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A Swiss perspective of DSM for electricity networks -Overview of ongoing projects - Dr. Matthias Galus, Dep. Head Networks





Overview

- Introduction – DSM in Switzerland
- Research projects on DSM
 - Distributed load management
 - THELMA
 - SmartGrid-Polysun
 - LLM / Adaptricity
- Demonstration projects on DSM
 - WarmUp
 - BeSmart
 - Aggregation of water management infrastructures



Introduction on DSM in Switzerland

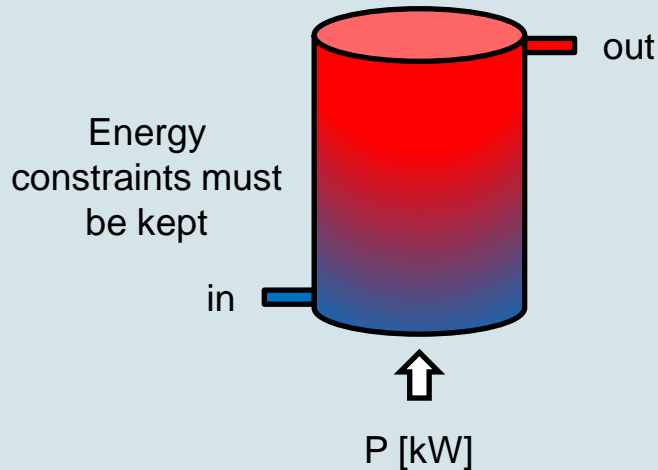
- Ripple control established and widely used in CH
 - Typically boilers / large loads are controlled
 - Shift large loads into the evening hours
 - Network is relived – network expansion reduced
- With distributed energy sources and a need for more flexibility, more control is needed on shorter time scales
- Modern DSM can be used for various purposes, but

Market  Network



Potential of Demand Side Management - Flexibility through aggregation and control -

Electric Water Heater properties



Storage



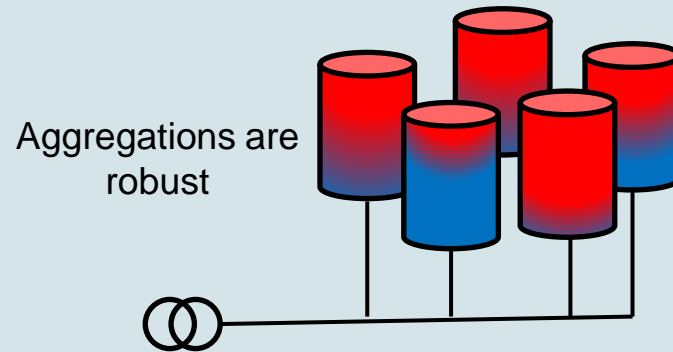
Consumption can be shifted
(up & down regulation)



Flexibility

- BG schedule compliance
- Offer ancillary services
- Integrate renewables

Aggregation properties



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- Ongoing academic research



Project: Distributed Load Management

Consortium: ETH, Landis+Gyr, EKZ, KTI

Project Aims:

- Investigate control and communication strategies for large aggregations of household appliances
- Analyze distribution grid operation benefits and constraints (PV integration, line ratings)
- Evaluate business models from the perspective of DSO's and retailers

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Project: Distributed Load Management

Content: Different market players, different interests

DSO

'relieve the grid'

Peak Shifting

- Reduce load on grid
- Defer investments

PV Integration

- Prevent over-voltages
- Integrate PV energy

Today: price ~ grid loading
High-RES: price ≠ grid loading

Retailer

'minimize cost'

Optimal Energy Acquisition

- Shift loads to low-cost hours
- Reduce cost for energy

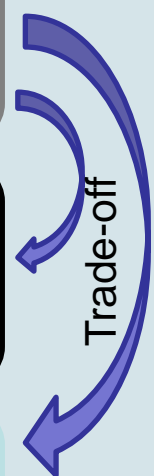
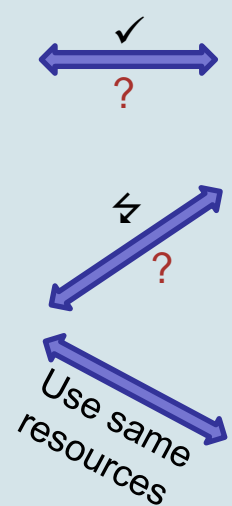
Schedule Compliance

- Use loads to reduce deviations
- Reduce balancing energy

Offer Control Reserves

- Loads adjust consumption
- Earnings at reserve markets

Possibly different objectives on different voltage levels



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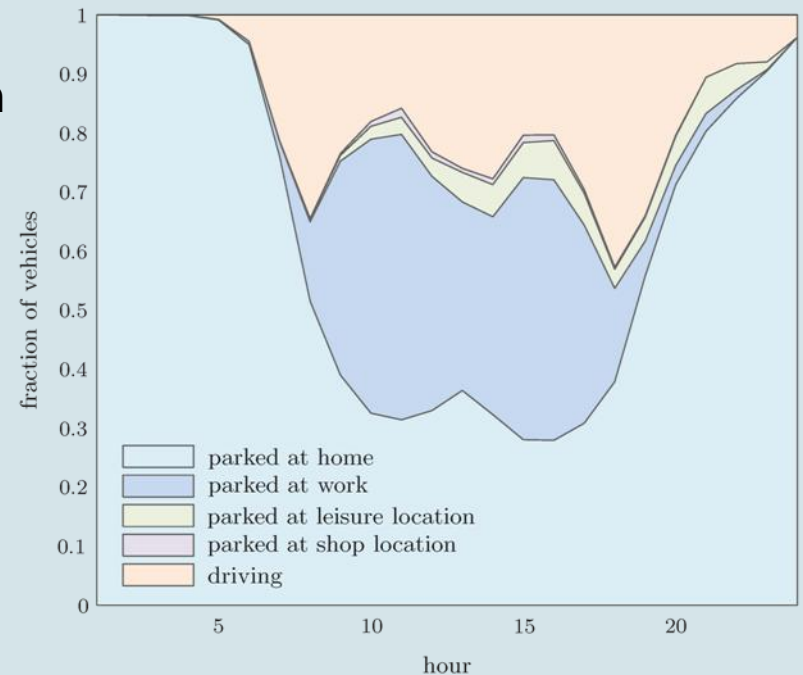
Project: THELMA

Consortium: ETH, EMPA, LAV, ESD, PS



Project Aims

- Investigate electric vehicle impact on power systems (transmission, distribution)
- Use electric vehicles for power systems
- Investigate control for large aggregations of electric vehicles
- Evaluate business models from the perspective of DSO's and retailers



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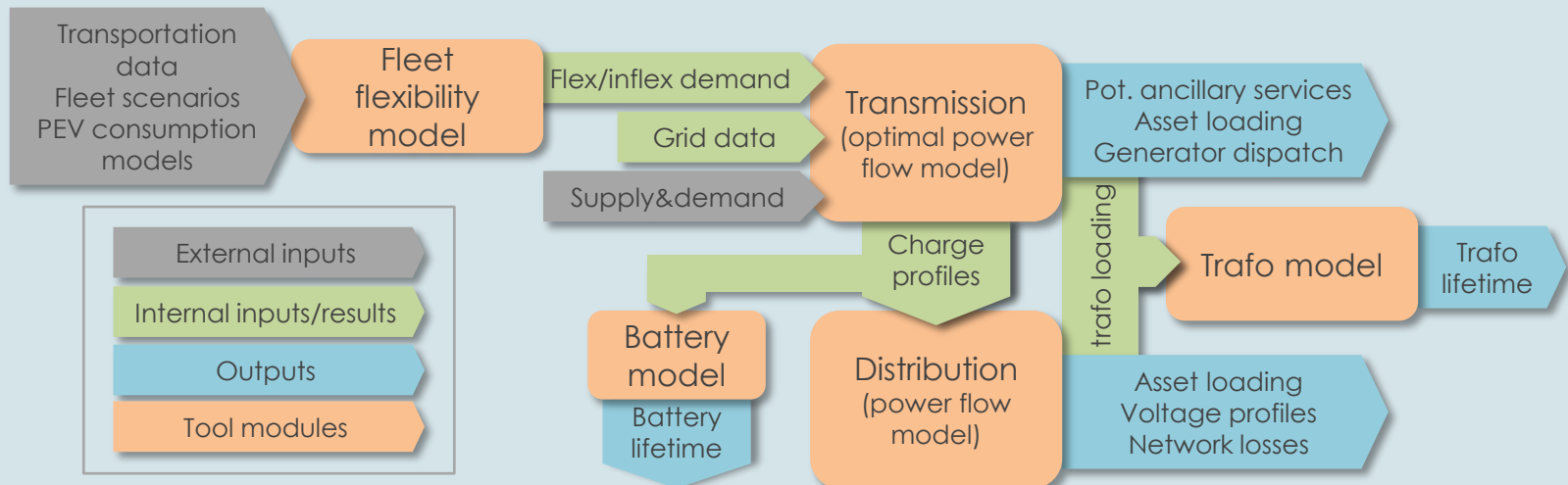


Project: THELMA

Content: Assess network impacts, appliance degradation



- Different modules assess:
 - Impact on distribution/transmission systems
 - Impact on battery and transformer degradations



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Project: SmartGrid-Polysun

Consortium: ETH, Vela Solaris, SFOE, swisselectric



Project Aims:

- Analysis, planning and operation of load management and small-scale energy storage (office buildings) in power systems
- Develop software prototype with three target groups:
 - (a) building planners
 - (b) distribution system operators
 - (c) market players
- Evaluate business models from the perspective of DSO's and retailers

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Project: SmartGrid-Polysun Project

Target group: Building planners, DSO, market players



DR Resources

Large aggregations of thermostatically controlled loads (TCLs)

Small-scale battery storage in buildings

Small aggregations of office buildings

Power System Applications

Ancillary services

- Frequency control reserves
- Methods: robust optimal control, state estimation

Market services[#]

- Balance group optimization
- Methods: stochastic optimization

Distribution networks

- PV integration & voltage control
- Methods: hierarchical control and optimal power flow

Building Applications:

Cost minimization[#]

- Predictive control of buildings under dynamic electricity prices

PV self-consumption[#]

- Rule-based control using heat pumps and batteries

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Project: DPG.sim

Consortium: LLM / Adaptricity, ETH Zurich



Project Aims:

- Develop grid planning tool considering Smart Grid features
- Reduce grid infrastructure and system costs
- Taking into account prosumers / aggregators in operation and planning
- Benefits of prosumers / aggregators for grid purposes and congestions in distribution networks

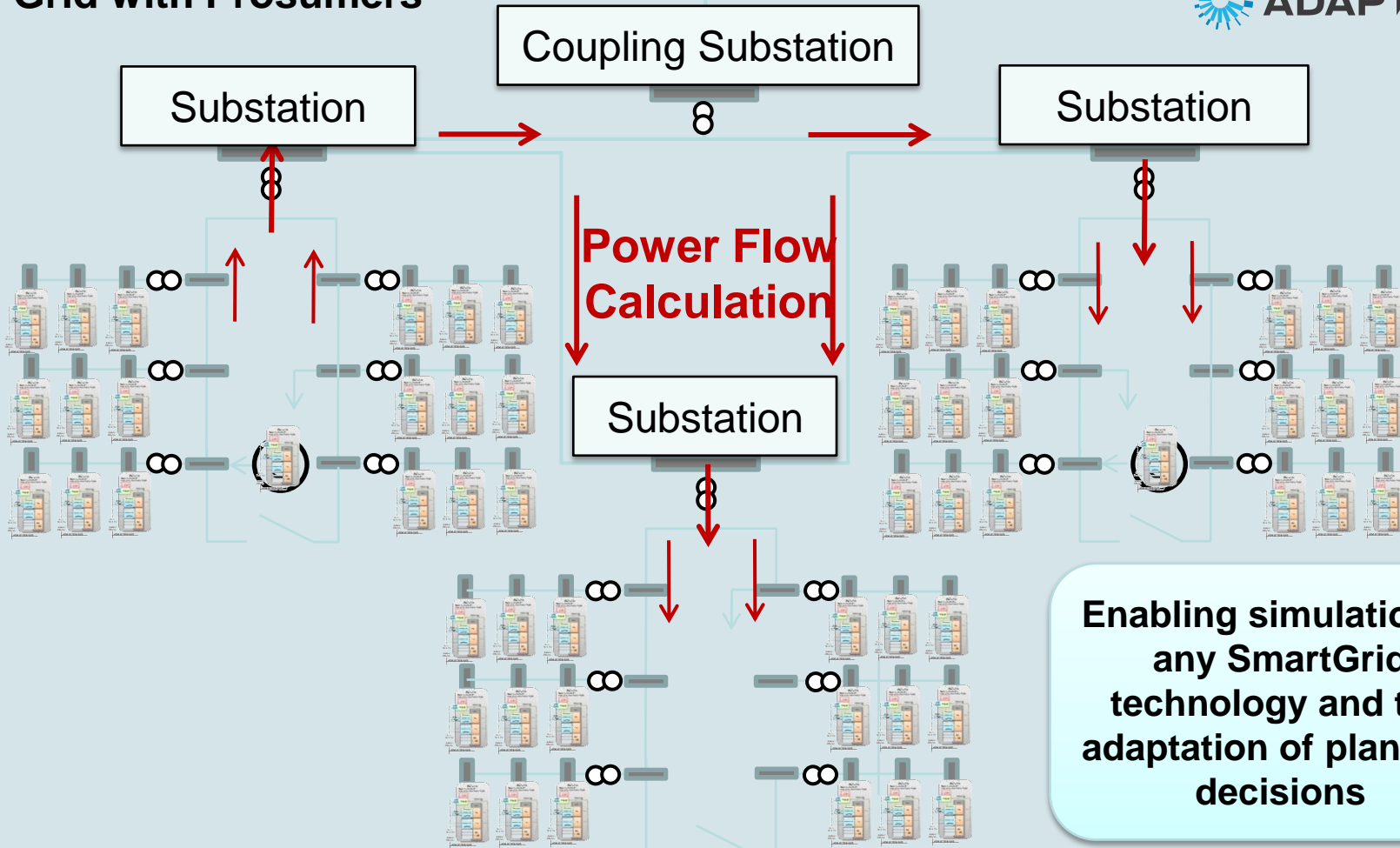


Project: DPG.sim

Content: Distribution grid planning for SmartGrids



Grid with Prosumers



Enabling simulation of any SmartGrid technology and the adaptation of planning decisions



- Ongoing demonstration projects



Project: WarmUp

Consortium: ewz, misurio, SFOE



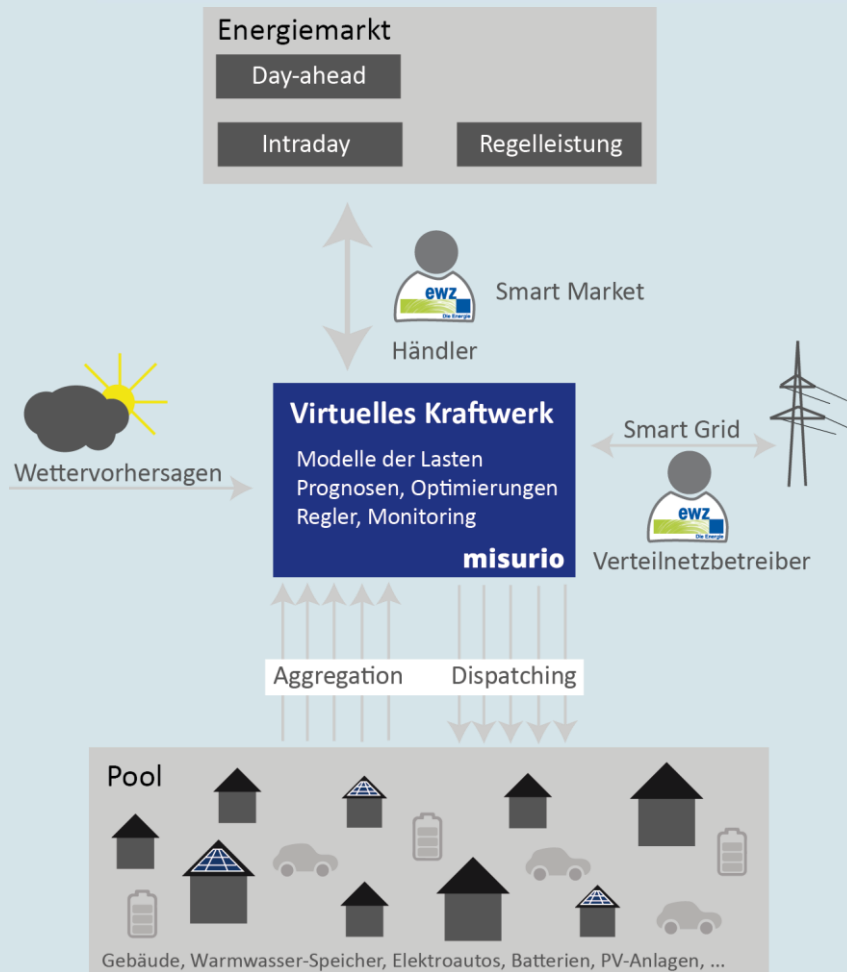
Project Aims:

- Using flexibility of thermal heat storage (buildings, hot water) and power-to-heat devices (heat pumps) for the electricity system
- Maximize the flexibility through a centralized management
- Optimization for grid and market (both) without disadvantages for user comfort



Project: WarmUp

Target group: DSO, Trading, market players



- Benefits of approach:

- Environment friendly services for consumers
- Flexibility for the market
- Flexibility for the network



Project: BeSmart

Consortium: Swisscom Energy Solutions, Repower, SFOE



Project Aims:

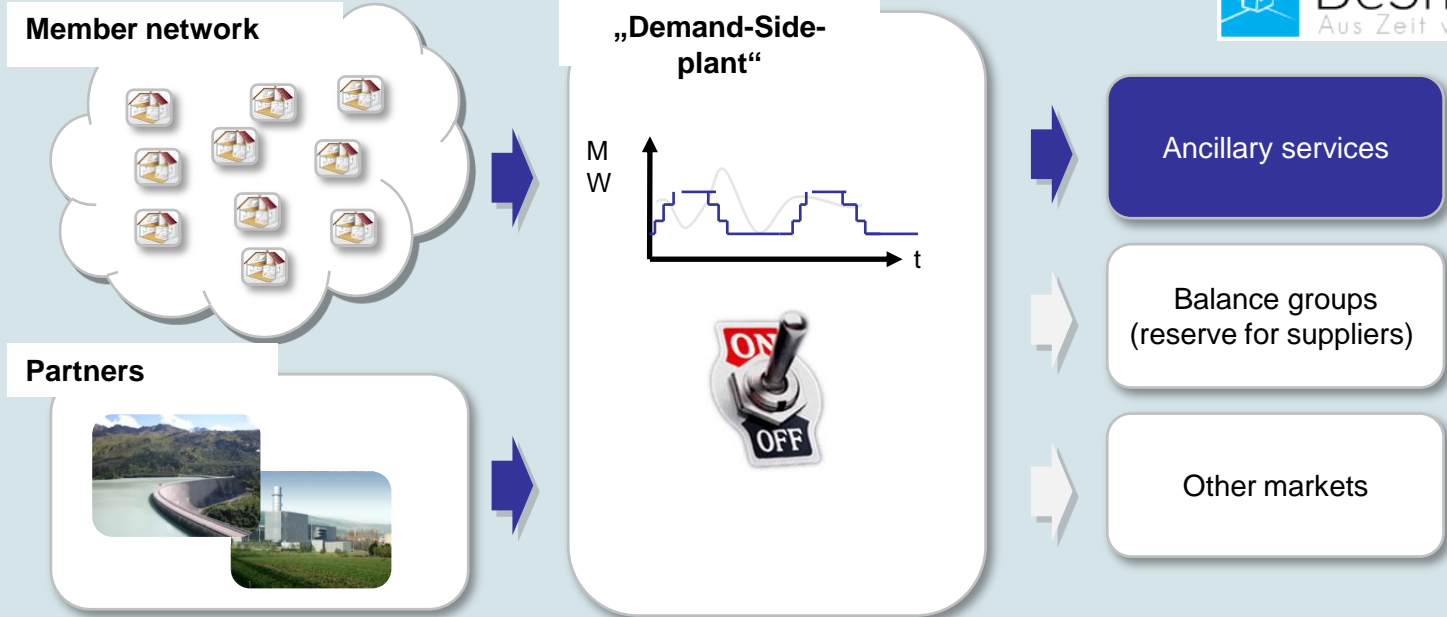
- Aggregation of flexible loads (boilers, heat pumps)
- Dynamic load management on top of ripple control
- Integration of virtual, controllable load and flexible generation
- Flexibilize load for ancillary services (secondary, tertiary control)
- Cost reduction through peak shaving



Project: BeSmart

Content: Flexibility of demand for ancillary services

Concept



Consumer Benefits

Monitoring

Detailed analysis allows for consumption reduction and comparisons.

Comfort and efficiency

Management of consumption during absence and energy efficiency.

Security

Immediate notification in the case of irregularities, technical failures etc.



Project: Aggregation of large infrastructure systems

Consortium: Infrawatt, Ryser Ingenieure, Alpiq

Project Aims:

- Load management with large infrastructure systems (water supply plants, sewage plants)
- Pooling of infrastructure systems for balancing energy (positive and negative)
- Pooling possible without disturbing normal operation of such infrastructures



Summary

- Various approaches to control load
 - Various aims for which loads are controlled
 - Interaction between grid and markets are so far unresolved
 - Customer benefits indirectly from DSM, through new services or reduced costs
- How can grid, market and consumer issues be integrated in an unbundled world



Thank you for your attention

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