Zürcher Hochschule
für Angewandte Wissenschaften
School of
Engineering
INE Institut für
Nachhaltige Entwicklung

Grid financing strategies under increasing decentralisation:

A simulation analysis of grid tariff designs for BKW

Presentation at the SimLab workshop 15th of March 2016

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BKW

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Project task and research question

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- Grid financing during times of the decentralisation of energy systems.
- Self-consumption reduces amount paid for the grid
- «Desolidarisation» of the grid

What are the impacts of alternative tariff designs on the decentralisation and the feedback to the tariff level?

Grid financing under decentralisation

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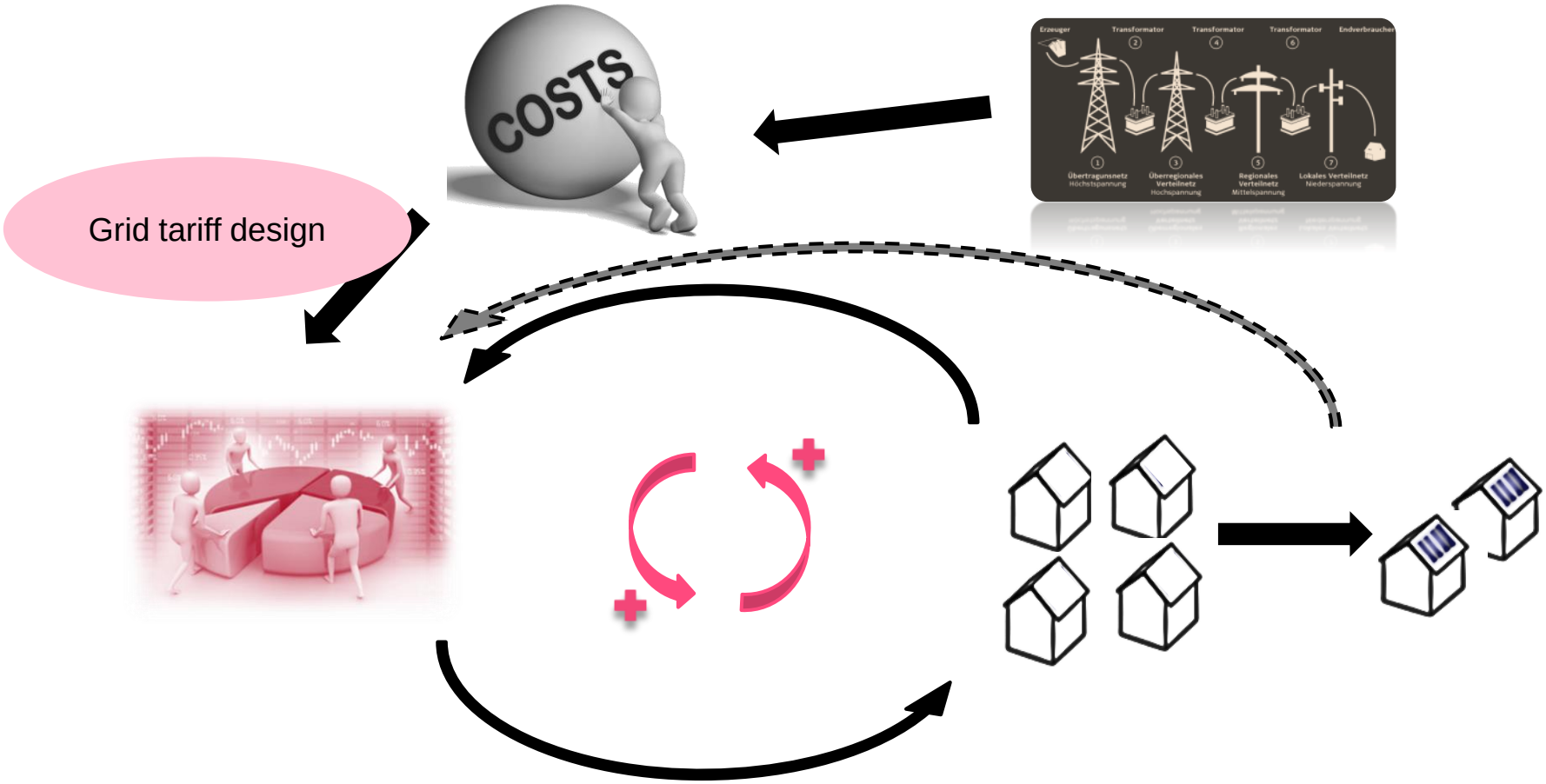

Dilemma

„Death spiral“ from the perspective of grid operators and utilites

„Success spiral“ for self-consumption concepts and renewable energies

Simulation model

Why a System Dynamics model?

- Easy modelling of the death spiral with adaptive tariff level.
- Long-term simulation of the diffusion
- Suitable for strategy testing (=> alternative tariff systems)

Modelling process

- Existing base model (Kubli et al, 2016; Decentralisation dynamics)
- Work on extending and calibrating the model for the specific task and the selected regions
- Strategy analysis for the different tariff designs
- Interactions with the client: to narrow down the task, discuss on suitable model structures, data exchange, validation.

Self-consumption concept for a one-family house

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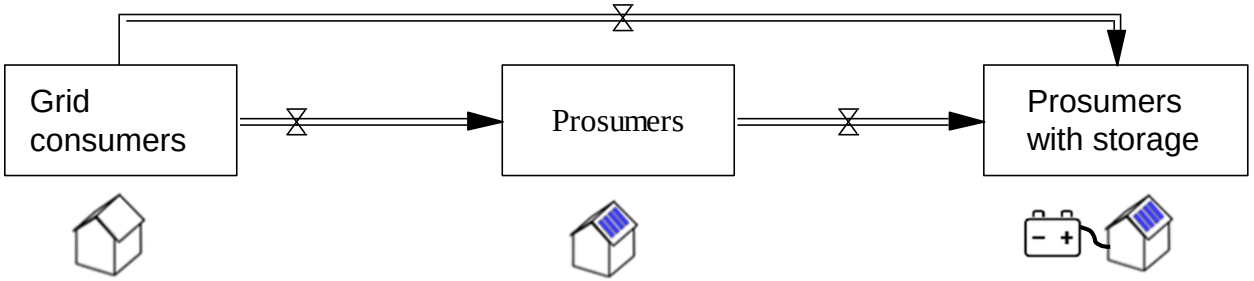
Differentiation of:
- One-family houses
- Multi-family houses
- Industry



Installed decentral technology	None	PV plant (6 kWp)[a]	PV plant (6 kWp) battery (7 kWh)
Total electricity demand	4520 kWh/year[a]	4520 kWh/year[a]	4520 kWh/year[a]
Autarky level	0%	35%[b]	60%[b]
Excess production	0	4424 kWh/year[b]	2765 kWh/year[b]
Peak demand	0.3 kW[c]	0.3 kW	0.15 kW
Subsidies	None	• FIT • From 2014: One-time reimbursement[d]	• FIT • From 2014: One-time reimbursment[d]

[a] BKW, [b] Weniger et al (2014), [c] Synergrid, [d] BFE.

Feedback loops in the model

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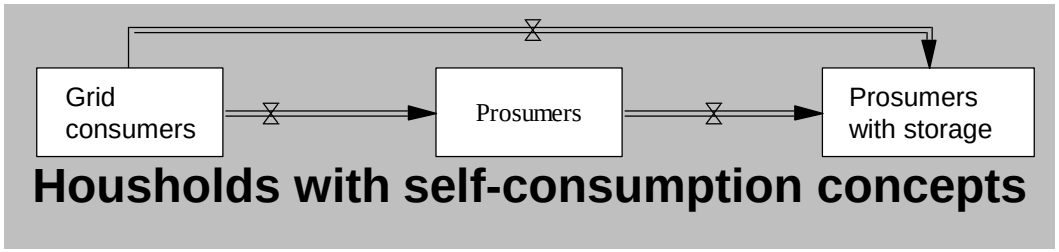

Adjustment of grid tariff

Learning theory

Scarcity effect

Attractivity of self-consumption concepts

Complementaries

Technology costs

Kubli, M., & Ulli-Beer, S. (2016). Decentralisation dynamics in energy systems: A generic simulation of network effects. *Energy Research & Social Science*.

Based on literature on network effects:
Complementaries: Gupta et al. 1999
Learning theory: Abrahamson & Rosenkopf, 1997; Basu et al. 2011; Sterman 2000; Bollinger & Gillingham (2012)
Adjustment of grid tariff: Scheidegger & Gallati 2011; Costello & Hemphill, 2014

Modelling of decision process

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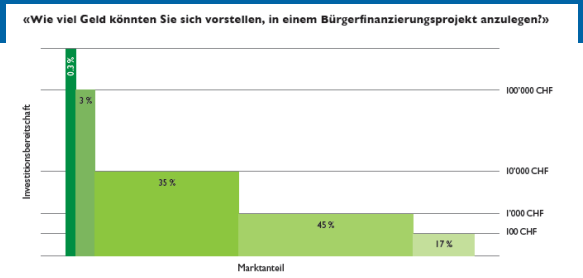
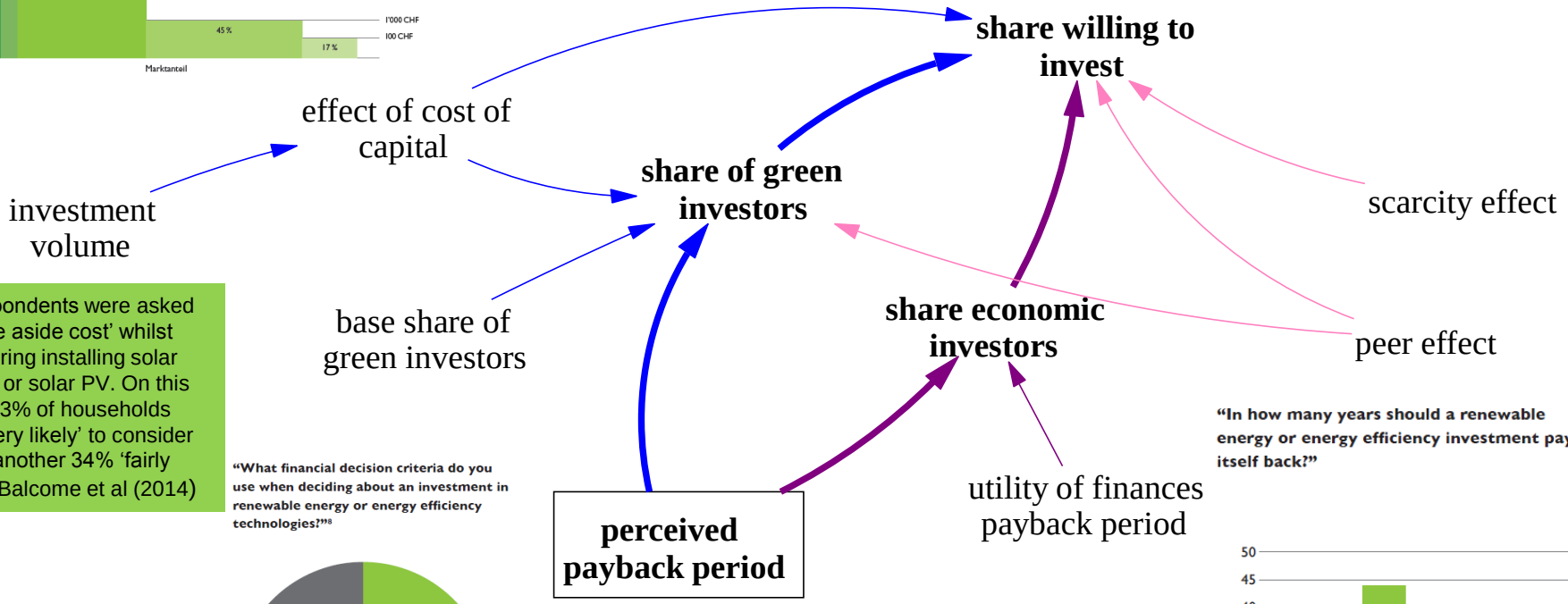
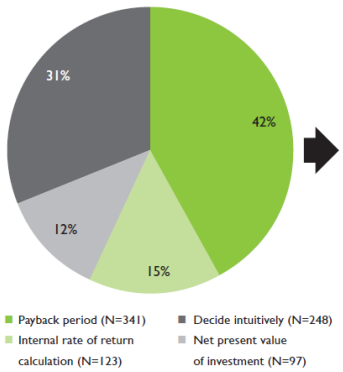




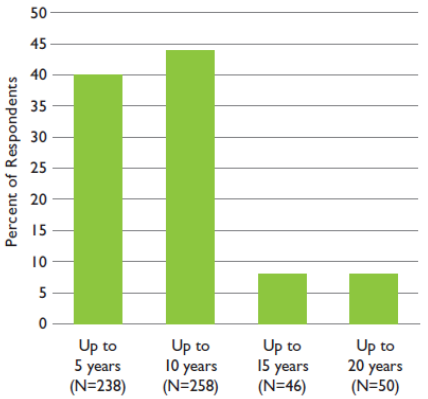
"… respondents were asked to 'leave aside cost' whilst considering installing solar thermal or solar PV. On this basis, 23% of households were 'very likely' to consider it, with another 34% 'fairly likely'." Balcome et al (2014)

"What financial decision criteria do you use when deciding about an investment in renewable energy or energy efficiency technologies?"[8]



Customer barometer 2014 & 2015, Institute for Economy and Ecology, university of St. Gallen

"In how many years should a renewable energy or energy efficiency investment pay itself back?"



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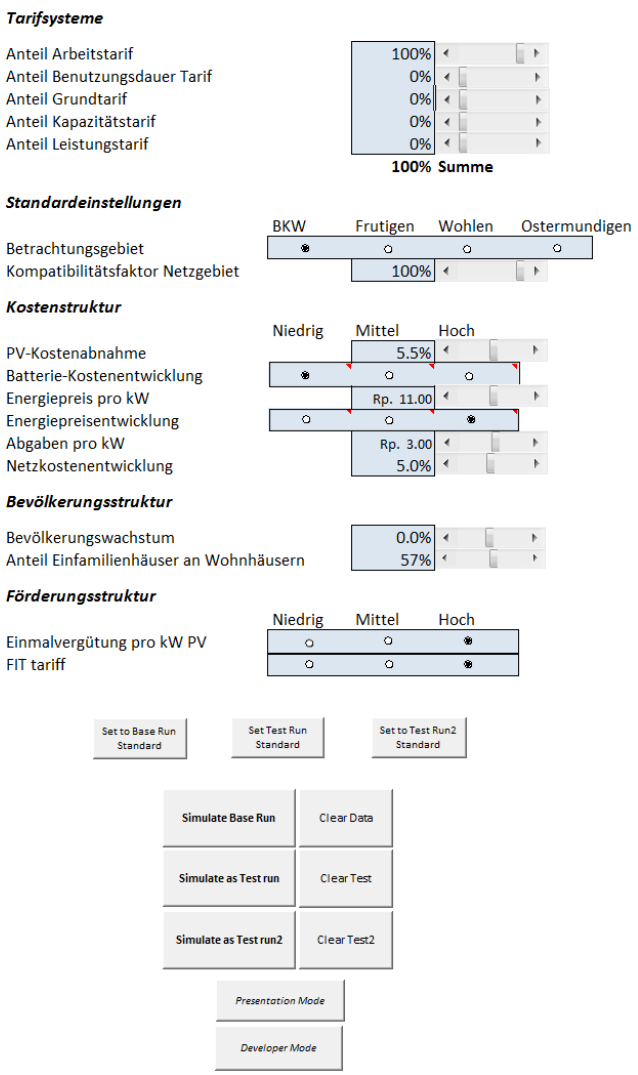
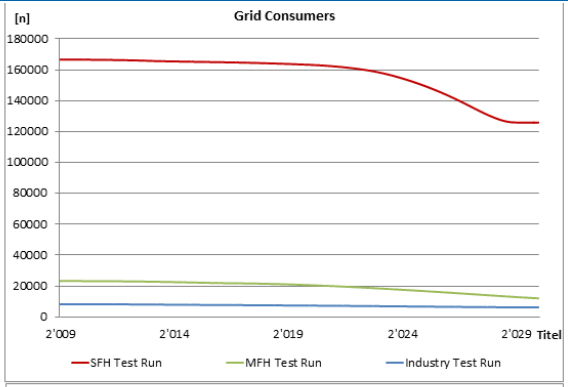
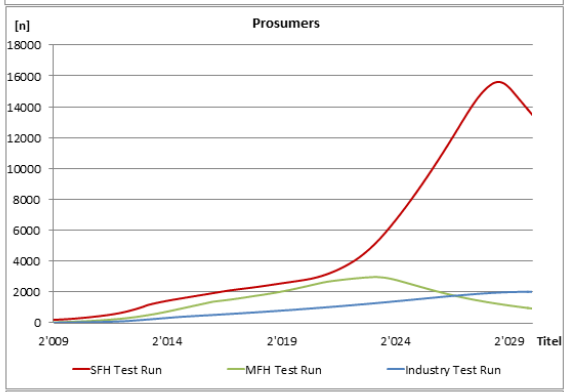
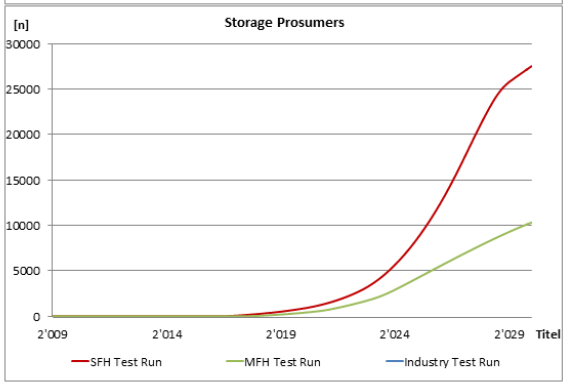
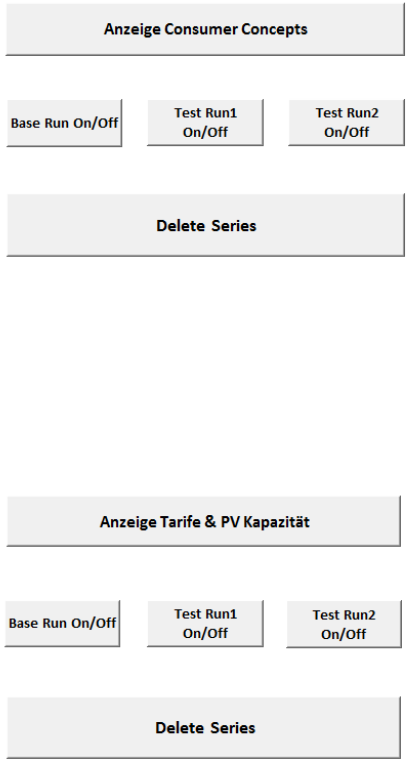
Grafical user interface











Hypothesis 1

„The diffusion of self-consumption concepts causes an **increase in the grid tariff** and as a consequence a **cross-subsidization** between consumers with and without self-consumption emerges.“

- Results are in publication process

Hypothesis 2

«**Alternative grid tariff designs** reduce the cross-subsidization and are fairer.»

- Results are in publication process

Summary of results

The decentralisation is about to come – with or without alternative design of grid tariffs. The tariff design can only influence the speed of diffusion and the absolute as well as relative attractiveness of the self-consumption concepts.

Conclusions of the hypotheses

- A cross-subsidization emerges, but in a fairly small extent.
- A perfect tariff only exists in theory, we need to look for pragmatic solutions.

So what? - Implications

Why not turn the „death spiral“ into a „success spiral“?

Decentralisation is about the start rolling. Becoming part of it might be a success strategy for utilities as well as grid operators.

Specificly designed business models could help reduce the financial pressure of decentralisation and incorporate decentralisation as a driver of the business.

Thank you for your attention!

Questions & feedback are welcome!

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