Challenges and options for the capacity management of grids through the use of flexible load

Gut vernetzt.
Bestens versorgt.

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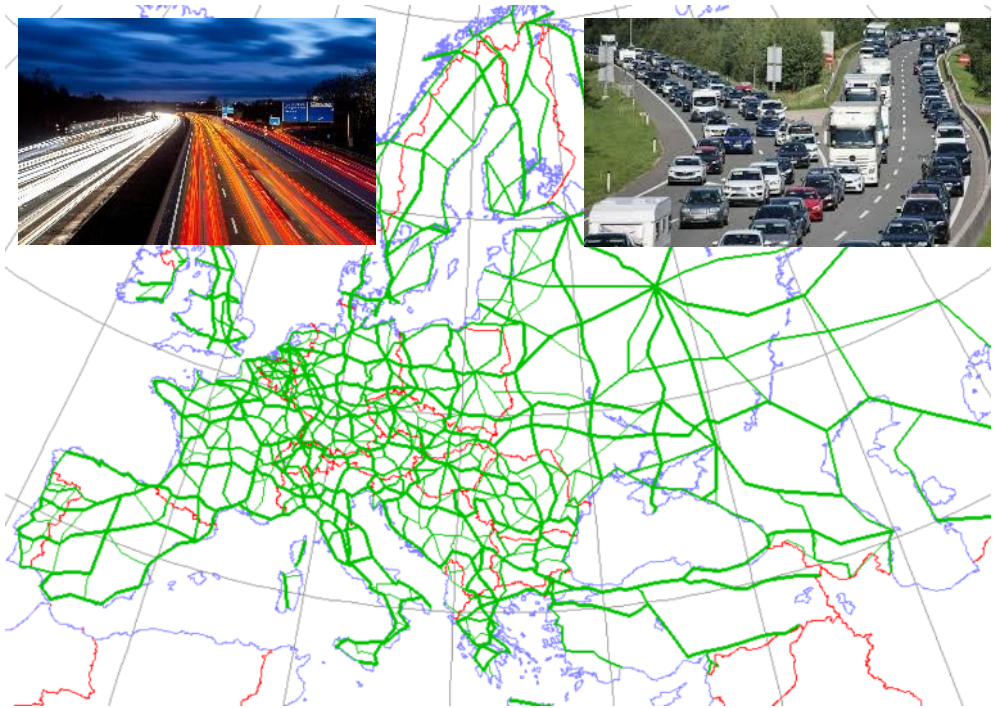
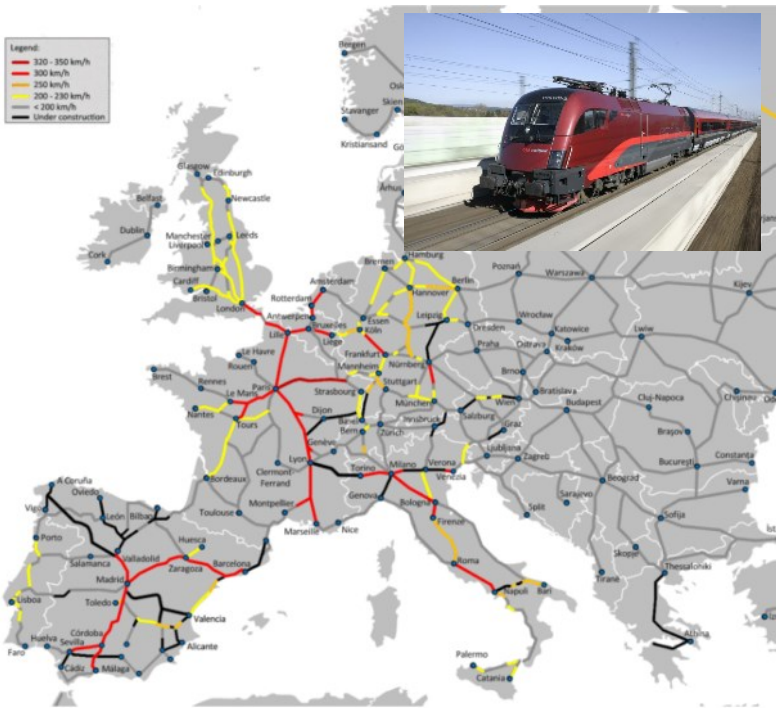
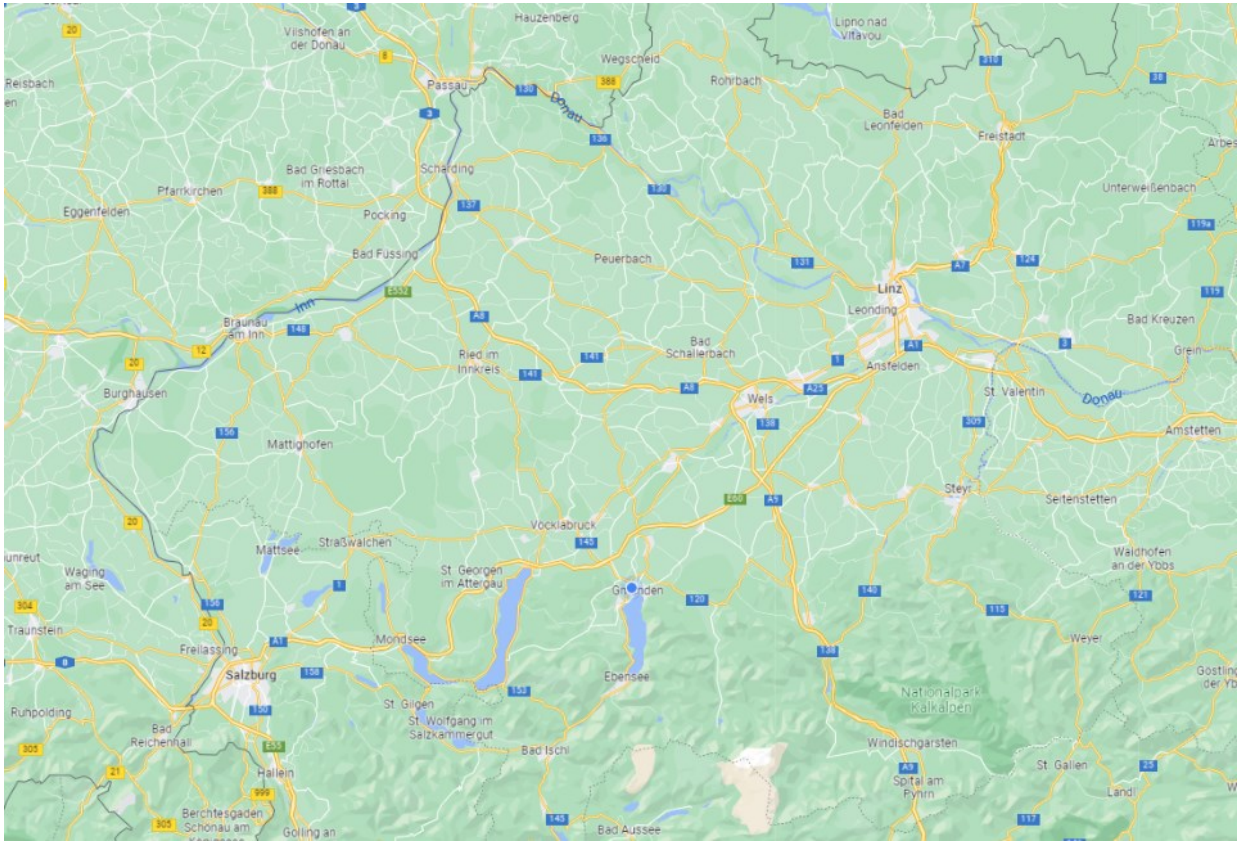
All in plan? – Transmission system





Roads in upper austria



- Planned traffic on highways – but lack of capacity => constraints, traffic jam
- well predicted traffic on main roads– but lack of capacity => constraints, traffic jam
- Lack of prognosis for other roads and streets
- Individual flexibility driven by experience

Control of 110-kV-Grid, n-1 secure load control in emergency case only

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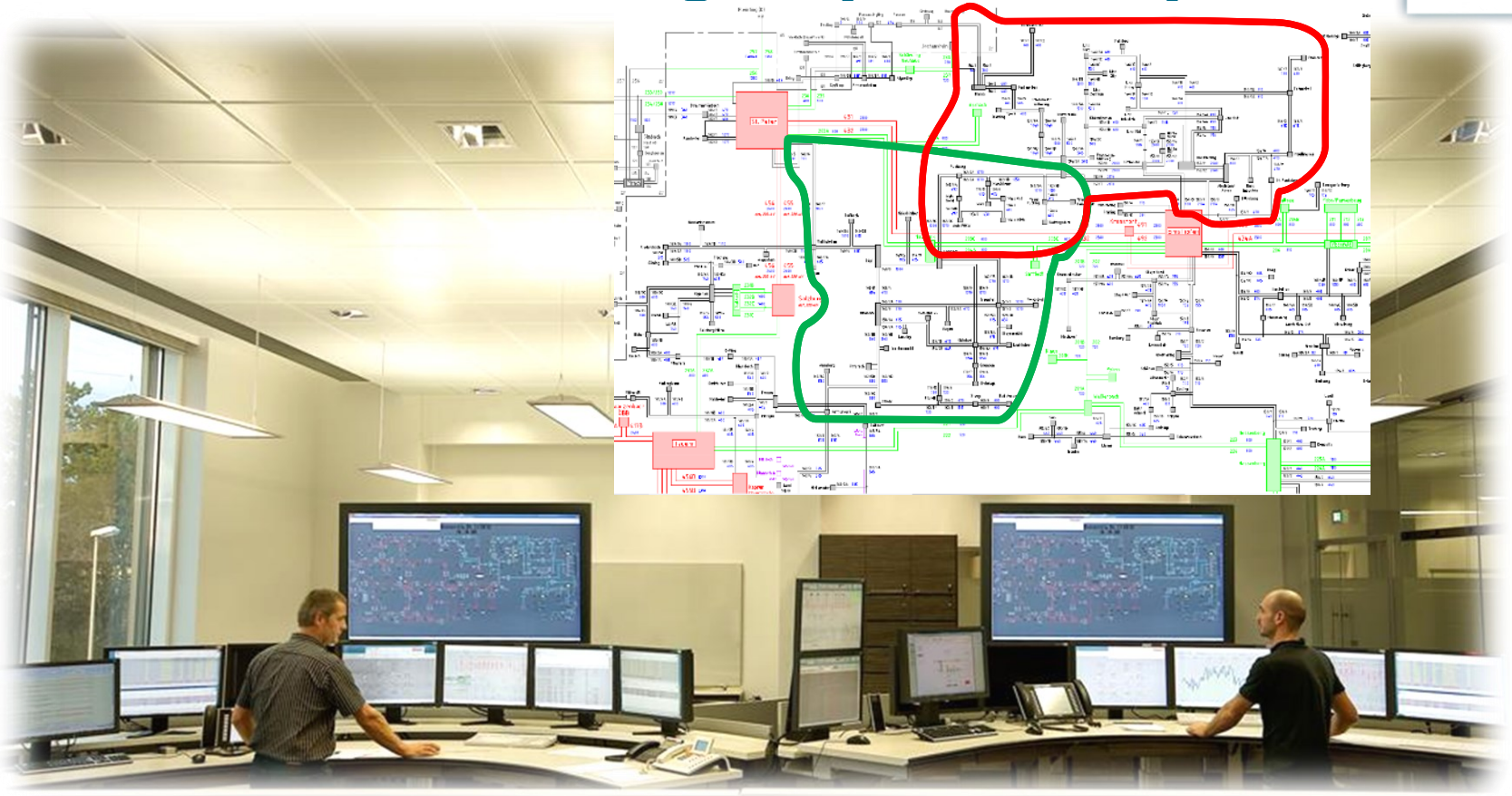
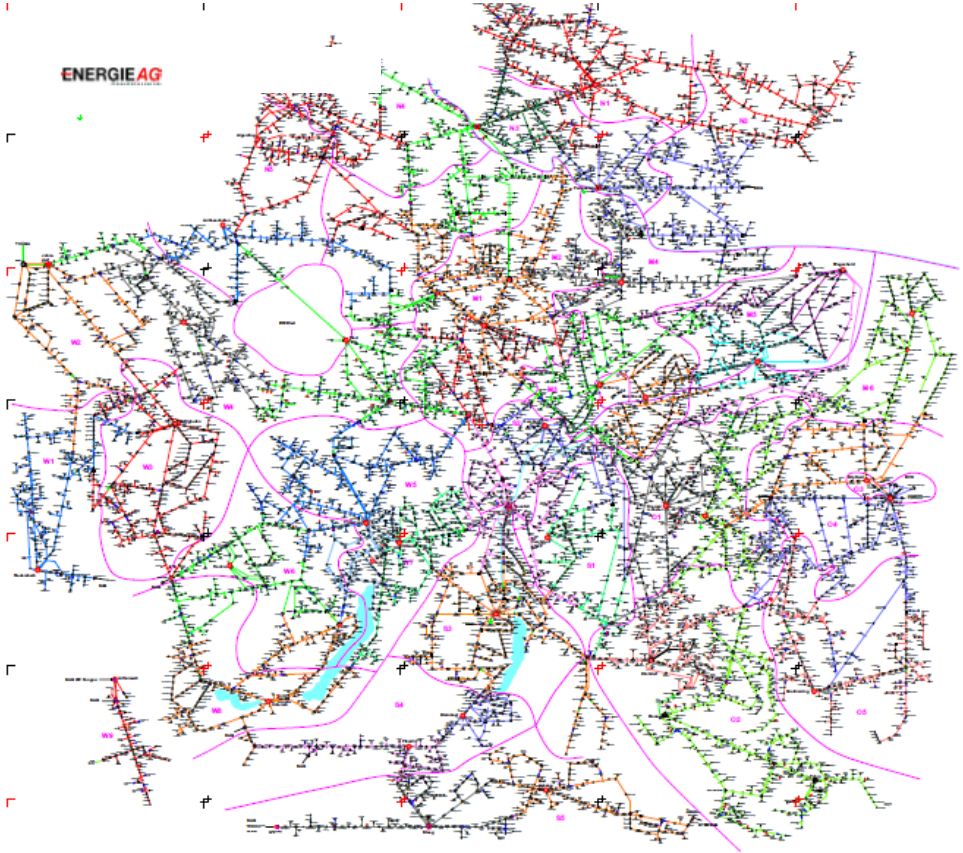


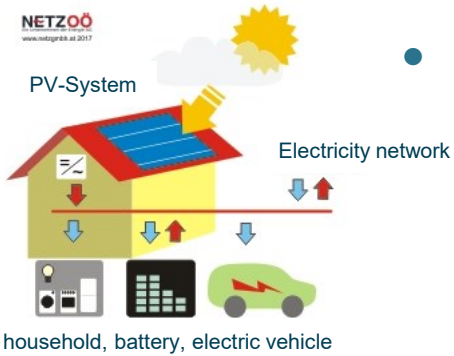
Medium voltage distribution Grid



- ~50 prim. substations
- ~15 MV/MV (small urban areas)
- 10 (urban)-20/30 kV (rural)
- Cables and over head lines (only exisiting)
- Feeders starting at primary substations
- Typ. Load per MV grid urban: 20…100 MW rural: <40 MW
- Typ. Load per feeder 2…5 MW
- n-1 save, open meshes
- Feeders legth up to 10…50 km (dep. on voltage and load)

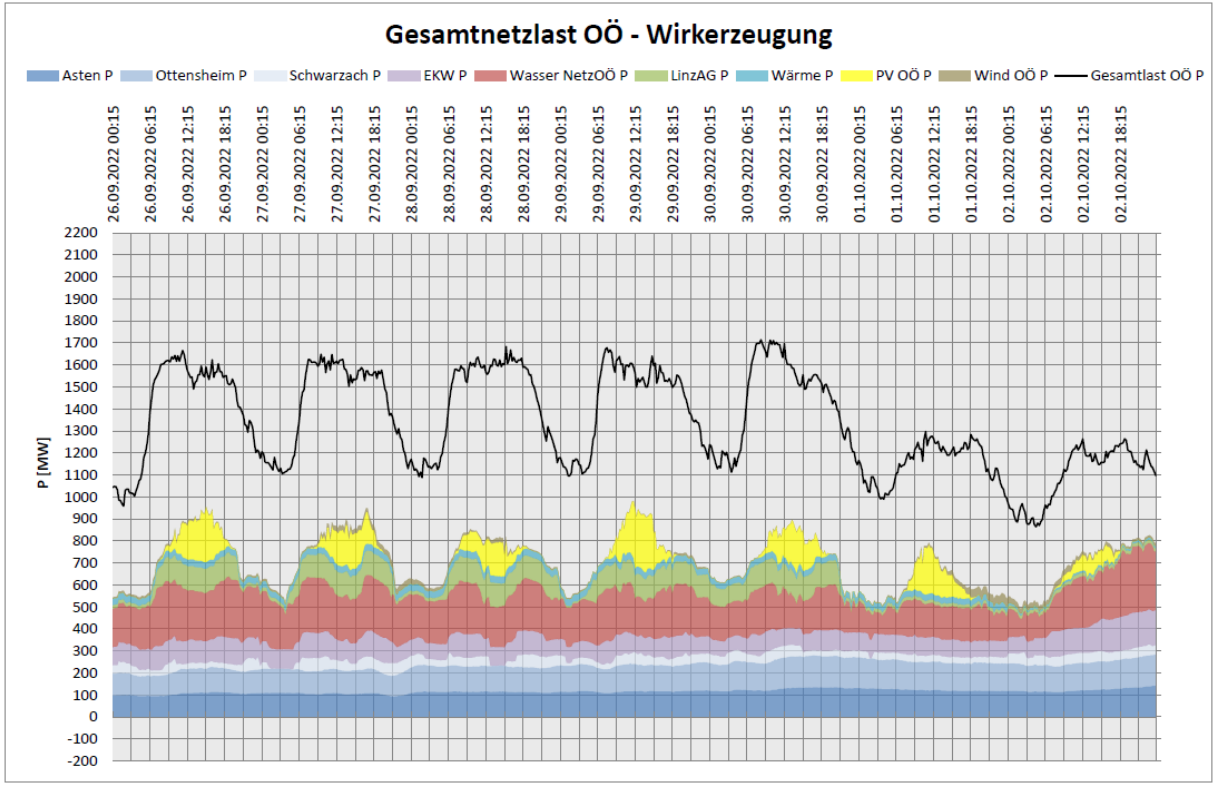
Developpement of electricity supply

… 1892-2022



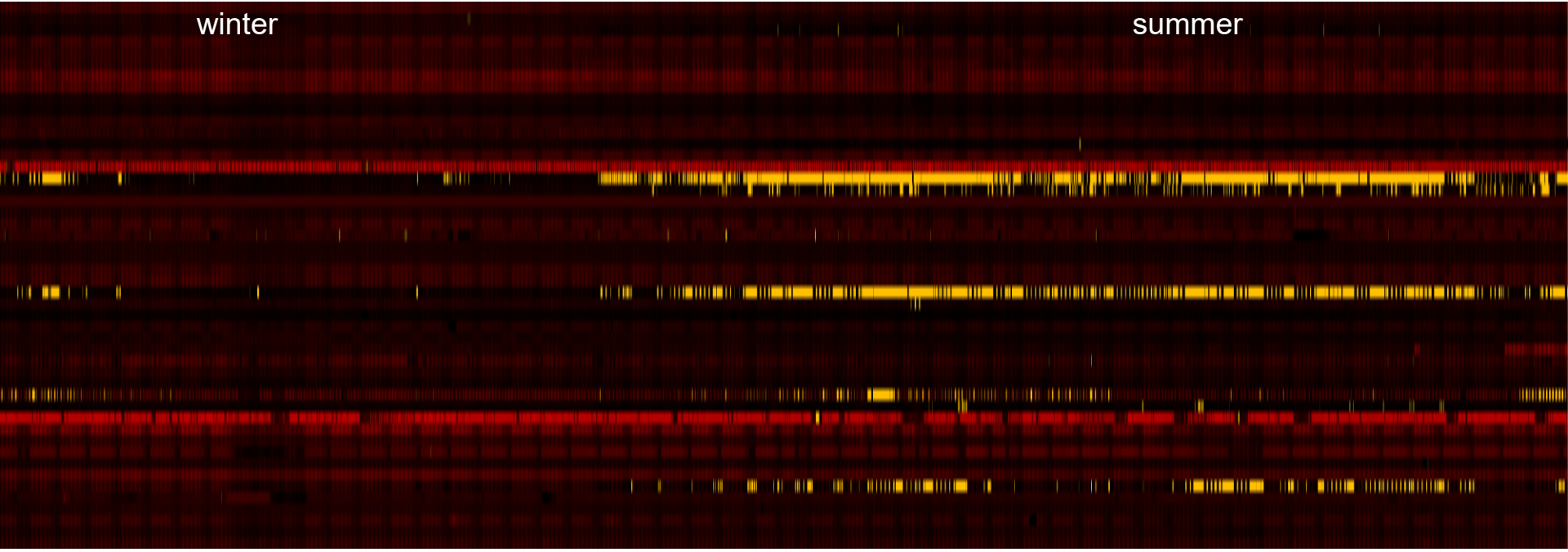
- private, local supply
- public, regulated networks
- Electricity market
  - liberalisation
  - regulation
- zero emission electricity
  - Dezentrale Erzeugung
  - storage
  - flexible loads
  - electric vehicle

Example of total demand 110-kV-grid OÖ



- little peak monday morning
- Decreas fo demand between 18:00 and 6:00 from1,6…1,7 GW to 0,9…1,2 GW
- Significantly reduced demand at weekend
- arround 50% of demand supplied by generators in the same110-kV-grid

Diversity of load for all Netz OÖ primary substations (110/30/10 kV)



Behind the total demand…

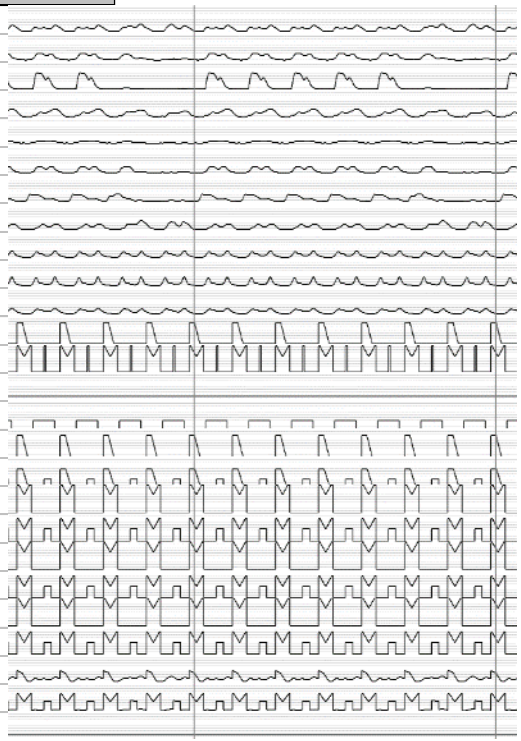
- Demand 15-min-profiles gathered with meters for customers with medium or large demand
- Peak demand per month values for customers with small demand
- Total annual demand for customers with very small demand

Actually: smart meters gathering load profiles for all customers

…but without relevance for billing

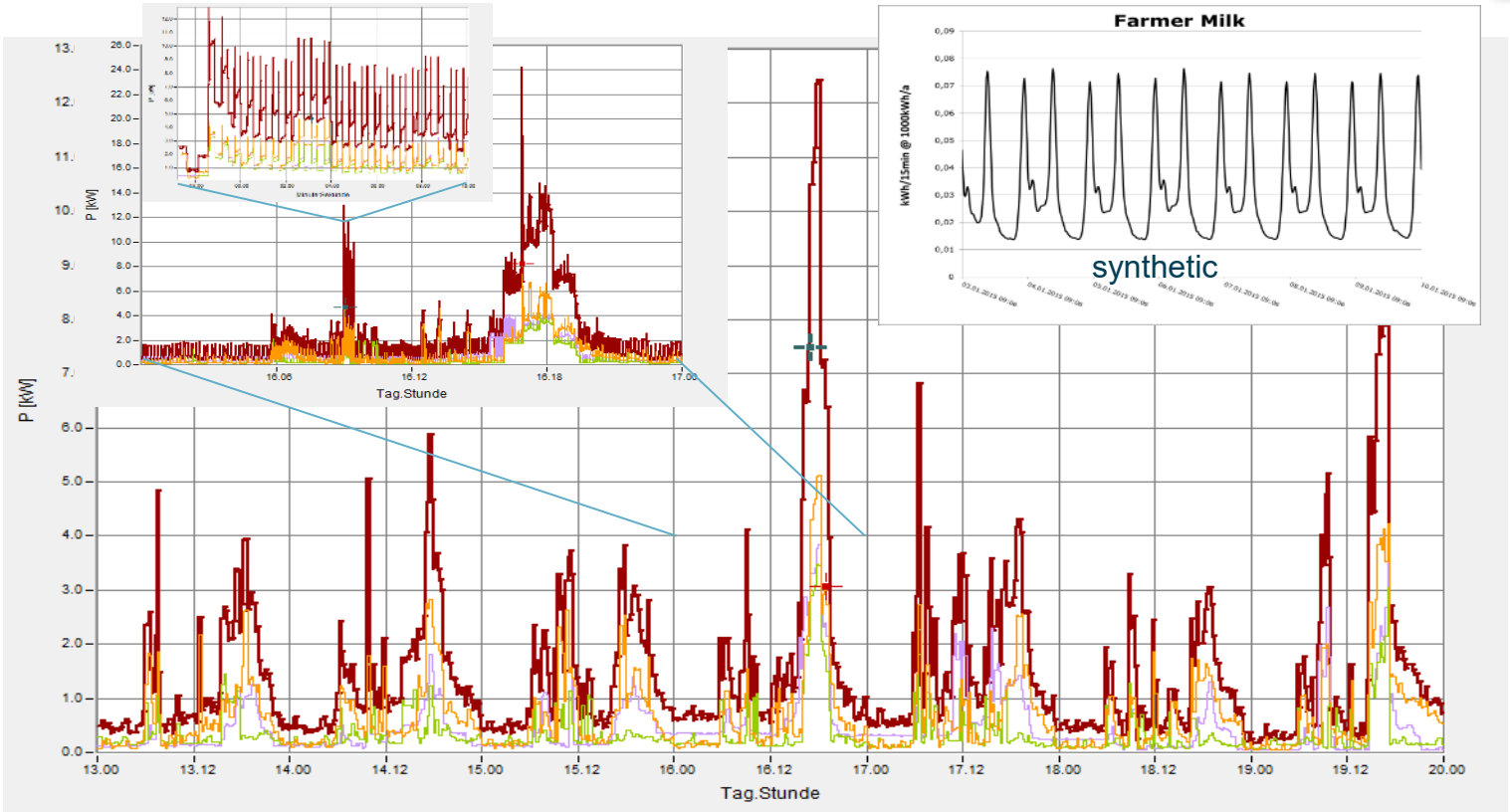
Market is using averaged profiles for clearing

Type	Text
H0	Residential
G0	industry & business general
G1	industry & business Mon-Fri 8:18:00
G2	business maximum load @ night
G3	business permanent
G4	shoping, hair cutter
G5	backery
G6	Weekend business
L0	Farmer
L1	Farmer Milk
L2	miscellenious farmers
U0	Water heating interrrupt.
U1	heating interrupt
E0	Generation hydro, wind, biomass
E1	Generation Photovoltaik
ULA	Boiler without reload during daytime
ULB	Boiler with reload during daytime
ULC	Night-storage-heater with reload during daytime
ULD	Night-storage-heater without reload during daytime
ULE	Mixer without reload during daytime
ULF	Mixer with reload during daytime
EAGU1	EAG Night-storage-heater with reload during daytime
EAGU2	EAG Night-storage-heater without reload during daytime
HA	Residental with boiler
HF	Residential with storage heating
G7	mobile base station

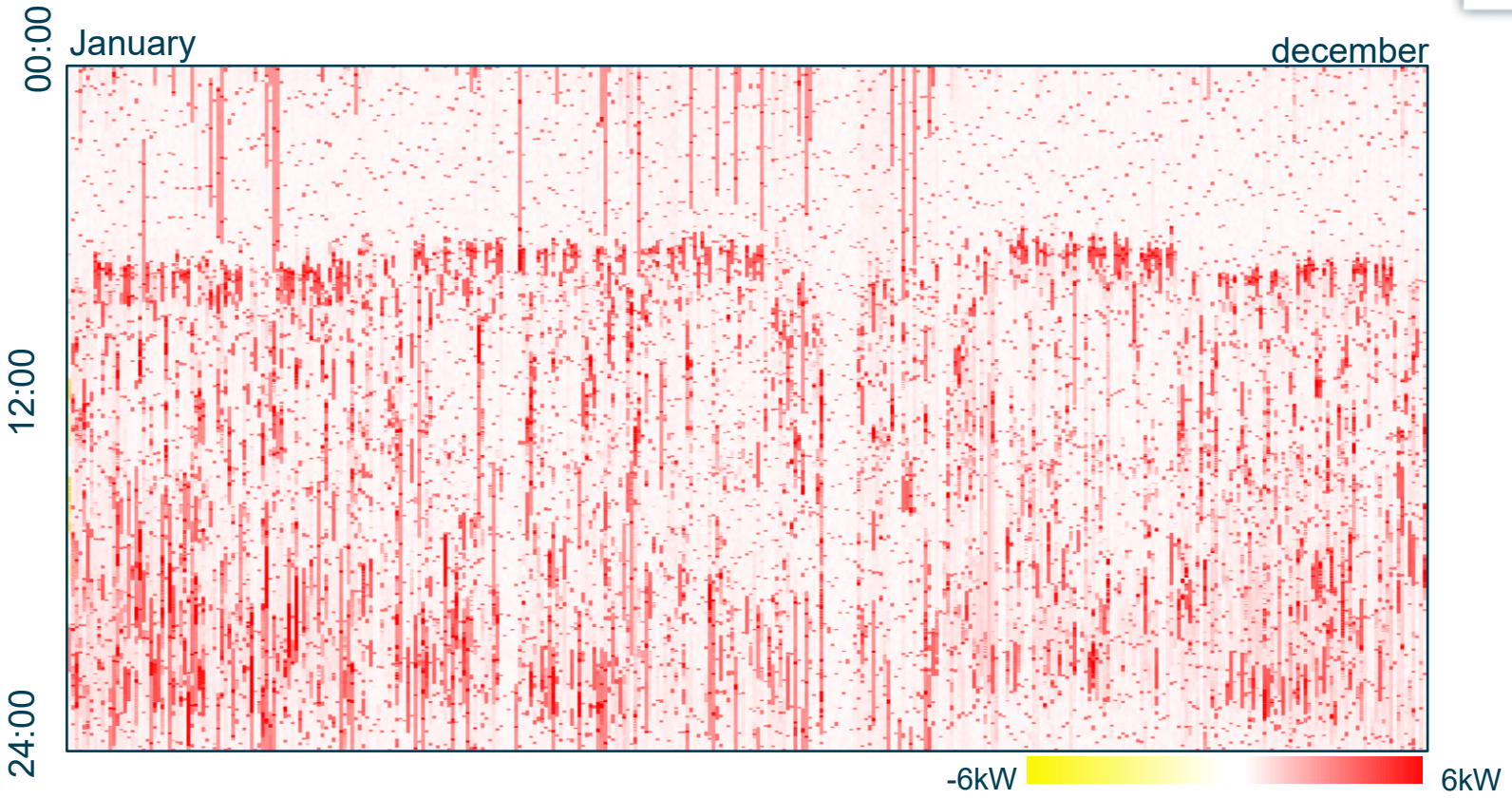


- 15-min-values are calculated from total annual demand
- more ore less applicable for >100 customers

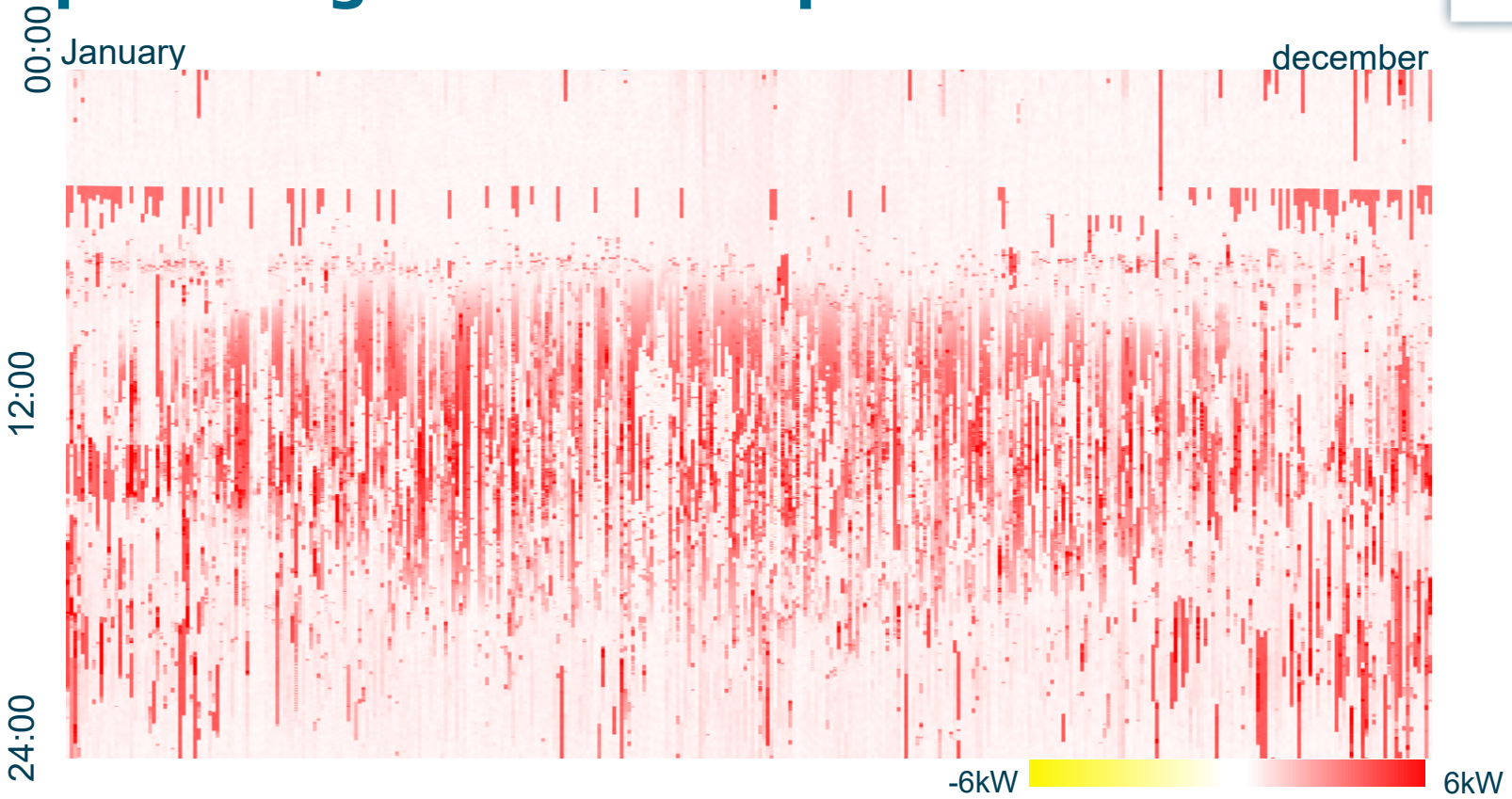
Farmer 10 MWh/year



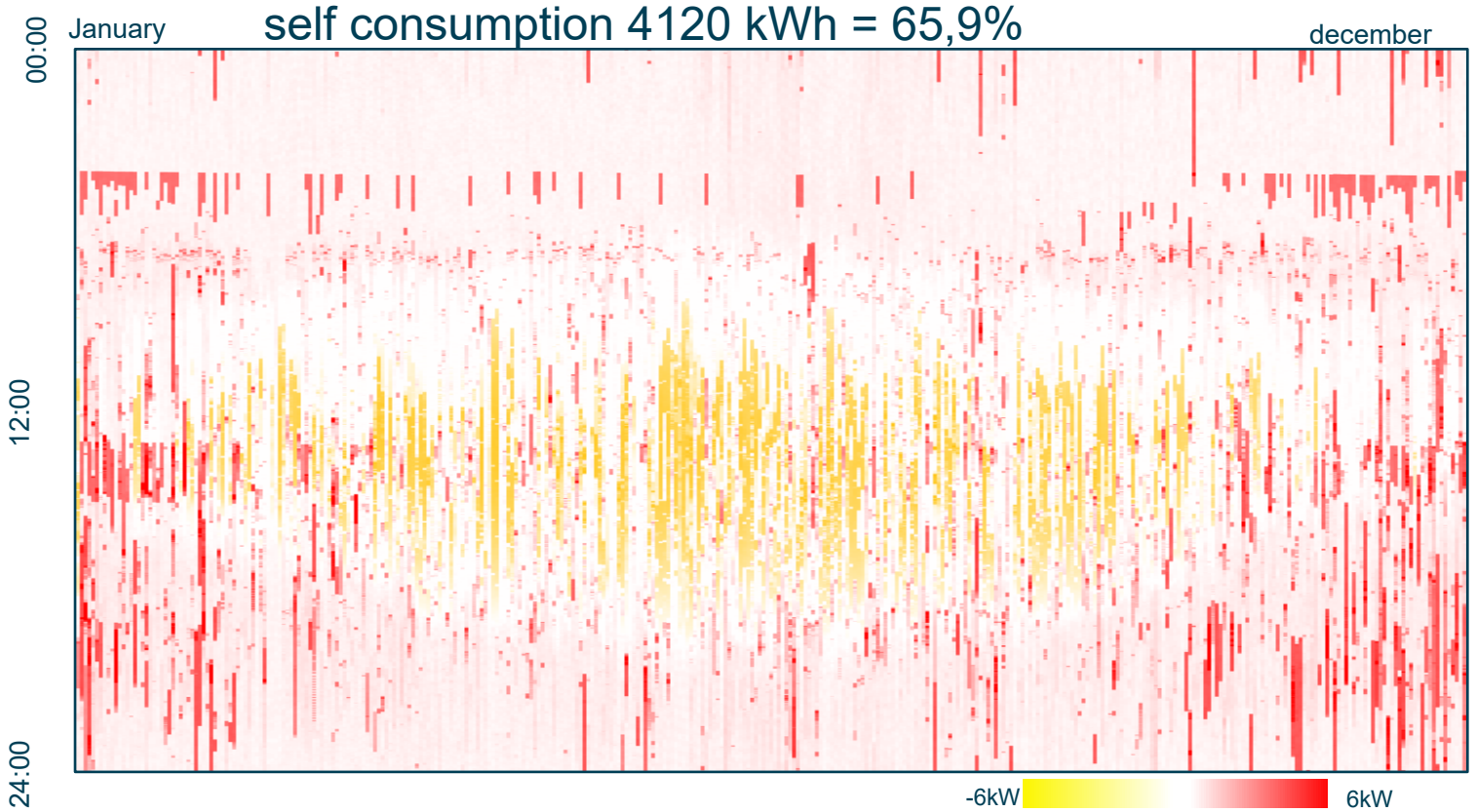
Household with water heating & EV



Household with water heating & EV optimizing self consumption from PV



Consumption & surplus of houshold with PV & EV & Boiler



Markets versus grids & networks

- vendors are selling total power profil without regarding locations of generation and load
- constraints in transmission grids have to be resolved by redispatch from powerplants to be paied for
- constraints in distribution networks are not occuring …yet.
- market offers with time dependent tariffs can cause shift of demands chellanging distribution systems
- drivers for use of flexibility
  - self consumption
  - energy tariffs
  - network tariffs

I4RD – Industry for Redispatch utilization of flexible industrial demand

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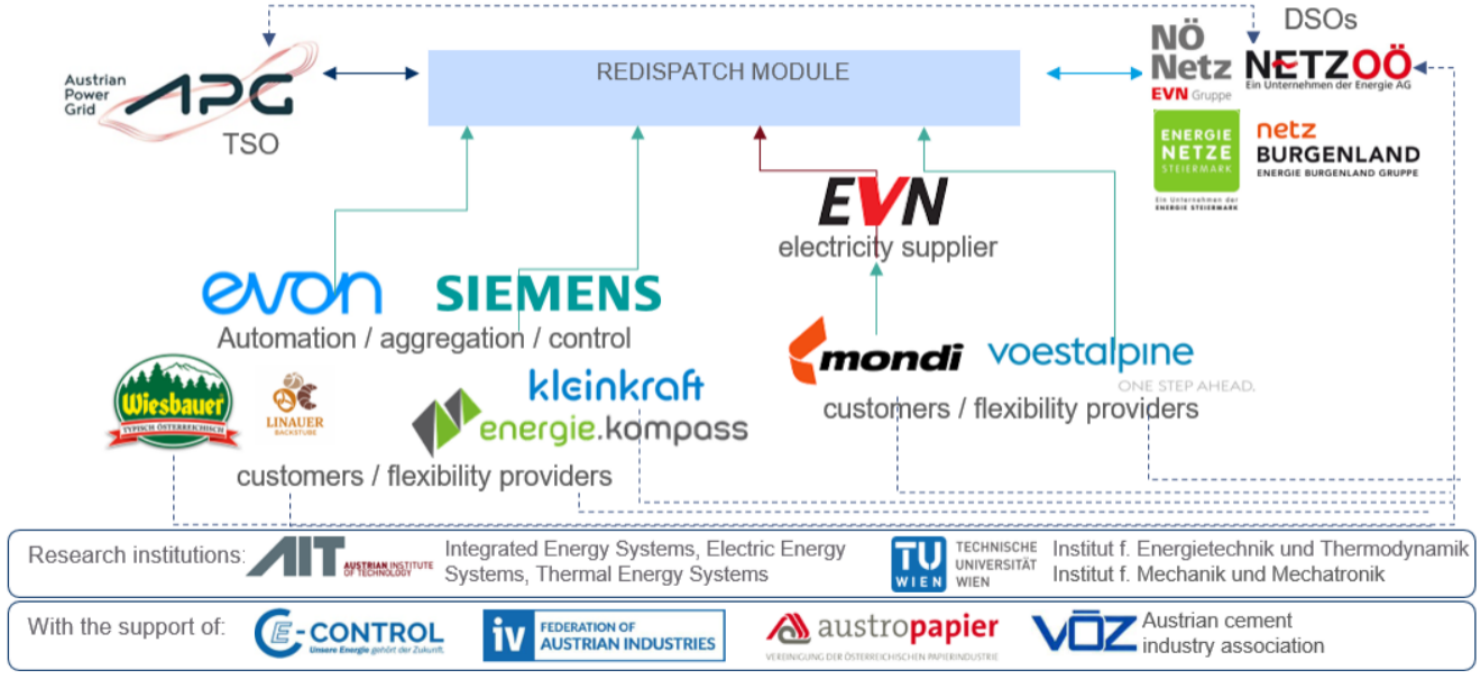
I4RD IN A NUTSHELL

NEFI
NEW ENERGY FOR INDUSTRY



conclusions

- the idea of using flexibility seems to be easy, but implemtation is a big challenge
- SCADA systems need more data and features for
  - prognosis
  - calculation of free network capacity
  - Capacity management
  - TSO/DSO interface
- customers need (more) flexible loads, automation and interfaces to:
  - aggregators
  - markets
  - network/grid operators
- developpment of proper SCADA tools and solutions at customer‘s sites might take several years