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PATHFNDR

Flexibility provision from electromobility and buildings

Synthesis Report

Executive Summary

A Report of the PATHFNDR consortium

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Executive Summary

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Disclaimer:
This report primarily presents research conducted within the PATHFNDR project, but includes selected external references where relevant to support, contextualize, or complement the findings. Detailed literature reviews can be found in the referenced papers and reports.

This report presents scenario-based results for Switzerland's energy system to 2050, focusing on the impacts of electric vehicle and heat pump flexibility. These are projections, not forecasts or predictions. They arise from empirical data and system modelling using least-cost optimization under the stated assumptions. Results depend on input data, socio-economic and technological assumptions, and methodological choices. They should therefore be interpreted as indicative "best estimate" values rather than precise figures, given uncertainties in technology uptake, prices, and regulation. The authors are responsible for the analysis and its interpretation.

AI tools have been used to assist in correcting grammar and style, as well as to rephrase certain sections for improved clarity and readability. The authors take full responsibility for the content of the final publication.

Executive Summary

Key messages

- **Flexibility is valuable for the energy system** as shifting electric vehicle and heat pump demand can enable higher renewable integration, lower system costs, lower net electricity imports, and lower average wholesale electricity prices, and reduce the additional capacity needed in gas plants and batteries.
- **Substantial flexibility is available** as electric vehicles and heat pumps offer shiftable demand: heat pumps can exploit buildings' thermal inertia and/or hot water storage, and electric vehicles can use flexibility within charging sessions or across charging locations.
- **Flexibility-aware planning** leverages end-user flexibility to defer and reduce the need for distribution grid upgrades by shifting and/or reducing the load from heat pumps and charging of electric vehicles, and limiting the power fed back to the grid by solar photovoltaics with modest losses in the energy production.
- **Flexibility-ready regulation** is key to enabling end-users, operators and aggregators to install infrastructure (e.g., nationwide "right to charge" compliant with smart charging standards), automate (e.g., interoperable, flexibility-ready controls), better participate and benefit from offering their flexibility (e.g., updated tariffs and market access).
- **Dynamic and hybrid tariffs** with default opt-out and automated control can shift the electricity consumption of electric vehicles and heat pumps to hours with low prices and high generation of renewable energy, delivering flexibility, cutting peaks, and deferring grid expansion.
- **End-user flexibility participation** scales when programs automate scheduling, use appliance-level direct load control, default to opt-out enrolment with clear overrides, and offer risk-hedging contracts, while protecting comfort and cutting costs.
- **Neighbourhood-scale flexibility** coordinates shared heat pumps and building thermal inertia in a common heating network, reducing peaks and grid congestion, maintaining comfort, lowering participation barriers, and enabling new revenue streams.
- **Public support of flexibility policies** is generally strong, and well-designed flexibility programs that reduce risk, protect comfort, and cut costs can scale participation.

Switzerland's energy transition requires the rapid uptake of electrification in transportation and heating, together with the total decarbonization of electricity supply. Achieving the national target of net-zero greenhouse gas emissions by 2050 will depend on integrating large amounts of new renewable generation while phasing out fossil fuels for heating and transport. Currently, hydropower serves as Switzerland's primary source of system-level flexibility, and controlled electric boilers are the main tool for grid-level flexibility. However, heat pumps (HPs) and electric vehicles (EVs) are emerging as valuable sources of additional, complementary demand-side flexibility across both system and grid levels.

This report highlights the role of HPs and EVs as key flexibility enablers, supporting this transition through both system-level balancing and grid-level management. Flexibility from HPs and EVs is relevant because it enables shifting electricity consumption to align with renewable energy generation, reducing system costs, lowering electricity prices and imports, and lowering stress on electricity grids. In this way, electrification can proceed reliably and affordably within the Swiss net-zero pathway. Realizing the full potential of this flexibility requires technological advances, updated regulatory and policy, and improved market and operational mechanisms. Accordingly, the report first discusses flexibility potential at system and distribution grid levels, then examines EV and HP flexibility, followed by regulatory, policy, operational and market mechanisms, social acceptance, includes challenges and opportunities and concludes with recommendations to stakeholders.

At a glance: System-level potential of HP and EV flexibility in Switzerland by 2050*

Scenario-based model results; values are approximate best estimates (not forecasts). All changes are given relative to a "Both off" scenario with no HP or EV flexibility.

- Substantial shiftable load (5 TWh from HPs and 3 TWh from EVs)
- Additional renewable integration (+4% via avoided curtailment of PV and wind)
- Lower total system costs (HP only: -2%, EV only: -2%, combined: -4%)
- Lower net electricity imports (HP only: -12%, EV only: -10%, combined: -22%)
- Lower average wholesale electricity prices (HP only: -5%, EV only: -2%, combined: -7%)
- Less gas-fired capacity needed (HP only: -8%, EV only: -14%, combined: -31%)
- Less system-level battery capacity needed (HP only: -11%, EV only: -17%, combined: -33%)

** Results are scenario-based projections for Switzerland to 2050 – not forecasts – derived from system modelling using least-cost optimization under stated assumptions. Figures are indicative "best estimate" values, conditional on input data and methods, with uncertainty in technology uptake, prices, and regulation.*

The results and analysis presented in this report, unless otherwise specified, assume a continued agreement for electricity system integration with neighbouring countries ("CH-EU Stromabkommen" [1]) and align with the Swiss energy system plans for 2050 as presented in the recent Electricity Supply Act ("Mantelerlass Stromversorgungsgesetz"/"Energiegesetz" [2]), including, e.g., increasing support for flexibility aggregation, dynamic network tariffs, and data access. The focus of the research is on Switzerland, while energy trading with neighbouring countries is considered for the system-level analyses. Major changes in the regulatory and policy frameworks of the Swiss energy transition (e.g., Switzerland's discontinued integration into EU electricity and balancing markets through the CH–EU Stromabkommen[1]) would change the role of EV and HP flexibility and may make their contribution even more valuable in the long-term. Future research aims to explore those possibilities further.

Flexibility potential at system level

Scenario-based modelling results for 2050 show that HP and EV flexibility can support Switzerland to meet its goals for 45 TWh of non-hydro renewables and net-zero CO_2 emissions. However, large-scale electrification can introduce significant new demand. By 2050, estimates of annual Swiss electricity consumption range from 9 TWh to 17 TWh for HPs and from 11 TWh to 17 TWh for EVs, depending on modelling assumptions (see full report in section **??**). Compared to an estimate of non-EV and non-HP annual consumption in Switzerland of 53 TWh in 2050, that means an additional electricity demand of at least 17% for HPs and at least 22% for EVs, while the total final energy demand falls.

If this demand is managed flexibly, the benefits are substantial. Simulations show that the system in 2050 makes good use of the available flexibility: 26% of Swiss HP demand (4.5 TWh) and 20% of Swiss EV demand (3.4 TWh) are shifted – a combined 8 TWh. For context, the contribution to shifted demand of batteries, net electricity imports, and pumped hydro generation were up to 1.0 TWh, 8.2 TWh, and 12.3 TWh, respectively, looking across the four scenarios studied.

Compared to a scenario with no EV or HP flexibility, HP flexibility can reduce net electricity imports by 12%, total system costs by 1.7%, and average wholesale prices by 4.9%; similarly, EV flexibility can reduce net electricity imports by 11%, total system costs by 2.1%, and average wholesale prices by 1.9%. However, with both types of flexibility combined we see even larger system benefits: nearly 4% more renewable generation through additional capacity and avoided curtailment, 22% lower net electricity imports, up to 4% lower total system costs, and around 7% reduced average wholesale prices, compared to the no flexibility case. In addition, combined EV and HP flexibility also reduce the need for investments in gas-fired plants (by up to 31%) and batteries (by up to 33%) compared to the system without EV or HP flexibility. These trends and positive system-level impacts are broadly confirmed by simulations with other electricity system models and scenarios [3].

Flexibility potential at distribution grid level

In the distribution level, the growing adoption of PVs, EVs, and HPs can stress Switzerland's low- and medium-voltage networks. Distribution networks in Switzerland are not dimensioned to handle very high shares of solar PV, EV charging, and HP unless flexibility measures are employed. Flexibility will be needed at the local level to reduce or defer costly grid reinforcements: transformer and cable upgrades due to overloads and/or voltage violations.

The analyses performed for over 50 MV and LV distribution grids show that flexibility through smart EV charging and HP control can reduce total required grid investments by a median of ~40% in urban areas, while limiting PV feed-in can reduce total grid investments by a median of ~40% in urban areas and ~ 50% in rural areas for 2040, with less than 3% annual energy loss when PV output is limited to the 70% of maximum production. These results underline the importance for utilities to implement flexibility-aware grid planning to manage peaks, and leverage local flexibility solutions [4; 5; 6; 7; 8; 9; 10; 11; 12; 13]. The median reductions are in relation to the investments that would be required by traditional planning methods when no flexibility measure is employed. It is noted that the results demonstrate maximum benefits based on the assumption that all HP, PV and EV charging infrastructure owners provide flexibility. In the meantime, it is important to emphasize that the level of uncertainty in estimating the available and reliable flexibilities is a significant challenge for the utilities.

Electric vehicle flexibility

Flexible EV charging is one solution to mitigate local congestions and integrate PV, particularly in urban areas with high adoption rates. The available flexibility varies with location and time and depends on technological and behavioural factors. Aligning EV charging with PV generation can reduce curtailment and enhance self-consumption, with workplace charging presenting an opportunity for demand shifting [14], as 40% of vehicles are parked near work or education locations during peak solar hours on weekdays [15]. Smart charging (V1G) and vehicle-to-grid (V2G) capabilities allow EVs to act as energy storage, shifting or discharging electricity to support the grid [16; 17]. V2G technology offers additional flexibility by allowing EVs to discharge energy back into the grid. V2G has the potential to reduce system-level PV curtailment even more than V1G by discharging ahead of high PV hours to make more space to charge and store more energy when PV production is high [18].

Heat pump flexibility

HPs offer flexibility in mitigating grid stress. HPs can be flexibly controlled to avoid peak loads (especially in winter), using thermal inertia of buildings and/or thermal energy storage (e.g., hot water tanks) to shift heating demand without losing comfort. Due to the high storage capacity of buildings, HP load can be curtailed for 2 to 10 hours at an outdoor temperature of 0℃ maintaining comfort levels (up to 10 hours in renovated or new Minergie-level buildings) [19]. As a reference, an average HP can shift about 7 kW over a 2-hour curtailment (around 14 kWh) at 0℃. Scaled to all buildings in Kanton Zürich, this would correspond to around 1.7 GWh of shiftable load if every building were equipped with a HP.

However, if not properly coordinated, HP curtailments can lead to rebound effects causing sudden demand surges, which will need to be properly managed by grid operators [19]. A promising solution involves community-level approaches that coordinate the thermal inertia of multiple buildings or use HPs and PV to serve multiple buildings. This concept was tested in the pilot and demonstration project “nanoverbund”, which demonstrated its ability to enhance flexibility, reduce grid congestion and peak demand, and improve overall efficiency [20].

Regulatory and policy mechanisms

Regulations and policies for demand-side flexibility are shifting from supporting “simple” to “flexible” electrification [21]. However, gaps remain, particularly regarding accessibility and costs of EV and HP infrastructure and operation. To unlock system benefits, now that technology is ready, flexibility-ready regulation should make it easy to install, automate, better participate and benefit from offering their flexibility.

Despite setting national targets for decarbonisation, Switzerland’s regulatory landscape is fragmented and flexibility-readiness is inconsistent across the country. For example, Switzerland lacks a nation-wide "right to charge" policy as well as binding requirements for compliance with smart charging and interoperability standards, creating barriers for tenants in e.g., multi-unit buildings who require charging access [21]. Some Swiss cantons provide subsidies for V1G and V2G chargers, but overall support remains inconsistent and prices sometimes prohibitively high (e.g., high station costs, tariff structures not yet aligned with flexibility needs, and double taxation on discharged energy) [18; 21]. Switzerland’s DSO–supplier model offers advantages for direct load control, but coverage is still limited [21; 22]. In addition, the majority of suppliers do not offer dynamic tariffs at all as they are not mandated to, preventing end-users to offer their flexibility. Targeted policies, like new or updated dynamic tariffs, clear aggregator market access, opt-in direct load control, and other financing options, are needed to expand adoption.

Initiatives in cities like Basel, Lucerne, and Bern put this into practice demonstrating how local policies can drive flexibility solutions – the nanoverbund concept. The concept forms neighbourhood micro-heating networks (around multiple connected buildings) that demonstrate shared heat use, pooled flexibility, new utility revenue streams, and lower participation barriers [20; 23].

Operational and market mechanisms

Beyond policy support, well-functioning electricity markets are essential for integrating flexibility services. Flexible loads can be managed by a variety of actors, such as system operators, aggregators, energy suppliers, or prosumers, which control the same loads, requiring coordination and priority rules to avoid conflicting signals and grid / device violations.

Direct control of flexible loads by energy suppliers and aggregators can produce efficient results but faces implementation challenges related to privacy concerns, infrastructure costs, and consumer acceptance [21; 24]. The efficiency of dispatch in case of direct load control depends on how accurately the dispatch impact on the grid is taken into account and balanced against the dispatch impact on wholesale markets and balancing markets.

Dynamic prices can incentivize EV charging and HP operation at optimal times. They are less intrusive than direct load-control, but require regulatory updates that expand availability to consumers on top of social acceptance challenges [21]. Hybrid pricing models, combining dynamic volumetric and capacity-based pricing, are a solution to prevent over-coordination of automated loads and stabilize grid demand [25]. Additionally, profile contracts, in which consumers pre-agree on electricity consumption patterns, are a promising solution that can reduce price volatility while still incentivise flexibility participation [26]. Moreover, by bidding the aggregated flexibility of their flexible loads in day-ahead and intraday auctions, aggregators and energy suppliers can lower the electricity costs for their customers and improve system efficiency [27].

Social acceptance

Consumer acceptance is another critical factor in determining the success of flexibility initiatives. Surveys indicate that preferences vary significantly, with some consumers prioritizing cost savings while others value convenience and comfort [28]. Around 30% of Swiss consumers are willing to accept some level of comfort reduction to lower electricity costs, whereas 70% will only offer flexibility if it does not impact their comfort [28]. Furthermore, most consumers prefer direct load control of individual appliances over demand-response approaches that limit their total electricity usage [28]. Automation reduces aversion to price volatility by handling scheduling in the background, making dynamic time-of-use tariffs about as acceptable as static tariffs [29]. Opt-out (default) enrolment boosts participation compared with opt-in designs [30]. Comfort can be preserved through device limits with easy user override (e.g., minimum EV state-of-charge, indoor temperature bands). Contract menus (e.g., flat-rate with automatic direct load control, or time-of-use for non-automated users) can accommodate different preferences and prevent rebound peaks [31]. Finally, profile contracts can hedge bill volatility while keeping incentives for load shifting and reductions, improving acceptability for risk-averse households [26; 32].

Recognizing these preferences is crucial for designing effective flexibility programs, as surveys reveal that the Swiss public generally supports flexible EV charging and HP integration [33].

Challenges and opportunities

Unlocking the full potential of flexibility from HPs and EVs still faces several obstacles. On the technical side, Switzerland's distribution grids are not dimensioned for widespread electrification, leading to risks of local congestion and costly reinforcements. Policy gaps persist, such as the absence of a nationwide “right to charge" compliant with smart charging standards, slow adoption of dynamic tariff structures, and inconsistent support for flexible-ready (i.e., automated, controllable) infrastructure. High upfront investment costs for EVs and HPs, along with consumer concerns over comfort and convenience, further limit adoption of flexibility.

To address these barriers, demand-side flexibility solutions are: (1) V1G and, where cost-effective, V2G strategies; (2) controlled HP operation that exploits buildings' thermal inertia, thermal storage, and shared heating networks; (3) flexibility-ready regulation that makes it easy for end-users, operators, and aggregators to participate and offer their flexibility; (4) dynamic or hybrid tariff models that reward flexibility; and (5) expanded market access for aggregators to integrate flexibility services into wholesale and balancing markets. Adopting flexibility-aware distribution grid planning frameworks enables utilities to identify cost-effective flexibility options that defer or reduce grid infrastructure investments. Together, these solutions can help Switzerland to accelerate the proliferation of EVs and HPs to reach its decarbonization targets, integrate them seamlessly into distribution grids, and enable additional services to upper grid levels, while providing benefits for consumers and utilities.

Summary and future work

The full report highlights the contributions of HP and EV flexibility, identifies the main challenges to their integration, and outlines possible solutions and stakeholder actions. Stakeholders across Switzerland including policymakers, electricity system operators, EV and HP providers, flexibility aggregators, cantons, municipalities, and end-users can all draw on the PATHFNDR research presented in this report to better understand the value of EV and HP flexibility, the barriers to its adoption, and the next steps needed to unlock its full potential in Switzerland.

Future work should focus on deepening the understanding of EV and HP flexibility synergies, adoption barriers, user behaviour, and real-life implementation to support scalable integration into Switzerland's energy system.

Recommendations to stakeholders

- **Federal government:** Enable flexibility-readiness by supporting combined electric vehicle and heat pump adoption, mandating nationwide "right to charge," requiring flexibility-ready controls, smart charging standards, and mandating suppliers to offer dynamic tariffs, and aligning market rules to allow actors to participate in flexibility services, reducing system costs, lowering net electricity imports, and supporting renewable integration.
- **Canton and municipality:** Promote local flexibility by providing incentives for controllable heat pumps, shared thermal networks, and smart electric vehicle charging (V1G/V2G) to scale participation, reduce grid stress and unlock new revenue streams for end-users.
- **Transmission system operator:** Coordinate with distribution system operators to ensure flexible resources can support both system balancing and local grid management, reduce costs, and improve grid stability.
- **Distribution system operator / utility:** Ensure that the grid models for low voltage networks (i.e., network layer 7) are available for grid simulations, which will enable effective adoption of flexibility-aware grid infrastructure planning frameworks that leverage end-user flexibility to defer and reduce the need for distribution grid upgrades by (i) shifting and/or reducing the load due to HPs and EV charging, (ii) limiting the PV feed-in, and (iii) taking into account the voltage support provided by PVs.
- **Aggregator and energy supplier:** Scale dynamic and hybrid tariffs with default opt-out, automation, appliance-level direct load control, and risk-hedging contracts to boost end-user participation while enabling aggregators to reduce procurement risks, access new revenue streams, and build scalable business models.
- **Technology provider and manufacturer:** Deliver flexibility-ready devices with open standards (e.g., SmartGridready), control automation, and measurement interfaces to enable flexible, grid-friendly operation, expand market access, facilitate interoperability, and increase the value of devices through participation in flexibility services.

The full report presents detailed recommendations tailored to each stakeholder group.

Bibliography

[1] B. für Energie (BFE), “Stromabkommen schweiz – eu.” https://www.bfe.admin.ch/bfe/de/home/versorgung/stromversorgung/stromabkommen-schweiz-eu.exturl.html, 2025. Last update: 13.06.2025.

[2] Swiss Federal Office of Energy (SFOE), “Federal act on a secure electricity supply.” https://www.bfe.admin.ch/bfe/en/home/supply/electricity-supply/federal-act-renewable-electricity-supply.html/, 2024. Accessed: 2025-3-12.

[3] Z. Wang and E. Trutnevyte, “Demand-side flexibility of electric vehicles and heat pumps in the swiss electricity system with high shares of renewable generation,” *Energy*, p. 138903, 2025.

[4] J. Bader, B. Heimbach, E. Kaffe, and et al., “Method for flexible long-term planning with agile adaption to changing requirements,” in *CIRED Glasgow*, 2017.

[5] F. R. Segundo Sevilla, D. Parra, N. Wyrsch, M. K. Patel, F. Kienzle, and P. Korba, “Techno-economic analysis of battery storage and curtailment in a distribution grid with high pv penetration,” *Journal of Energy Storage*, vol. 17, pp. 73–83, 2018.

[6] S. Klyapovskiy, S. You, H. Cai, and H. W. Bindner, “Incorporate flexibility in distribution grid planning through a framework solution,” *International Journal of Electrical Power Energy Systems*, vol. 111, pp. 66–78, 2019.

[7] J. Stiasny, T. Zufferey, G. Pareschi, D. Toffanin, G. Hug, and K. Boulouchos, “Sensitivity analysis of electric vehicle impact on low-voltage distribution grids,” *Electric Power Systems Research*, vol. 191, p. 106696, 2021.

[8] S. Fahmy, R. Gupta, and M. Paolone, “Grid-aware distributed control of electric vehicle charging stations in active distribution grids,” *Electric Power Systems Research*, vol. 189, p. 106697, 2020.

[9] R. Gupta, F. Sossan, and M. Paolone, “Countrywide pv hosting capacity and energy storage requirements for distribution networks: The case of switzerland,” *Applied Energy*, vol. 281, p. 116010, 2021.

[10] R. Gupta, A. Pena-Bello, K. N. Streicher, C. Roduner, Y. Farhat, D. Thöni, M. K. Patel, and D. Parra, “Spatial analysis of distribution grid capacity and costs to enable massive deployment of pv, electric mobility and electric heating,” *Applied Energy*, vol. 287, p. 116504, 2021.

[11] A. Heider, L. Kundert, B. Schachler, and G. Hug, “Grid reinforcement costs with increasing penetrations of distributed energy resources,” in *2023 IEEE Belgrade PowerTech*, pp. 01–06, 2023.

[12] N. Savvopoulos, A. Marinakis, Y. C. Evrenosoglu, and T. Demiray, “D2.3.2a: Flexibility-aware planning of distribution network reinforcements,” tech. rep., PATHFNDR, 2025.

[13] C. Y. Evrenosoglu, T. Demiray, P. Buchecker, A. Nazaré, D. Incesu, and R. Tessier, “Distribution grid planning in switzerland considering local flexibilities,” *CIRED Geneva*, 2025.

[14] Z. Wang, J.-P. Sasse, and E. Trutnevyte, “Home or workplace charging? spatio-temporal flexibility of electric vehicles within swiss electricity system,” *Energy*, vol. 320, p. 135452, 2025.

[15] M. P. Herrera, M. Schwarz, and G. Hug, “Spatio-temporal modeling of large-scale bev fleets’ charging energy needs and flexibility,” in *2024 International Conference on Smart Energy Systems and Technologies (SEST)*, pp. 1–6, IEEE, 2024.

[16] B. Koirala, R. Mutschler, A. Bartolini, A. Bollinger, and K. Orehounig, “Flexibility assessment of e-mobilty in multi-energy districts,” in *CIRED Porto Workshop 2022: E-mobility and power distribution systems*, Institution of Engineering and Technology, 2022.

[17] F. Bellizio, Y. Guo, and P. Heer, “Sector-coupled vehicle-to-everything operation of ev fleets for demand-side flexibility provision,” *Energy*, vol. 337, p. 138508, 2025.

[18] D. Andersen and S. Powell, “Policy and pricing tools to incentivize distributed electric vehicle-to-grid charging control,” *Energy Policy*, vol. 198, p. 114496, 2025.

[19] C. Meister, S. Schneeberger, and P. Schuetz, “Bottom-up heat pump flexibility estimation for swiss buildings considering monitored building data,” *In prep*, 2025.

[20] B. Bernadino, H. Cai, B. Koirala, P. Schuetz, and P. Heer, “Decentralized energy communities with heat prosumers: economic and ecological performance,” *In prep*, 2025.

[21] A. Mellot, C. Moretti, A. Nuñez-Jimenez, J. Linder, N. Moro, S. Powell, J. Markard, C. Winzer, and A. Patt, “Electrification, flexibility or both? emerging trends in european energy policy,” 2025.

[22] A. Mellot, J. Linder, J. Garrison, C. Winzer, G. Sansavini, C. Meister, P. Schütz, and C. Moretti, “Exploratory analysis of direct load control policies for heat pumps in the future swiss electricity system,” *2025 21st International Conference on the European Energy Market (EEM)*, 2025.

[23] L. Miehé, 2025.

[24] C. Winzer, P. Ludwig, S. Auer, and A. Hlawatsch, “Netflex: Effiziente netzentgelte für flexible konsumenten,” tech. rep., 2023.

[25] C. Winzer and P. Hensler-Ludwig, “Design and impact of grid tariffs,” *Energies*, vol. 17, no. 6, p. 1364, 2024.

[26] C. Winzer, H. Ramírez-Molina, L. Hirth, and I. Schlecht, “Profile contracts for electricity retail customers,” *Energy Policy*, vol. 195, p. 114358, 2024.

[27] T. Hübner and G. Hug, “Package bids in combinatorial electricity auctions: Selection, welfare losses, and alternatives,” *Operations Research*, 2025.

[28] C. Winzer and H. Zhang, “Cost focus versus comfort focus: Evidence from a discrete choice experiment with swiss residential electricity customers,” *The Energy Journal*, vol. 45, no. 2, pp. 209–235, 2024.

[29] M. J. Fell, D. Shipworth, G. Huebner, and C. Elwell, “Public acceptability of domestic demand-side response in great britain: The role of automation and direct load control,” *Energy Research Social Science*, vol. 9, pp. 72–84, 2015.

[30] B. Parrish, R. Gross, and P. Heptonstall, “On demand: Can demand response live up to expectations in managing electricity systems?,” *Energy Research Social Science*, vol. 51, pp. 107–118, 2019.

[31] P. Ludwig and C. Winzer, “Tariff menus to avoid rebound peaks: results from a discrete choice experiment with swiss customers,” *Energies*, vol. 15, no. 17, p. 6354, 2022.

[32] W. Elsenbast, C. Winzer, and U. Trinkner, “Dynamische stromtarife – wie können sie für haushalte und kmus attraktiver werden?,” *ET. Energiewirtschaftliche Tagesfragen*, vol. 12/2024, pp. 57–63, 12 2024.

[33] M. Krainz, V. Sorgato, I. Vallaeys Mora, E. Trutnevyte, and T. Brosch, “Identifying and validating the strongest predictors of informed energy policy support across europe,” *Research Square Preprint*, 2025. Preprint. Version posted September 30, 2025.