

Local energy communities for an inclusive energy transition

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Context



Why Local Energy Communities

- Swiss Energy Perspectives 2050+ → strong PV expansion on private roofs.
- Challenges: grid capacity, platform for decentral trading.
- Local markets enable participation even without own generation assets



Background Inclusion & Justice

- 60% of Swiss households rent; most lack PV access or ownership rights
- Income and knowledge barriers limit participation.
- Develop socially fair local electricity markets for all, including low-income renters.



Motivation

- Rapid renewable expansion causing local grid stress
- Growing demand for social acceptance & fairness
- Accelerating electrification across buildings, mobility, and industry

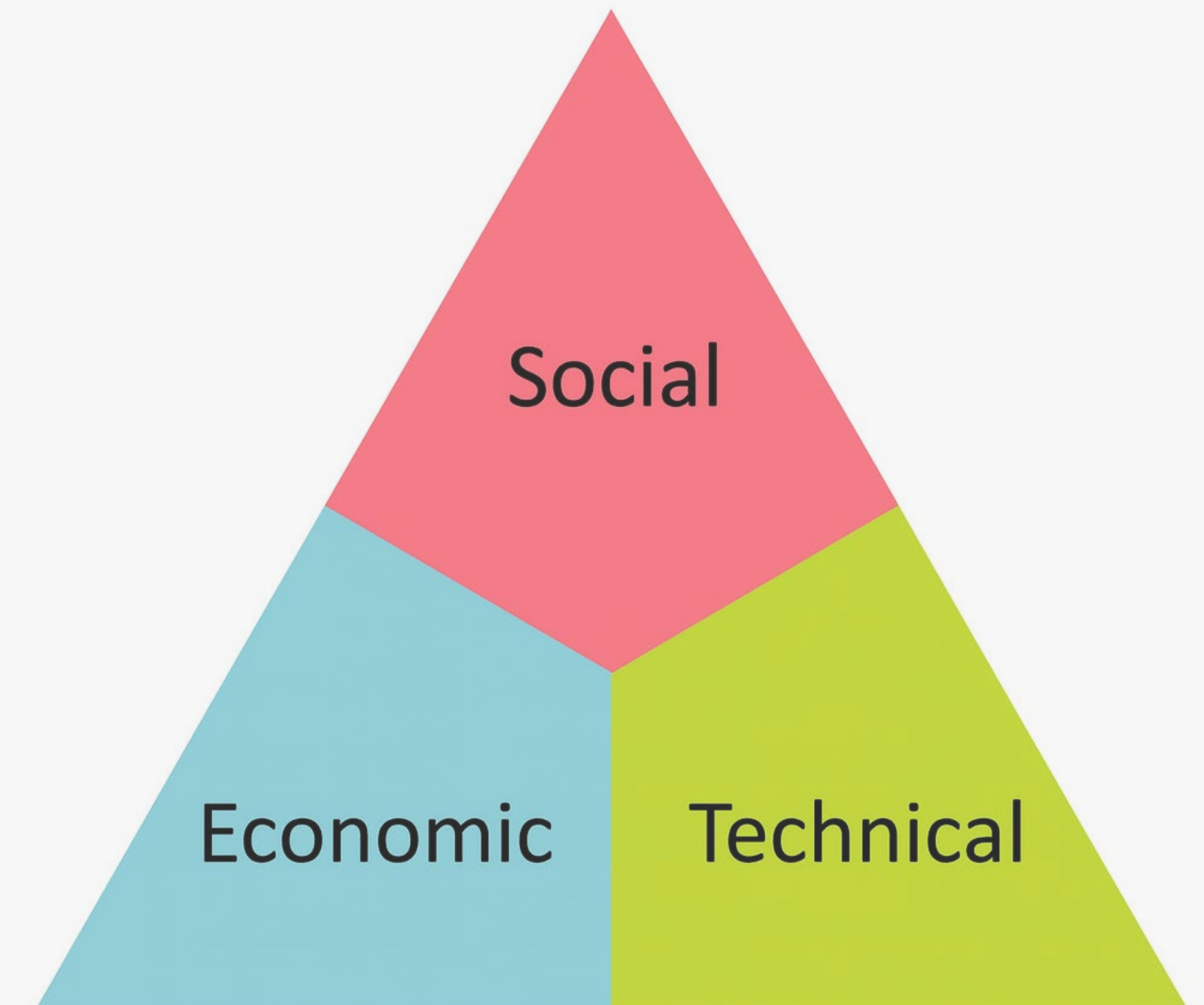
Research Objectives and methodology

Objectives

- Explore inclusive and scalable designs for local energy communities
- Integrate technical, organizational, and social perspectives
- Address how to include tenants and low-income households
- Assess future scenarios and the influence on energy security

Methodology

- Transdisciplinary mix of qualitative and quantitative methods.
- Focus on the integration of prosumers and pure consumers
- Combine techno-economic modelling with social research on participation and behaviour.



How LECs contribute to Energy Security

Energy Security Dimension	Contribution of Swiss LECs
Reliability	Local balancing reduces grid stress; storage improves outage resilience
Affordability	Shared PV lowers bills; communities shield consumers from high wholesale prices
Sustainability	Faster PV deployment, efficient electrification, local flexibility
Resilience	Microgrid capability, backup services, better response to climate events
Social Acceptance	Citizens actively co-own and co-benefit, reducing opposition to local projects

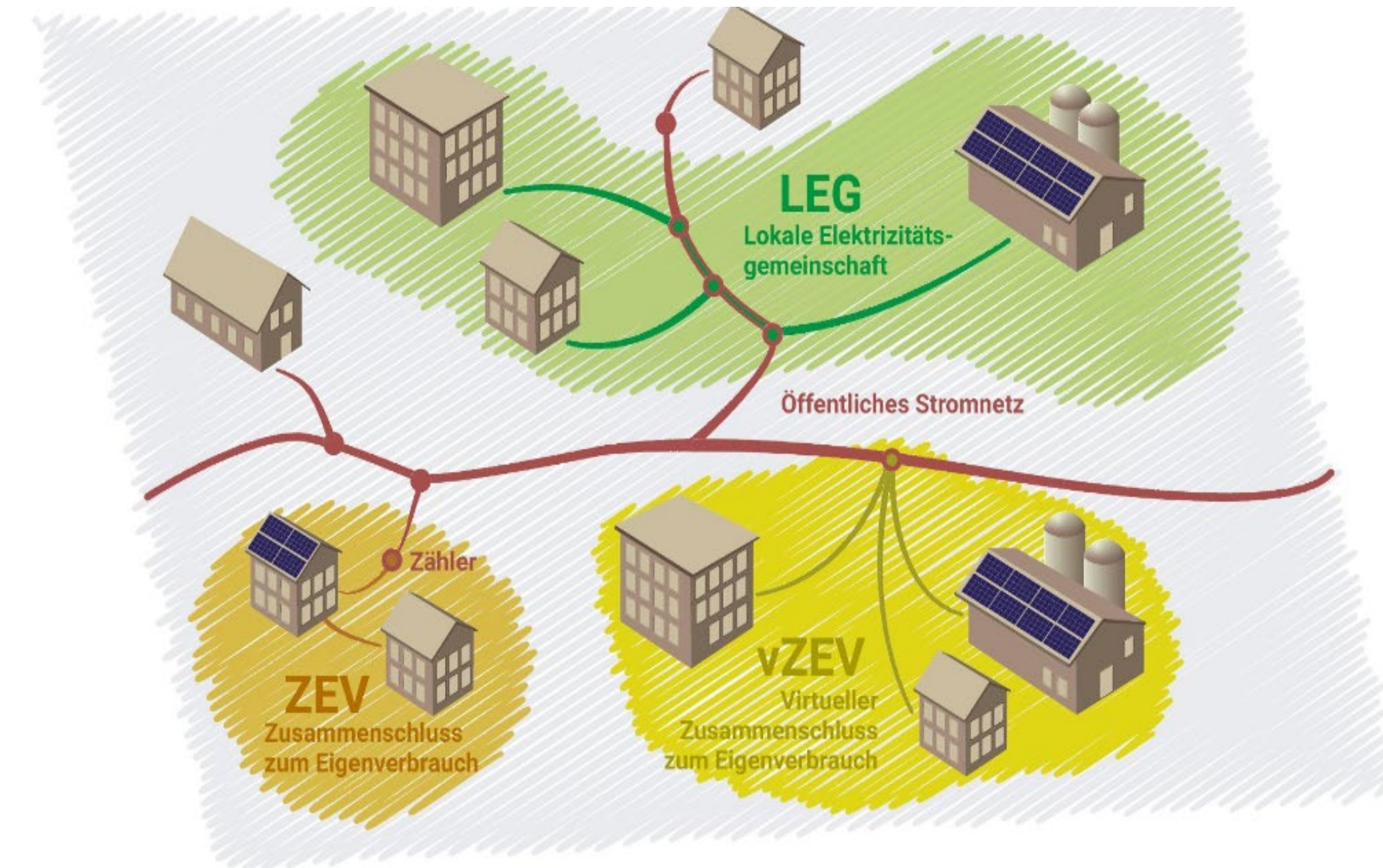
Policy framework in Switzerland (1/2)

Self-Consumption Communities (ZEV)

- Introduced 2018
- Building-level or multi-building communities
- Focus: collective PV self-consumption and local optimisation

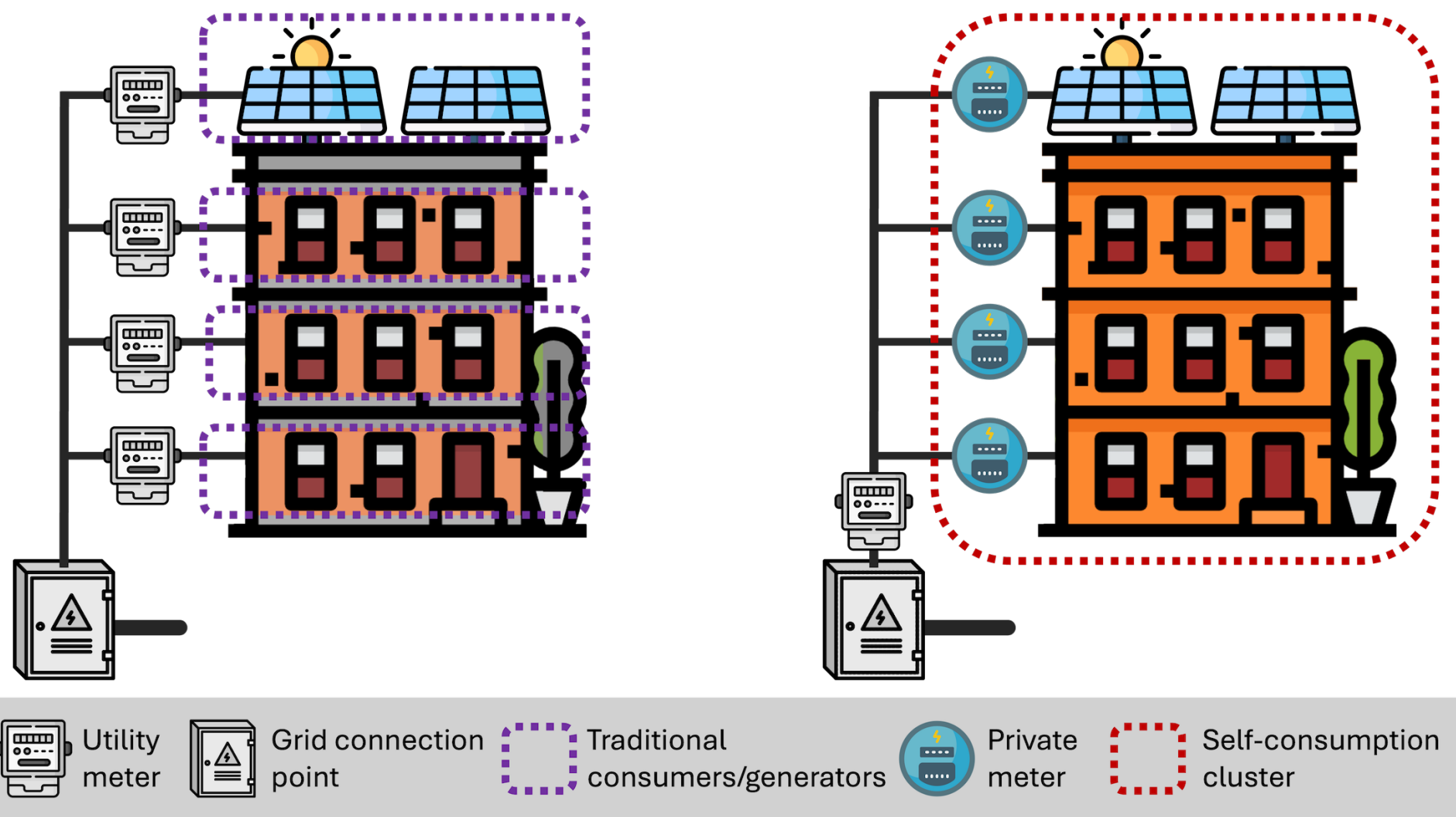
Renewable Energy Communities (RECs) – *currently being implemented (2025)*

- Enabled by Energy Act revisions
- Municipality or neighbourhood-scale
- Allow shared production, storage, and community energy services
- Prepare Switzerland for EU-compatible energy governance

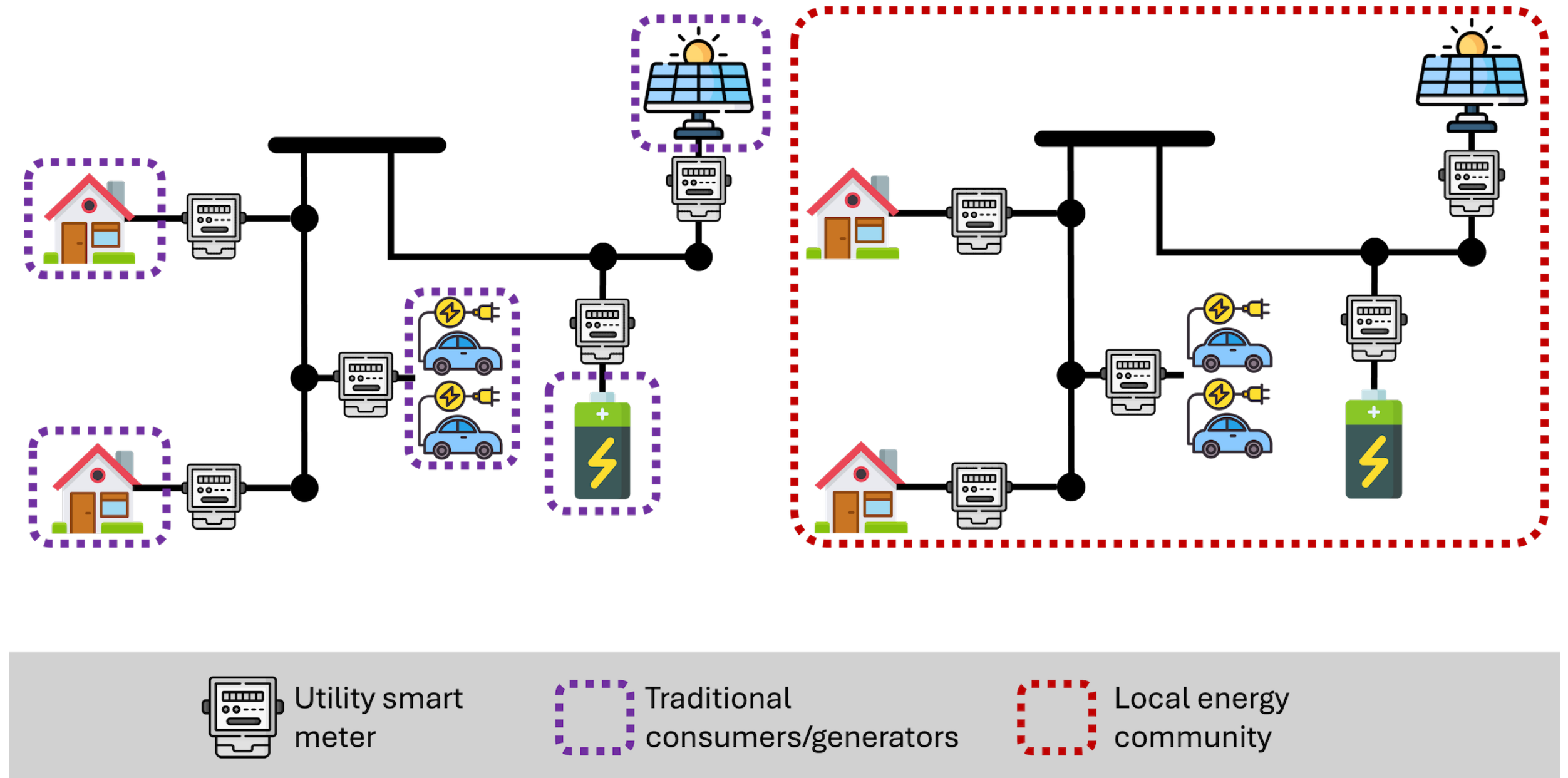


Policy framework in Switzerland (2/2)

Self-consumption clusters (ZEV) / virtual self-consumption clusters (vZEV)



Local energy communities (LEG)



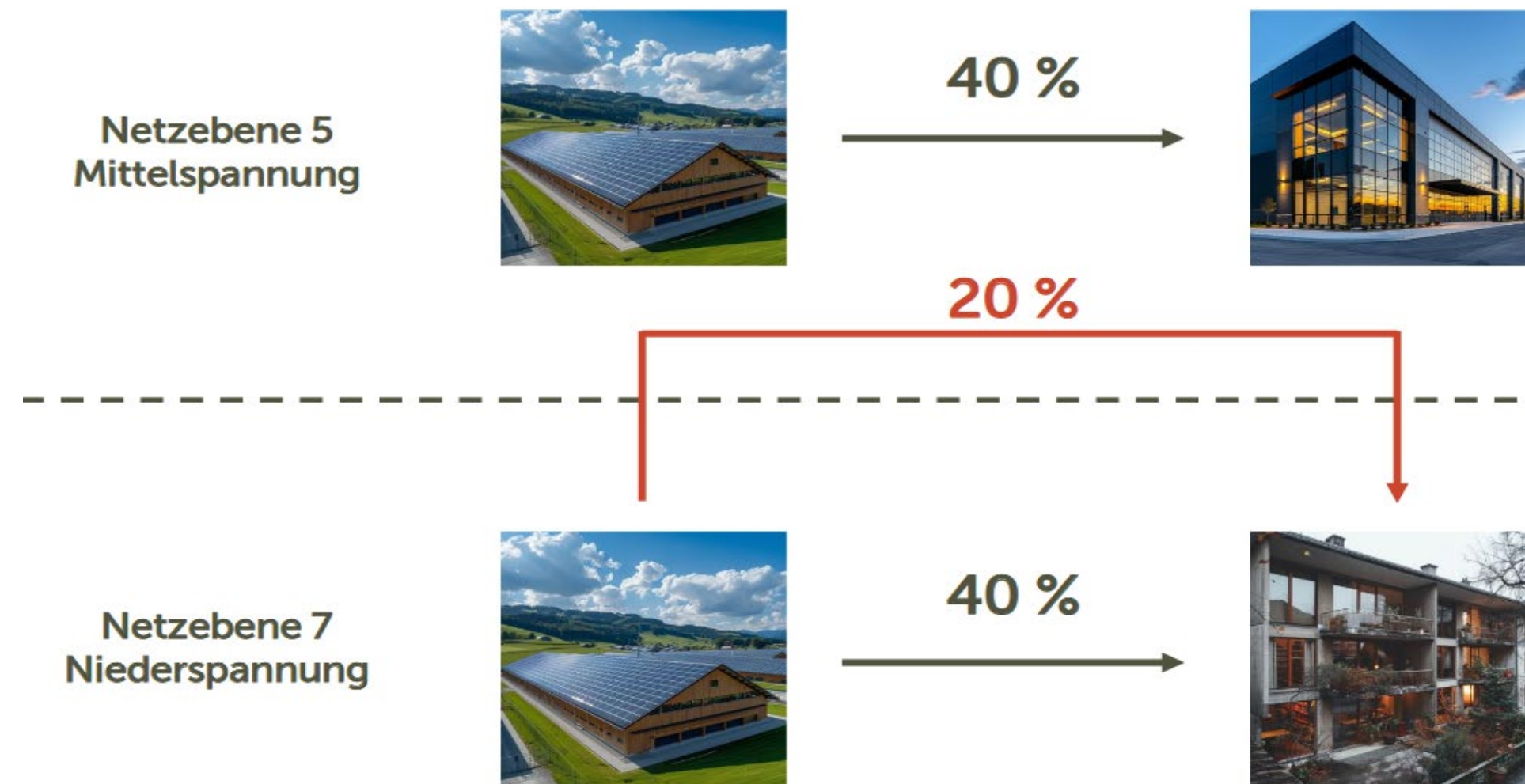
Source: <https://gridlab.hevs.ch/en/2025cel/index.html?>

Influence of LEC on grid usage fees for households

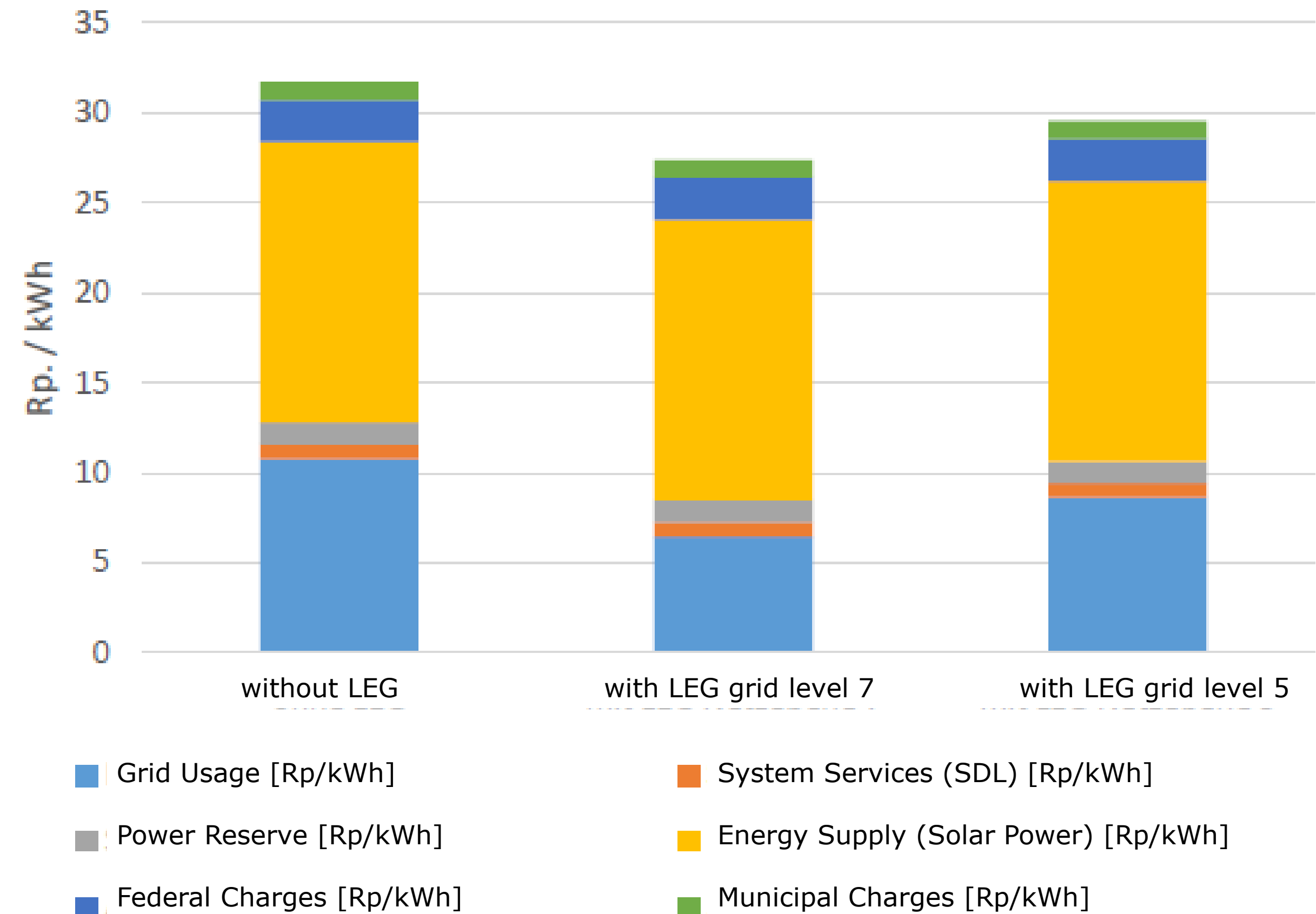
A household (type H4) could achieve annual savings based on reduced grid usage charges by joining a LEG. The calculation assumes full electricity consumption from a LEG:

$$(4.32 \text{ Rp./kWh} - 2 \text{ Rp./kWh}) \times 4500 \text{ kWh} = \text{CHF } 104.4/\text{y}$$

This is the estimated net gain after deducting billing costs.



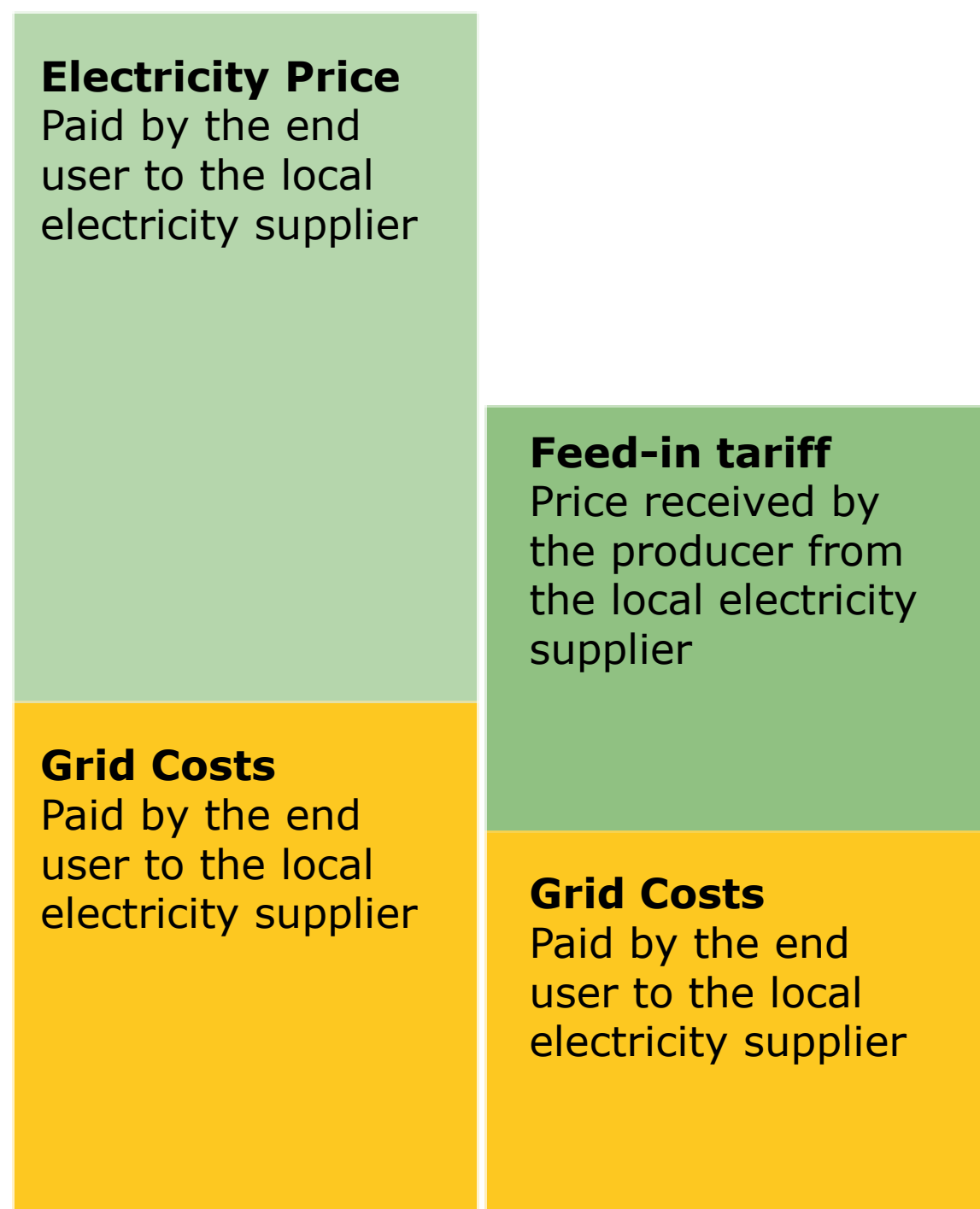
Solar Power Prices Median Values Households H4, Total Costs in Rp./kWh



Financial Added Value for All Participants

The electricity delivered directly within a LEG is cheaper than grid electricity from the utility provider. These savings can be shared among community members.

Consumption | Production



→ **Feed-in Tariff:** The price paid by the utility to the producer is usually significantly lower than the retail electricity price.

Additionally, electricity delivered directly within the LEG benefits from a **20–40% reduced grid usage fee.**

Category	Cost Element	Without LEC	Grid Level 7	Grid Level 5
Grid-Related	Grid Usage [Rp/kWh]	10.80	6.48	8.64
	SDL [Rp/kWh]	0.80	0.80	0.80
	Power Reserve [Rp/kWh]	1.20	1.20	1.20
Energy Supply	Solar Energy [Rp/kWh]	15.60	15.60	15.60
Charges	Federal Charges [Rp/kWh]	2.30	2.30	2.30
	Municipal Charges [Rp/kWh]	1.00	1.00	1.00
Total Costs [Rp/kWh]		31.70	27.38	29.54
% of Baseline		100%	86%	93%

Economical calculations of different LEC scenarios

a) Industrial LEG:

Producer with large surplus generation and low self-consumption. Community with several consumers (industrial rooftop + 3 apartments OR school + retirement home).

Scenario	NPV (CHF)	IRR
Without Storage – Small Consumers (2 × H5 and 2 × H2)	-12,808	2.72%
With Storage (10 kWh) – Small Consumers (2 × H5 and 2 × H2)	-12,314	2.89%
Without Storage – Large Consumers + 2 × H5	-3,124	3.77%
Without Storage – Combination ZEV – LEG & Large Consumers + 2 × H5	+38,773	7.58%
Without Storage – 40 × H5 Apartment Units	+85,362	11%

b) Neighborhood LEG:

Association of prosumers formed because the grid topology does not allow self-consumption. (2 single-family homes with PV installations + 2 apartments)

Scenario	NPV (CHF)	IRR
Without Storage	-5,218	1.19%
With Storage (10 kWh)	-8,453	0.53%
Combination ZEV – LEG without Storage	-1,406	3.29%
Combination ZEV – LEG with Storage (10 kWh)	-4,652	2.15%

Strategic Role of LECs in Swiss Energy Security

Economic

- Reduced energy costs: **10–25% for participating households**
- Lower exposure to high-price periods
- Stronger business case for PV & batteries when shared

Social Inclusion

- Cooperative models reduce entry barriers
- Shared assets support low-income households
- Communities create *local energy citizenship* and engagement

Municipality Benefits

- Increased autonomy
- Better planning capability and local reinvestment cycles



Conclusion

- Switzerland's LECs are scaling rapidly and have strong potential to support energy security
- They provide flexibility, resilience, and cost savings
- They reduce exposure to market volatility and supply shocks
- Their inclusive structure makes the energy transition more socially equitable
- With targeted policies, they can become a central pillar in Switzerland's 2030–2050 energy strategy



Outlook

- Model the influence of LECs under the new Swiss regulatory framework on local and national energy security.
- Integrate social and inclusivity dimensions by analysing how LECs can support vulnerable groups, reduce energy poverty, and strengthen community participation.
- Explore governance and market design options that enable LECs to provide flexibility, resilience, and fair access to all citizens.
- Investigate long-term system impacts, including interactions with DSOs, municipalities, and emerging local energy markets
- Assess the role of LECs across multiple future scenarios, including higher electrification, renewable expansion, and climate-related stress events.

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Questions

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