DSM AND CUSTOMER INVOLEMENT
REFLECTIONS AND APPLICATIONS

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The prototype customer involvement in the smart grid world

Smart Consumer reacting to tariff signals

Massive use of IOT
DER and the redefinition of the end-customer’s role

Technical changes
- Electrifications of the heating/cooling system and mobility
- Availability of convenient energy production and storage technologies for residential use, including electrical vehicles
- Intelligent control applications and massive use of ICT

Economic changes
- Smart and grid aware tariffs
- P2P markets
- Falling marginal energy costs
- Changing role/business model for DSO and new market actors/entrants

Regulatory changes
- Self-consumption
- SCCs
- Full liberalization of the end-user market and grid services
Customer relations in the old local energy market

Vertical relation in a monopolistical context /market

Customer is price - taker
Customer relations in the new local energy market

- TSO
- DSO
- End Customer/Prosumer
- P2P
- SC
- Ancillary services
Design of local energy markets and mechanisms

Local energy market

Players
- Consumers
- Prosumers
- Aggregators

Optimization objectives
- Social welfare max.
- Infrastructure cost min.
- Non discrimination

Clearing methods
- Auction methods
- Game theoretic based methods
- Multi-agent systems
BFE, Elektrizitätsstatistik, VSE 2018

Switzerland's national consumption in 2019 was 61.5 billion kWh. After deducting transmission and distribution losses of 4.3 billion kWh, electricity consumption was 57.2 billion kWh.
From the Customer to the Prosumer:
Involvement at different stages and with different commitments

Smart energy consumer
• User of some smart technology offered by DSO
• Energy cost optimisation

Prosumer – emerging actor in the energy transition
• Energy consumer with own DER
• Investment in energy generation technology
• Optimisation of investment and energy costs
• Proactive behaviour in the energy transition

Member of a Self-consumption community
• Combination of smart energy consumer and prosumer
• Willingness to participate in a community and to optimize energy costs
Energy Community: the LIC setup

Community of 18 single family houses with:
- 4 solar rooftops, totalling 37kWp
- 26 kW of electric heater for DHW
- 10 heat pumps

Kindergarten with 27kW PV

District battery 60kWh/50kW
Energy Community: LIC Self Consumption Community

LIC is a **self-consumption community** that optimises and automates the use of local solar energy between 18 prosumers in the same district combined with a public solar and battery plant.

**TECHNOLOGY**
Assess local flexibility potential through centralized and decentralized solutions.

**ECONOMICS**
Compare centralized vs decentralized load management methods from the DSO point of view (grid costs), energy consumption and economic point of view.

**POLICY**
Provide recommendations how to allow and facilitate the replicability and scalability of peer-to-peer self-consumption communities.

**STAKEHOLDERS**
Evaluate the degree of knowledge or acceptance among the community stakeholders to be willing to participate in these new self-consumption communities.
Energy Community: LIC daily view

Daily consumption

Daily production

From the community • From battery • To the grid
Energy Community: LIC monthly view

Monthly consumption

Monthly production

From the community  From battery  From the grid

To the community  To battery  To the grid
Energy Community: LIC, peak shaving

**Consumed energy**
- From the community
- From battery
- From the grid

**Produced energy**
- To the community
- To battery
- To the grid

<table>
<thead>
<tr>
<th></th>
<th>With battery (kWh)</th>
<th>Without battery (kWh)</th>
<th>Difference (kWh)</th>
<th>Difference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>From the grid</td>
<td>227.77</td>
<td>265.75</td>
<td>-37.98</td>
<td>-14.29%</td>
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<tr>
<td>To the grid</td>
<td>5.44</td>
<td>58.26</td>
<td>-52.82</td>
<td>-90.66%</td>
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</tbody>
</table>
Energy Community: LIC, dynamic pricing
Dynamic pricing at city level, AMB case

AMB implemented in Bellinzona a dynamic tariff to perform peak-shaving. The prices are fixed (low and high tariffs) but the timeslots change every day, depending on the forecasted total demand of AMB (including hydro generation).
Conclusive Remarks

The energy transition is transforming the role of the customer, who is profoundly reshaping the power sector landscape to a complex system.

The transformation of the power sector in its initial stage poses many important challenges for the planning, controlling of the grid and the forecasting to ensure the constant balancing and a reliable supply.

In this transition, the prosumer is an emerging and central actor. Whether he leads to a fundamental change in the overall economy and society similar to energy transitions in the past is an open question.