPAs). IND2s integrate sector coupling and long-term carbon neutrality into strategy, ready to invest in electrification and green hydrogen given stable rules. IND3 are smaller niche players open to pilot projects and regulatory sandboxes, more ambivalent toward rigid regulation).

The latent classes for households were: HH1 represent empowered homeowners installing PV, EVs, efficient heat pumps, driven by green values and cost savings. HH2 have low trust in providers and policy, unmotivated by incentives, little adoption of new tech. and HH3 values sustainability but hindered by external barriers like renting, policy confusion, or upfront costs.

- **IMPLICATIONS FOR BUSINESS MODELS AND SECTOR COUPLING**

These preliminary segments highlight how behavioural segmentation allows tailoring business models to each group's context. For instance, energy communities can be differentiated by formality and innovation-readiness: regulators might streamline rules and provide technical assistance for those belonging to EC1, offer sandbox environments and innovation grants to those identifying to EC2, and provide capacity-building support to grassroots groups, such as EC3.

Each type of community contributes to sector coupling differently, so support should be segmented accordingly.

In the industrial sector, business models can distinguish companies that need predictable long-term frameworks such as IND2. This is opposed to those that respond to targeted incentives IND1, and those that require flexibility for innovation, like archetype IND3.

For example, stable carbon pricing and infrastructure planning will enable IND2 to invest in electrifying processes and deploying green hydrogen, while IND3 might benefit from pilot programs and partnerships to test new models.

For household-level, segmentation suggests that programs be tailored to different levels of agency and trust. HH1 can be tapped as early adopters. For example, incentivized to participate in demand response or vehicle-to-grid programs that enhance grid flexibility. HH2 require rebuilding trust and lowering complexity: business models and policies should provide simpler incentives and use trusted local outreach to demonstrate the benefits of technologies like heat pumps or EVs. The HH3 points to the need for systemic solutions (e.g. landlord-tenant incentives, community solar, shared resources) to enable their participation despite structural hurdles.

Tailoring residential programs in this way can accelerate the uptake of distributed assets (EVs, PV, batteries, heat pumps) across all segments.

Another cross-cutting insight is the role of trust, perceived control, and stakeholder engagement. These “softer” factors vary considerably between the found groups. This underscores that successful incentive design is not only about the economic value proposition, but also about communication and design. Engaging stakeholders in the design of policy measures and new business models can improve receptivity. For example, co-designed interventions tend to achieve greater buy-in and effectiveness than top-down measures [5]. Our ongoing interviews with participants from each segment aim to delve deeper into these attitudinal dimensions, ensuring that the final intervention strategies and tailored business models are grounded in the lived experiences of the stakeholders themselves. Early evidence shows that bringing diverse perspectives can broaden business model innovation with system-level thinking [5]. Tools such as a recent energy community business model typology enable stakeholders to configure tailor-made models for their context [6]. Building on such insights, our next phase will develop segment-specific business model for each of the found archetypes.

- CONCLUSION

Latent class analysis has provided a data-driven map of hidden archetypes within three stakeholder groups. These preliminary segments reveal that different actors will embrace the sector coupling innovations in different ways. A nuanced understanding of these classes allows for more precise and inclusive business model design and development: rather than treating all actors as monolithic, business developers can craft segmented incentives, communication, and support programs that resonate with each group’s motivations and constraints. This approach can increase the uptake of critical technologies (from EVs and heat pumps in homes to multi-vector integration in industry) by aligning policy tools with stakeholders, thereby accelerating progress toward decarbonization.

These findings are preliminary; future work will integrate qualitative insights and co-designed business models. However, even at this early stage the segmentation provides immediate value for business model design and stakeholder engagement. By acknowledging heterogeneity and targeting business models accordingly, public authorities and energy providers can foster a more inclusive and effective energy transition.

- [1]B. van der Zwaan *et al.*, ‘Electricity- and hydrogen-driven energy system sector-coupling in net-zero CO₂ emission pathways’, *Nat. Commun.*, vol. 16, no. 1, p. 1368, Feb. 2025, doi: 10.1038/s41467-025-56365-0.
- [2]J. Ramsebner, R. Haas, A. Ajanovic, and M. Wietschel, ‘The sector coupling concept: A critical review’, *WIREs Energy Environ.*, vol. 10, no. 4, p. e396, 2021, doi: 10.1002/wene.396.
- [3]T. Vanhanen and M. Hanhijärvi, ‘Energy Policy Integration for Sector Coupling: A Scoping Review’, in *2024 20th International Conference on the European Energy Market (EEM)*, Jun. 2024, pp. 1–9. doi: 10.1109/EEM60825.2024.10608957.
- [4]F. Barjak, J. Lindeque, J. Koch, and M. Soland, ‘Segmenting household electricity customers with quantitative and qualitative approaches’, *Renew. Sustain. Energy Rev.*, vol. 157, no. 112014, Apr. 2022, doi: 10.1016/j.rser.2021.112014.
- [5]L. Gorissen, K. Vrancken, and S. Manshoven, ‘Transition Thinking and Business Model Innovation—Towards a Transformative Business Model and New Role for the Reuse Centers of Limburg, Belgium’, *Sustainability*, vol. 8, no. 2, Art. no. 2, Feb. 2016, doi: 10.3390/su8020112.
- [6]M. Kubli and S. Puranik, ‘A typology of business models for energy communities: Current and emerging design options’, *Renew. Sustain. Energy Rev.*, vol. 176, no. 113165, 2023, doi: 10.1016/j.rser.2023.113165.

