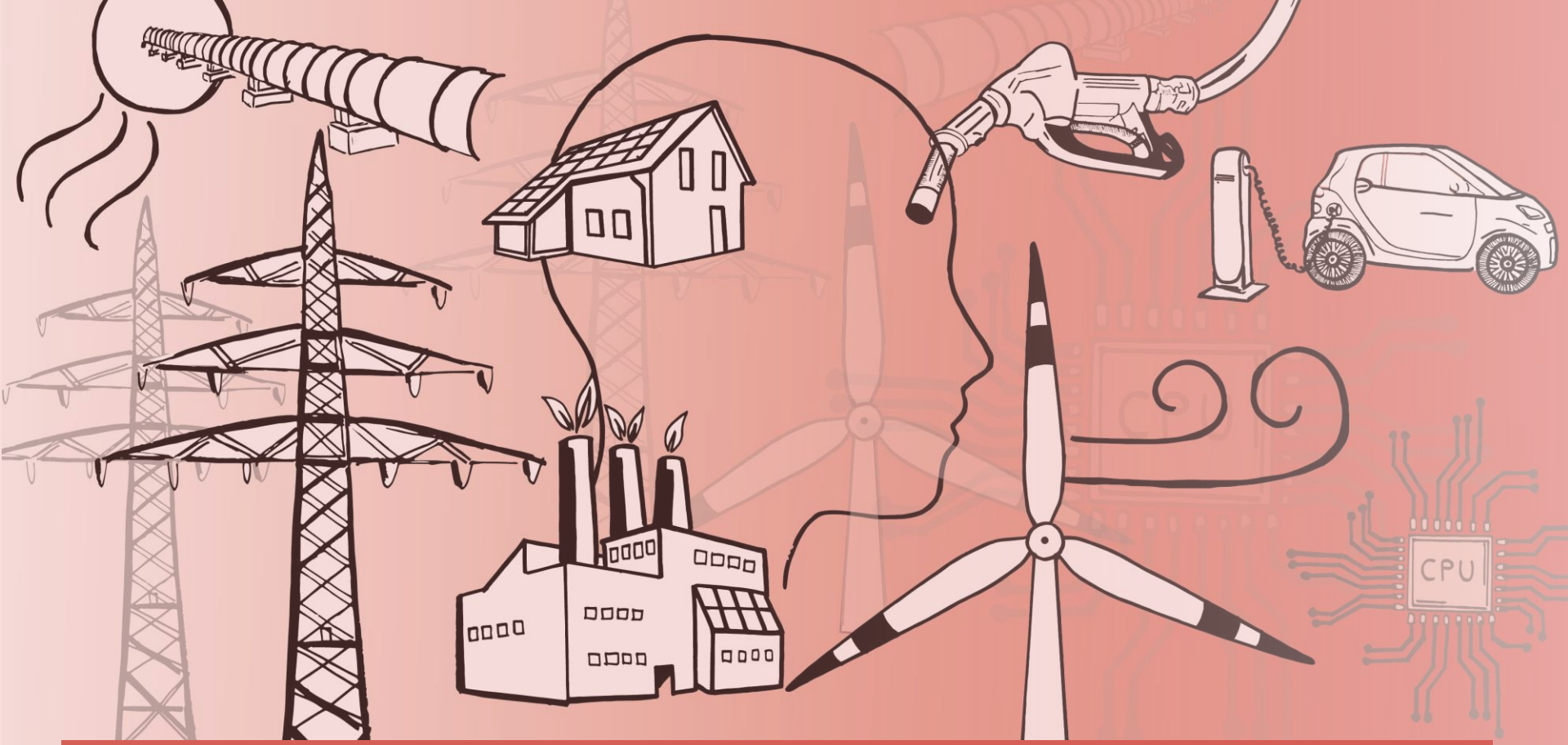


Intelligent Energy Systems

100 % Climate Neutrality/ Dr.-Ing. Serafin von Roon

05.10.2017

Forschungsgesellschaft für Energiewirtschaft mbH FfE

The Research Institute FfE in Munich

background

- Independent institution dealing with topics related to energy technology and energy economics
- Research results are published independently from political orientations or regulations and are solely based on scientific analytical methods

evolution

Founded 1949 in Karlsruhe

Moved to Munich in 1969

Affiliated company: FfE GmbH since 2001

main features

Outcome of more than 300 researchers

About 30 theses projects every year

More than 30 dissertations

members

Members from the energy sector, industry, science, administration and private members

Active exchange of experiences, involvement in a network of knowledge, direct contact to scientific assistants

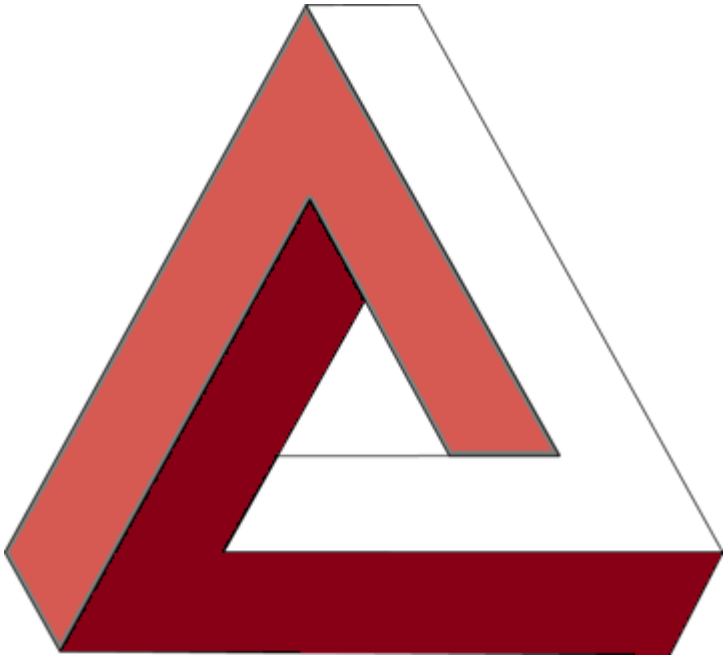
research

Current topics: storage and grids, electric vehicles, energy markets, energy efficiency

Methods: system analyses and simulations, data mining, GIS-models, audits

First of all, what is an intelligent energy system?

Security of supply



Economic viability

environmental sustainability

+ acceptance

A system which optimize the energy policy triangle!

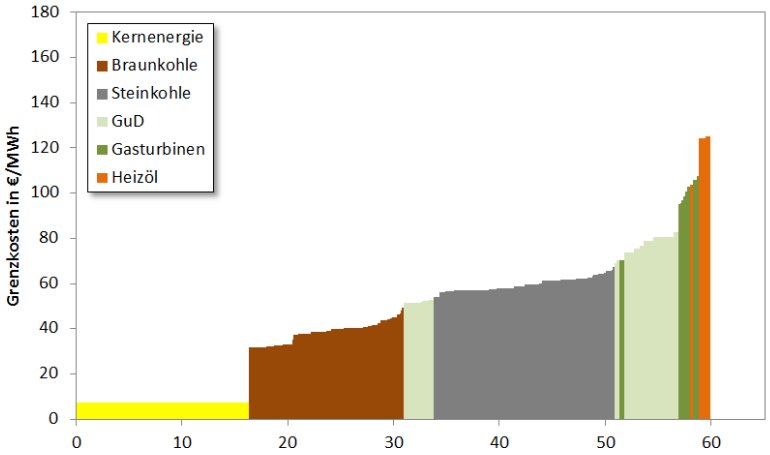
Where is intelligence needed to optimize the goals of that triangle?

First step: Build the right assets!




Source of the pictures: Pixabay

Second step: Run the built assets in the right way!



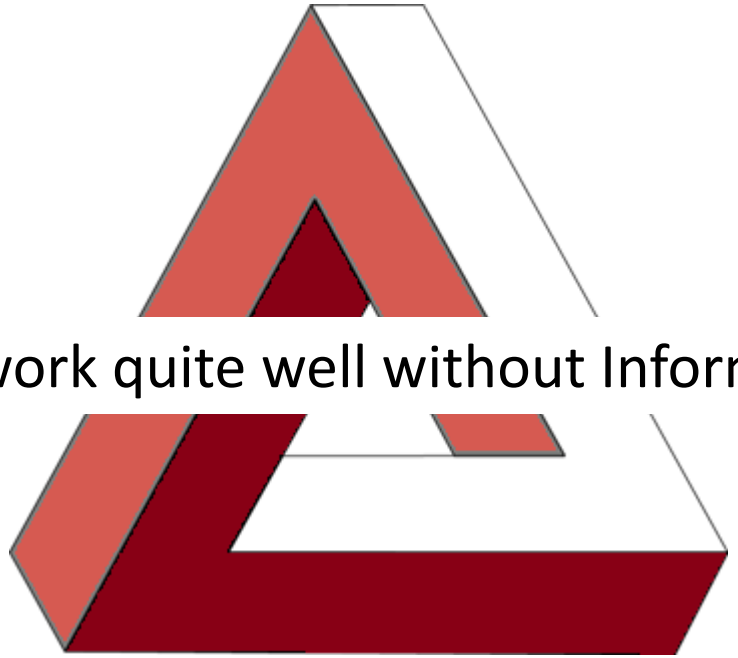
What do people normally think when they hear “Intelligent Energy System”?

- Smart Meter
- Smart Grid
- Virtual Power Plants
- Energy Agents
- Blockchain
- …

But information and communication technologies are only an enabler, which is used to achieve the goals of the energy policy triangle!

Does this mean that the old energy system in Europe was a mess?

Security of supply

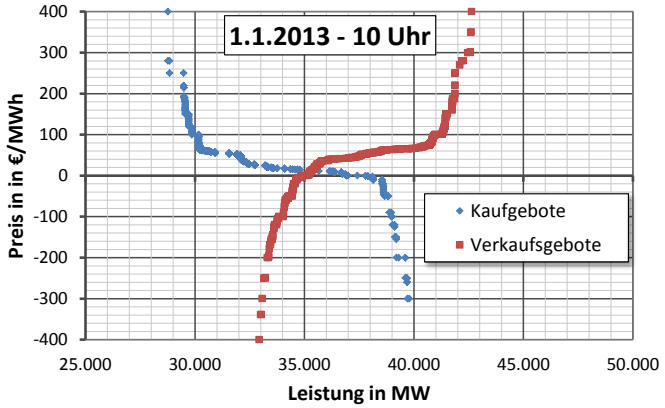


Economic viability

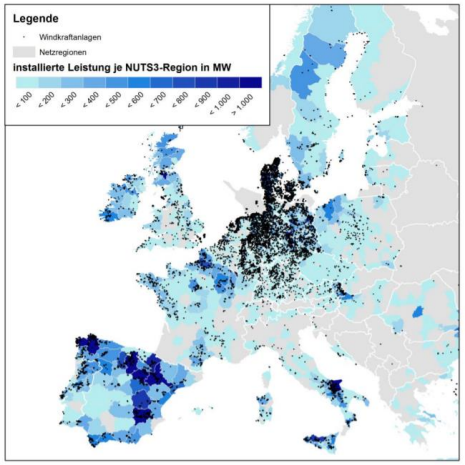
Environmental sustainability

And did this all work quite well without Information Technologies?

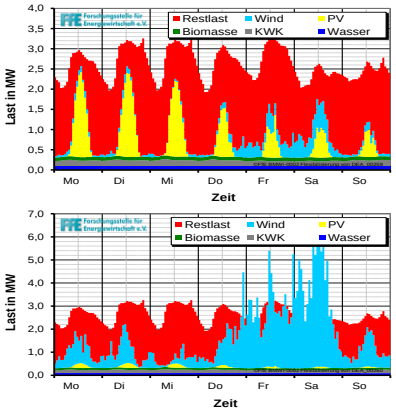
The world has changed…



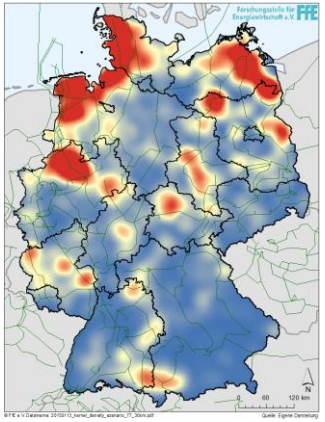
Liberalisation & Unbundling



Number of Players



New Generation



Change in transportation and distribution

How can Information Technologies help in a liberalized market?

In der Studie IKT für Energiemärkte (https://www.iese.fraunhofer.de/content/dam/iese/de/documents/Internet_der_Energie_tcm122-45131.pdf) wird auf Seite 8 dargestellt, dass an einer Stromlieferung vom Erzeuger zum Verbraucher in Summe 10 Akteure beteiligt sind und hierfür mindestens 13 Verträge notwendig sind.

-> Information technologies can decrease transaction costs dramatically, enables new Business Cases and brings liquidity into the market and makes them more efficient.

Source: BDI Initiativ IKT für Energiemärkte der Zukunft, 2008

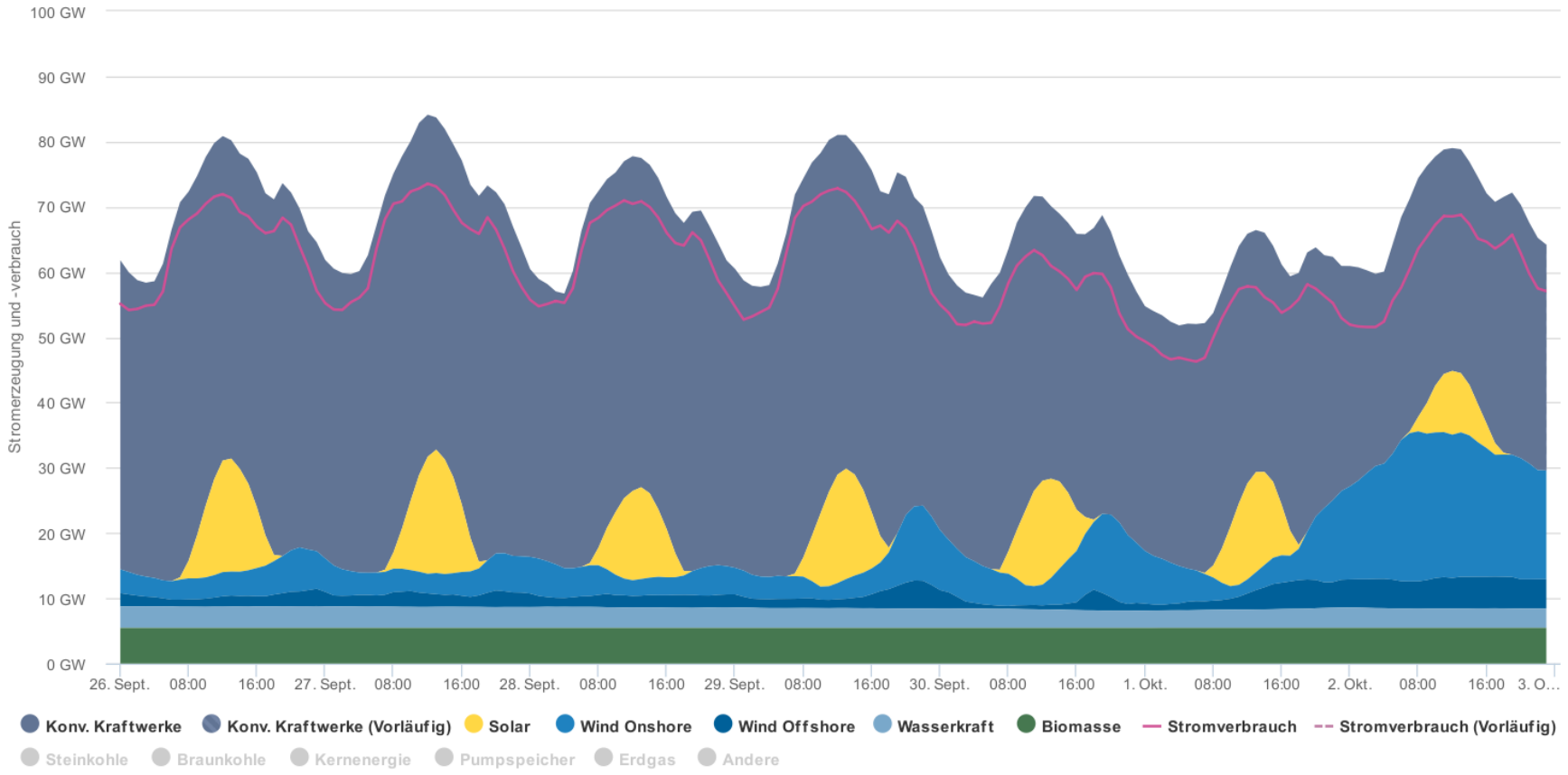
Are Blockchain and Smart Contracts the next step?

The Idea is to use smart contracts in the blockchain technology and skip the intermediary with the goal to establish new business cases.

But, is the use of Blockchain really energy intelligent?

https://digiconomist.net/bitcoin-energy-consumption calculated that the overall electricity consumption for bitcoin in 2017 is higher than 19 TWh. This is roughly the electricity consumption of Iceland or Ecuador. So the Electricity consumed is estimated at 221 kWh per transaction.

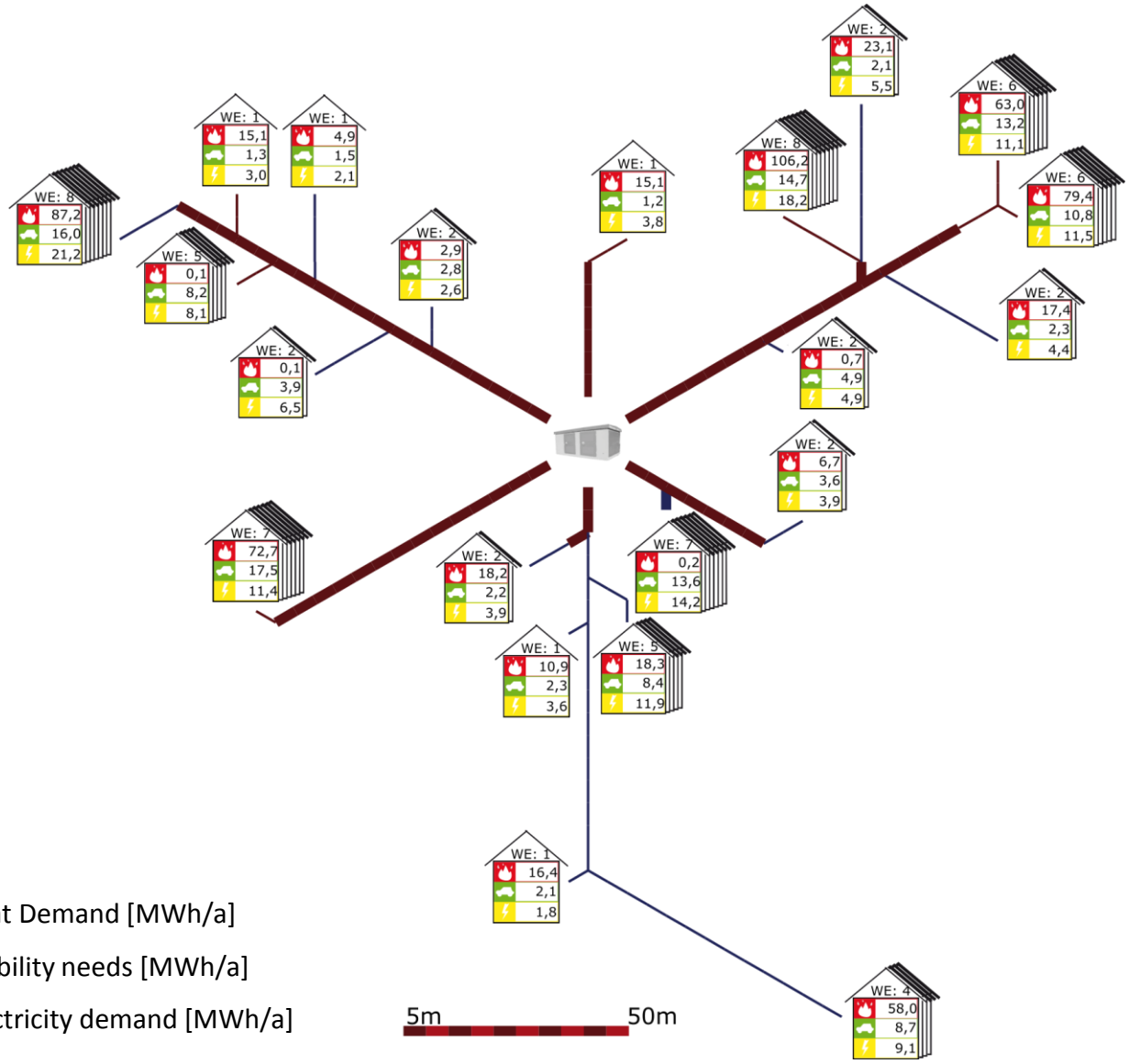
How can information technologies help to integrate the new generation of wind power and PV?



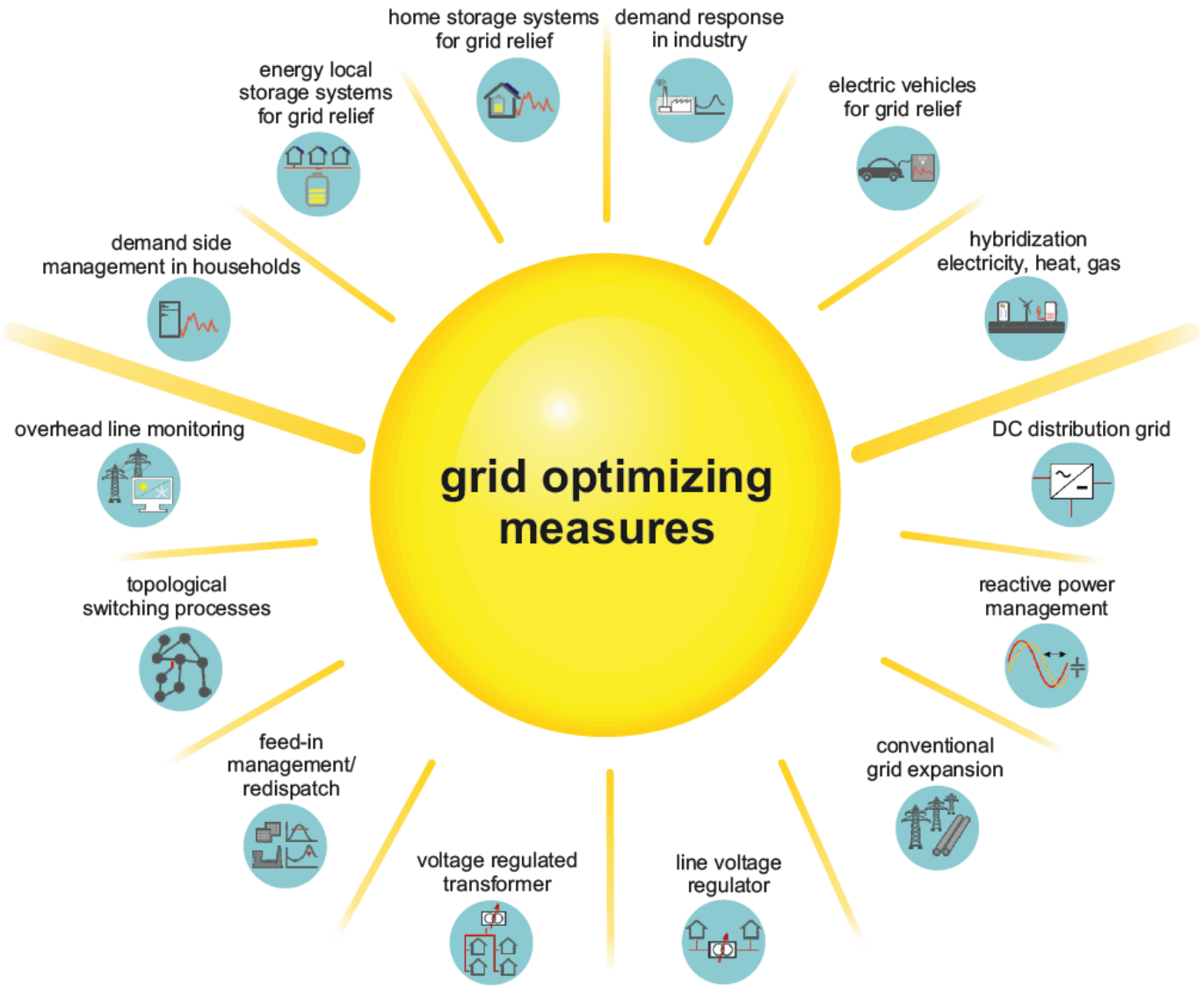
Minimizing forecast errors is essential for the security of supply.
Real time data and new algorithms are improving the forecast.

Source: https://www.agora-energiewende.de/de/themen/-agothem-/Produkt/produkt/76/Agorameter/

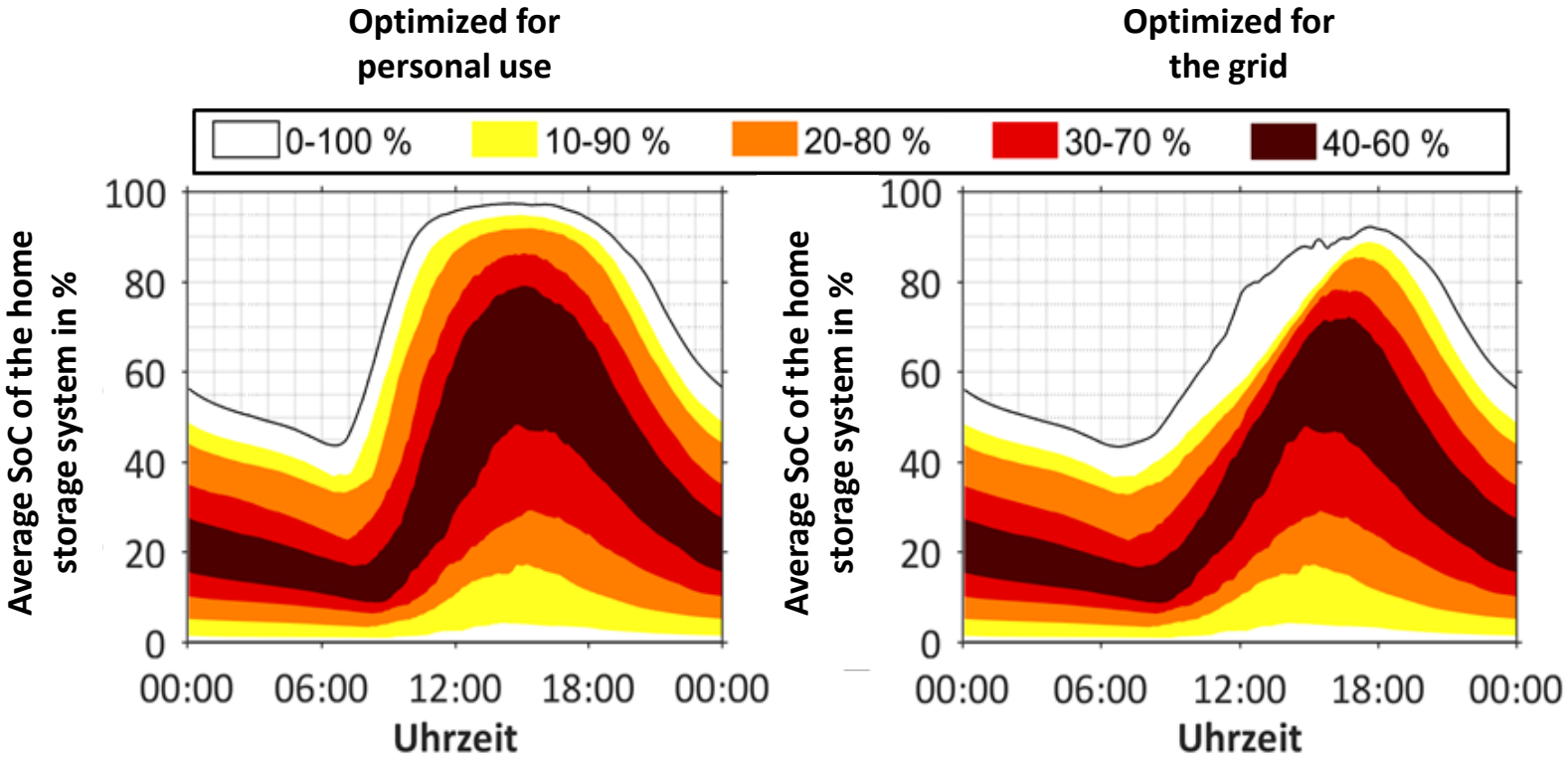
How can data help grid management on the distribution level?



For a better integration, many new solutions are available – which are based on information technologies?



How can Information Technologies ensure an intelligent dispatch of the assets?



- The different patterns of the state of charge reflect the different conditions applied to the system:

Personal use: the battery recharges as soon as a specific number of connection points in the house is reached
Network: regenerative power (=power sent back to the network) is avoided by the system

- With network-optimized conditions:

Significant shift of the time when the battery is fully charged

Significant network relieving effect, as the PV peak is completely cut off

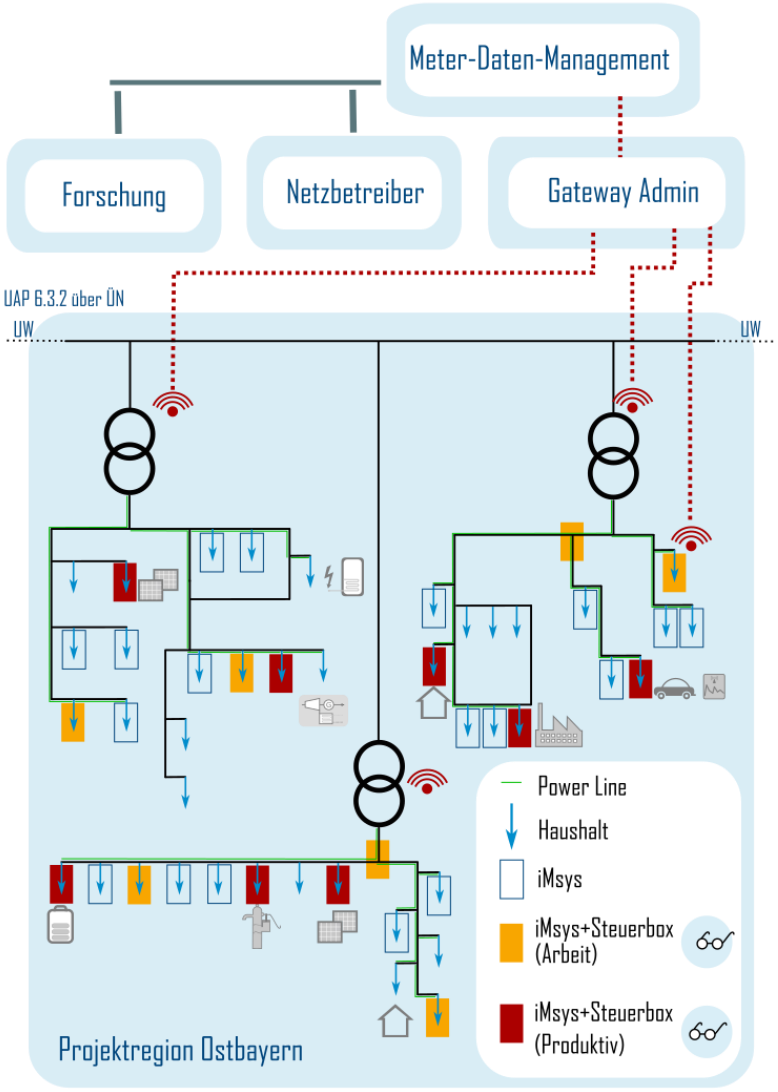
What is the role of the Smart Meter in such an intelligent energy system?

Technical infrastructure

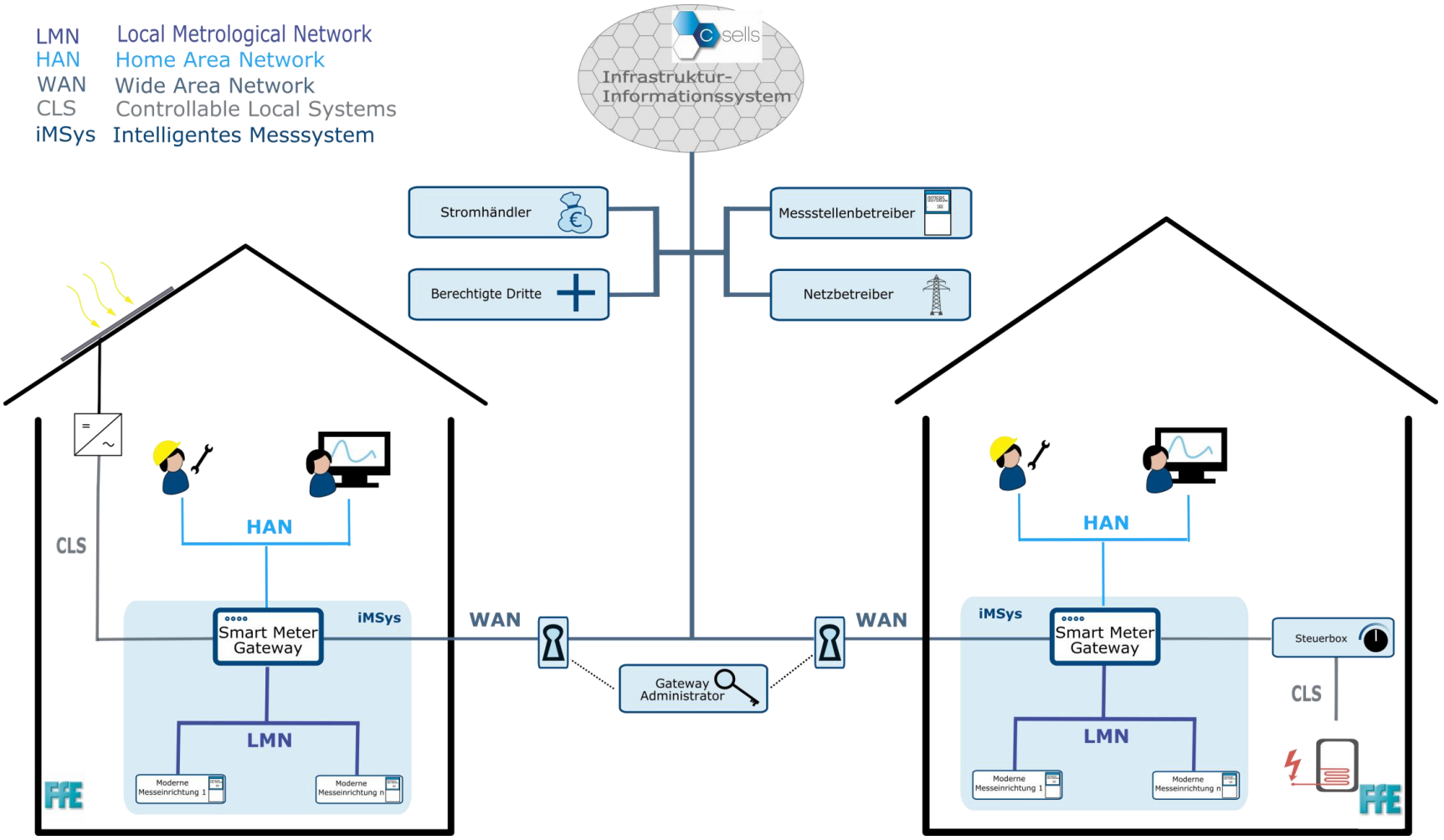
- Rollout up to 1.500 Smart Meter + Smart Meter Gateway
- Implementation of up to 150 control boxes at suitable test persons
- Combination of different communication technologies
- Meter-Daten-Management to store and supply 15-min data
- Smart Meter + Smart Meter Gateway has got a geocode

Field test partners

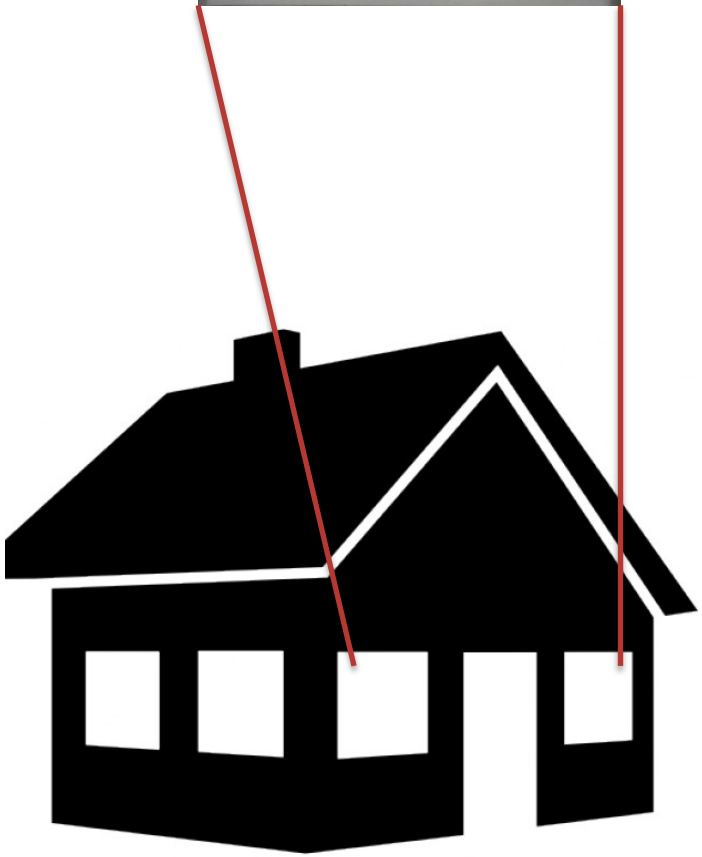
- Bayernwerk AG
- FfE e.V.
- FfE GmbH
- E.ON SE
- Intel GmbH
- PPC AG
- OTH Regensburg

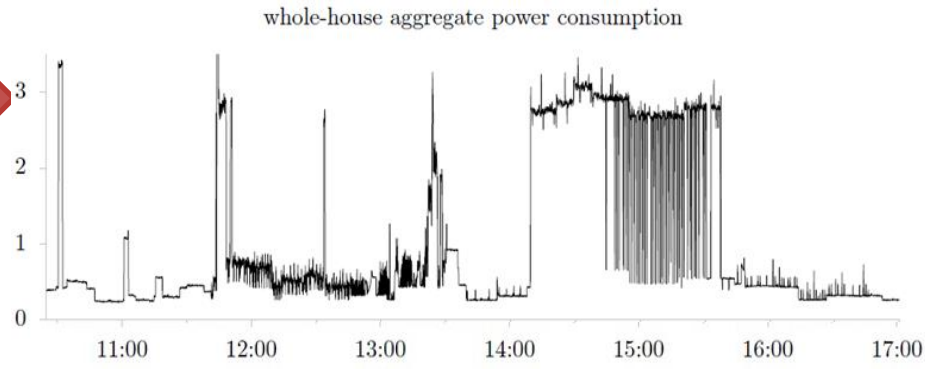


How to integrate your home in the intelligent energy system?

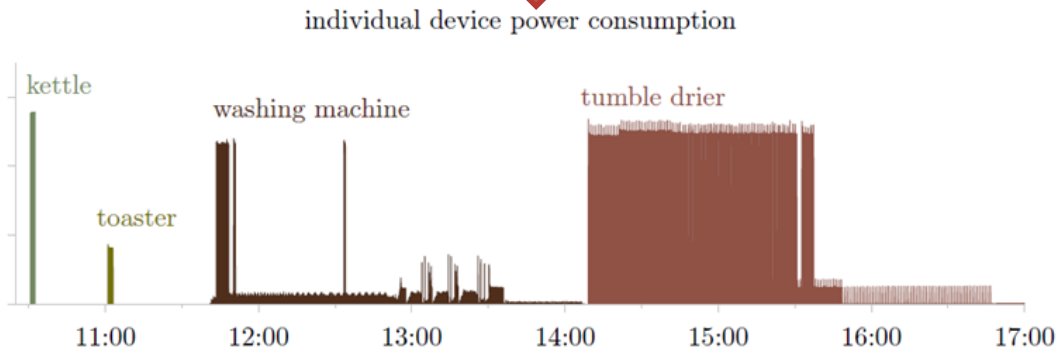


How can we use Smart Meter data?





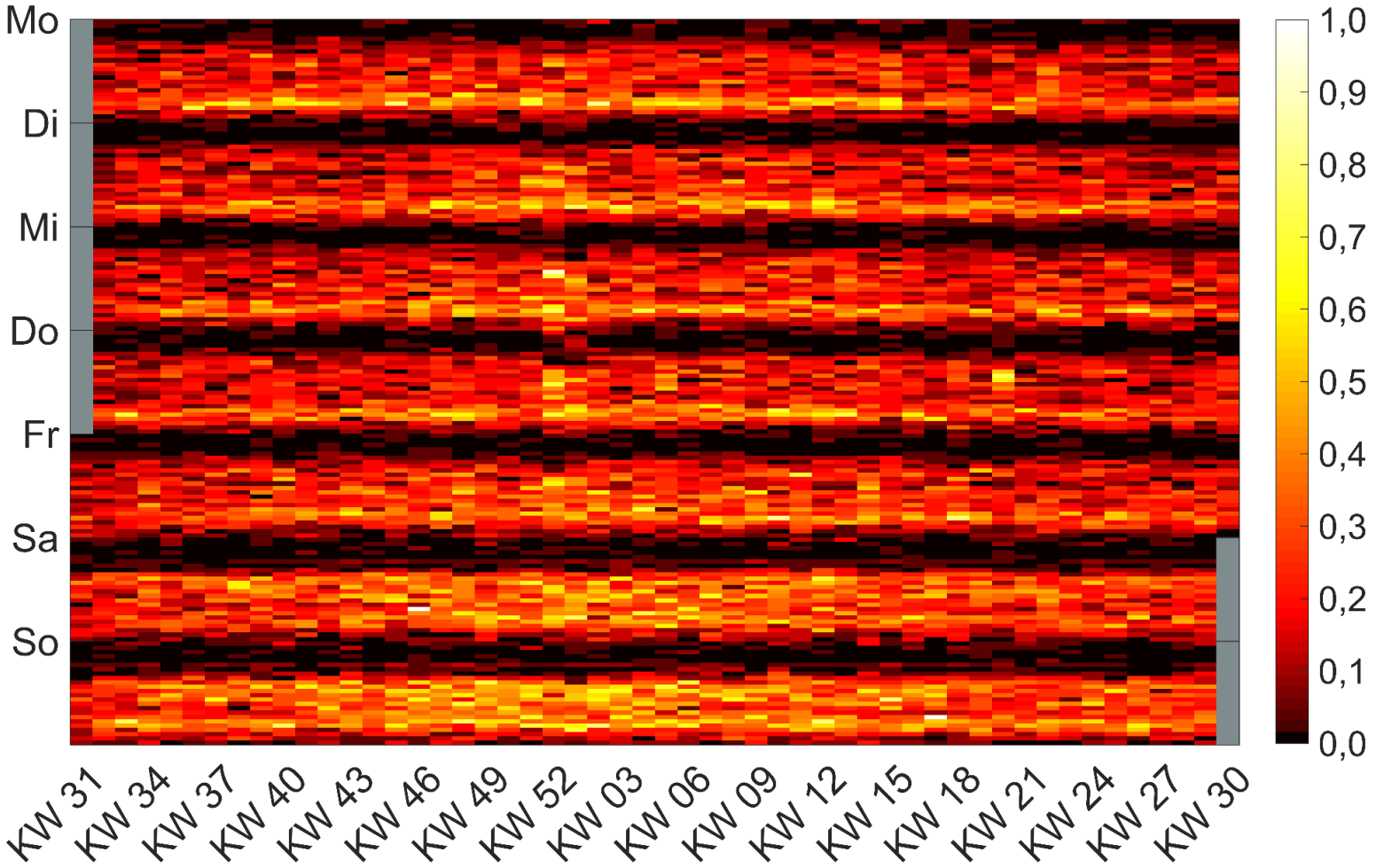
„Disaggregation“



Load Shift

How can we use Smart Meter data?

Usage rate of dishwashers



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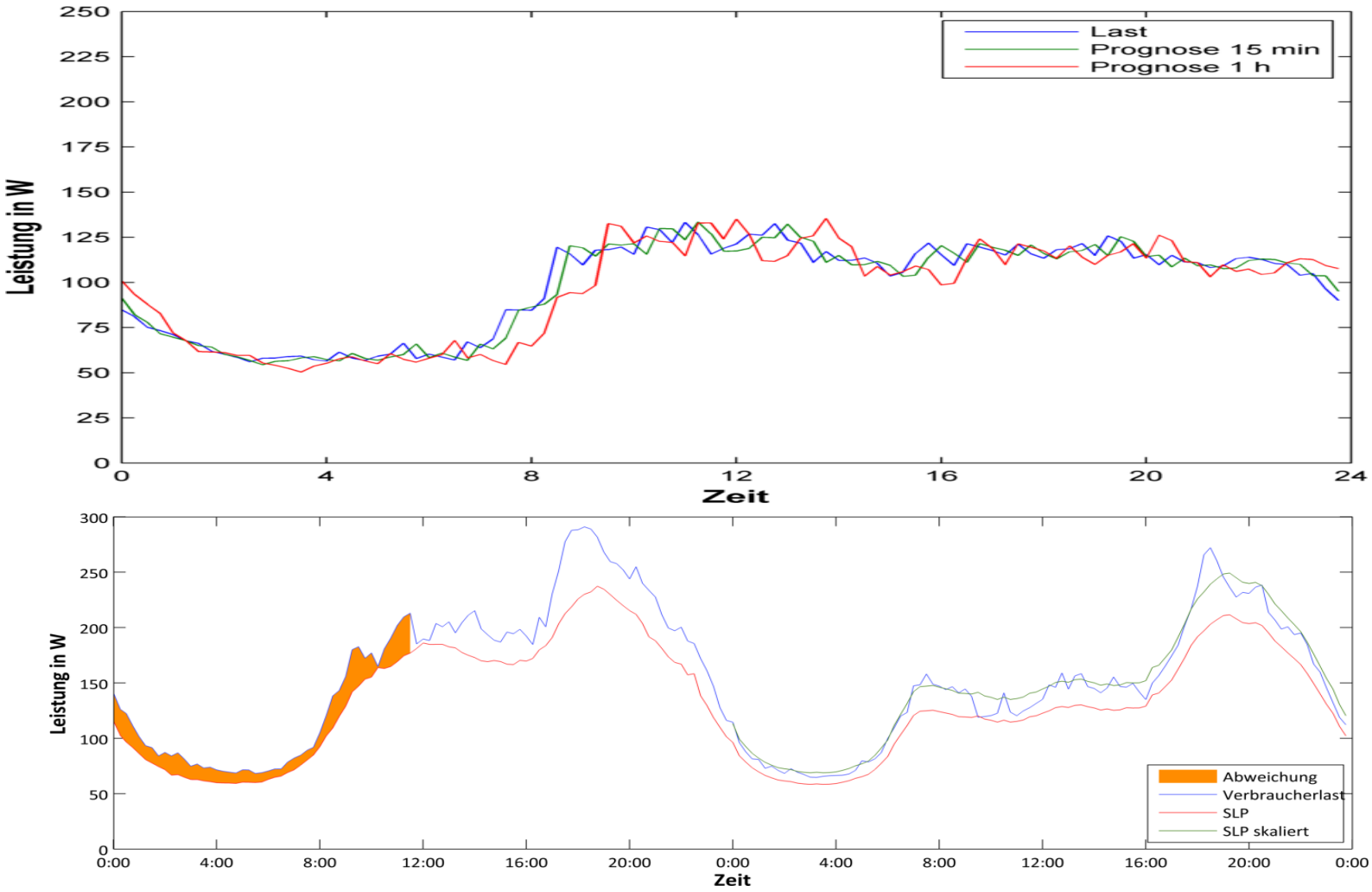

Load Forecast can be significally improved.

And what could be the contribution of the industry?

SynErgie is a joint project where the industrial processes are adapted to a fluctuating energy production. ICT Technologies are required for:

- Flexibilization of the industrial processes - Demand Side Management
- Industry 4.0

Source: https://www.kopernikus-projekte.de/projekte

Conclusion

Basically an intelligent energy system will be a 100 % climate neutral energy system with a high security of supply, that doesn't cost too much.

There a many challenges in this transition, where information technologies can provide solutions. But they aren't the solution in itself.

We also have to chose them carefully to avoid additional energy consumption and new risk of cyber security.