SmartNet

Smart TSO-DSO interaction schemes, market architectures and ICT Solutions for the integration of ancillary services from demand side management and distributed generation

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The Danish Pilot:
Electrically heated swimming pools as flexible assets

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Energinet.dk

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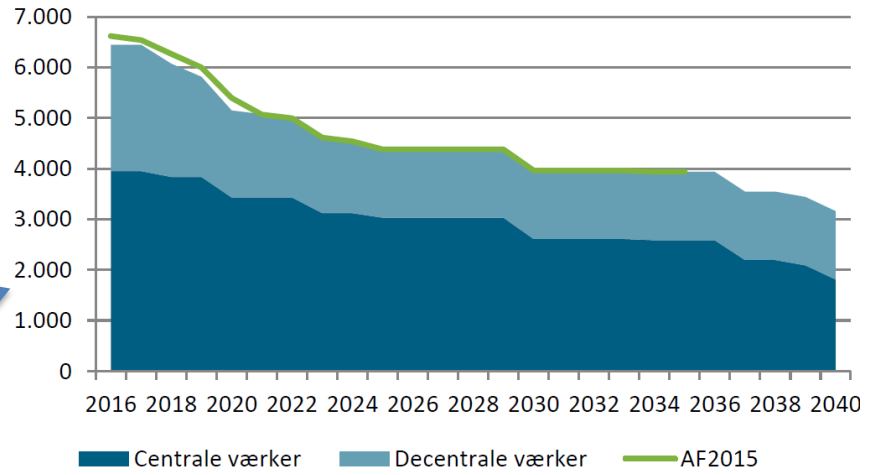
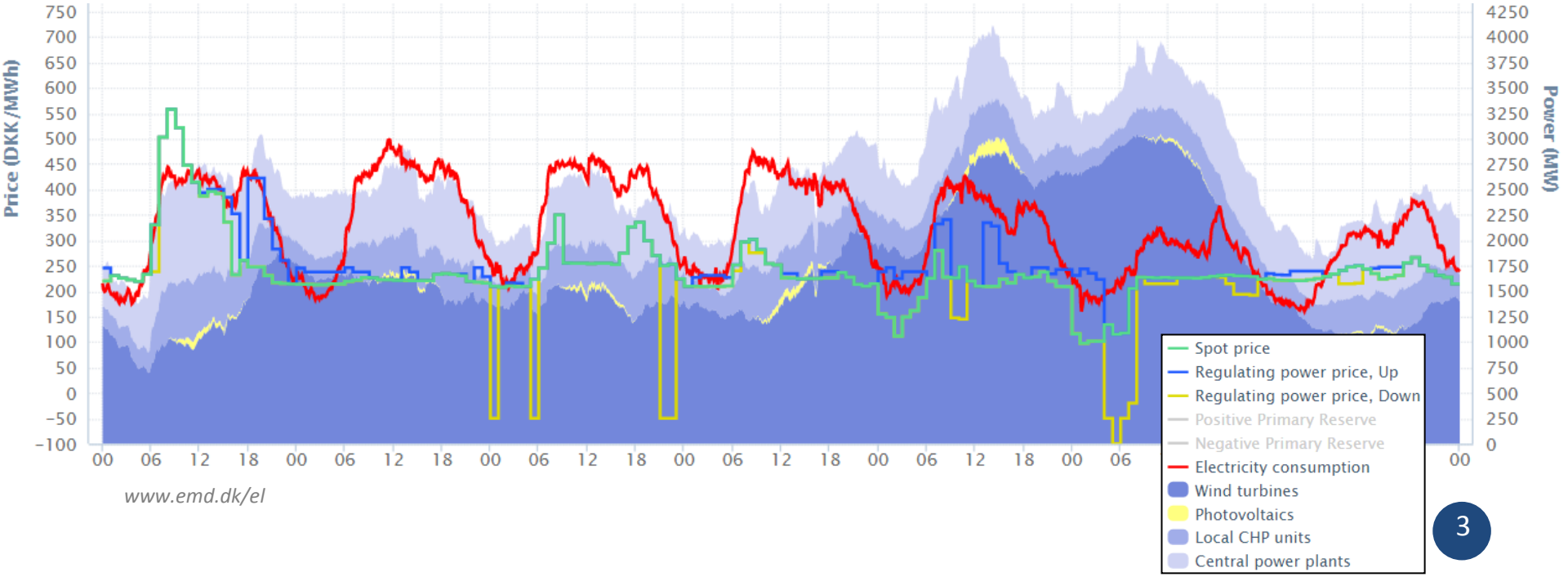
Agenda

- Challenge:
  - Grid balancing
  - Congestion management
- Pilot case:
  - Case of swimming pools
  - Balancing market design

Challenge: Grid Balancing

- 42% wind power in 2015
- Thermal capacity decreasing
- Currently no demand response





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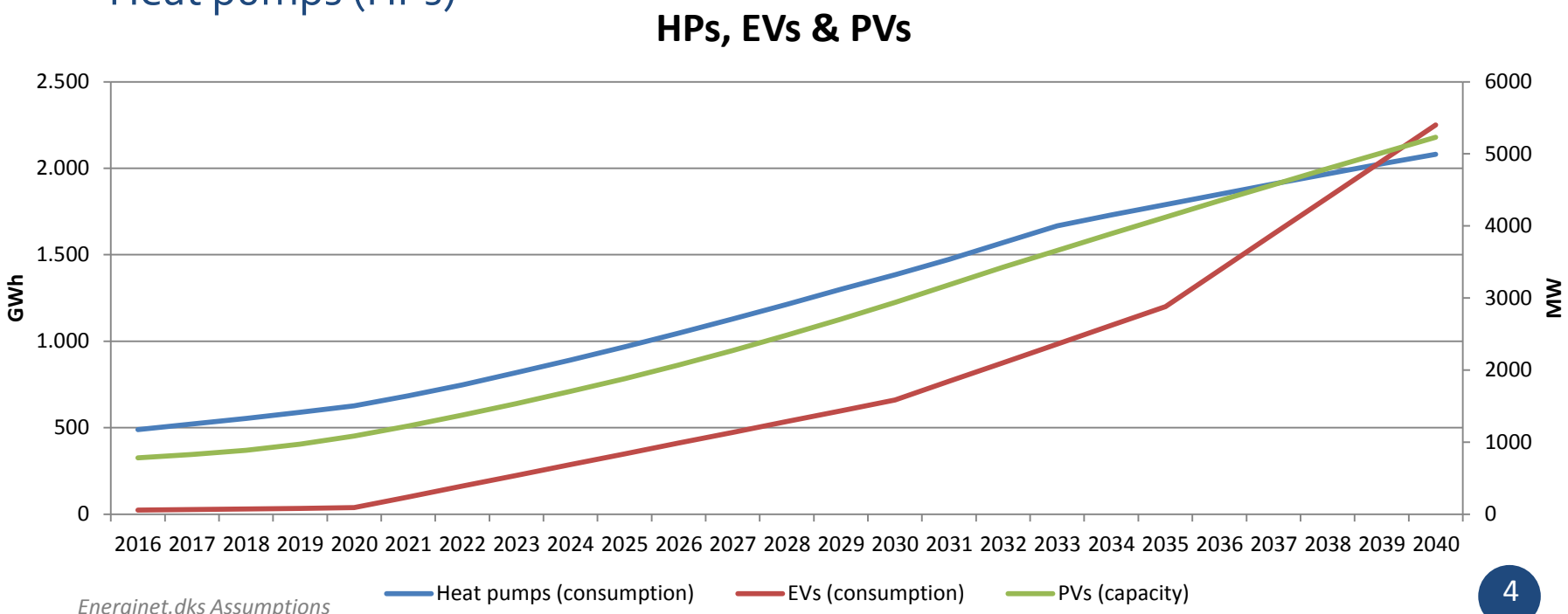
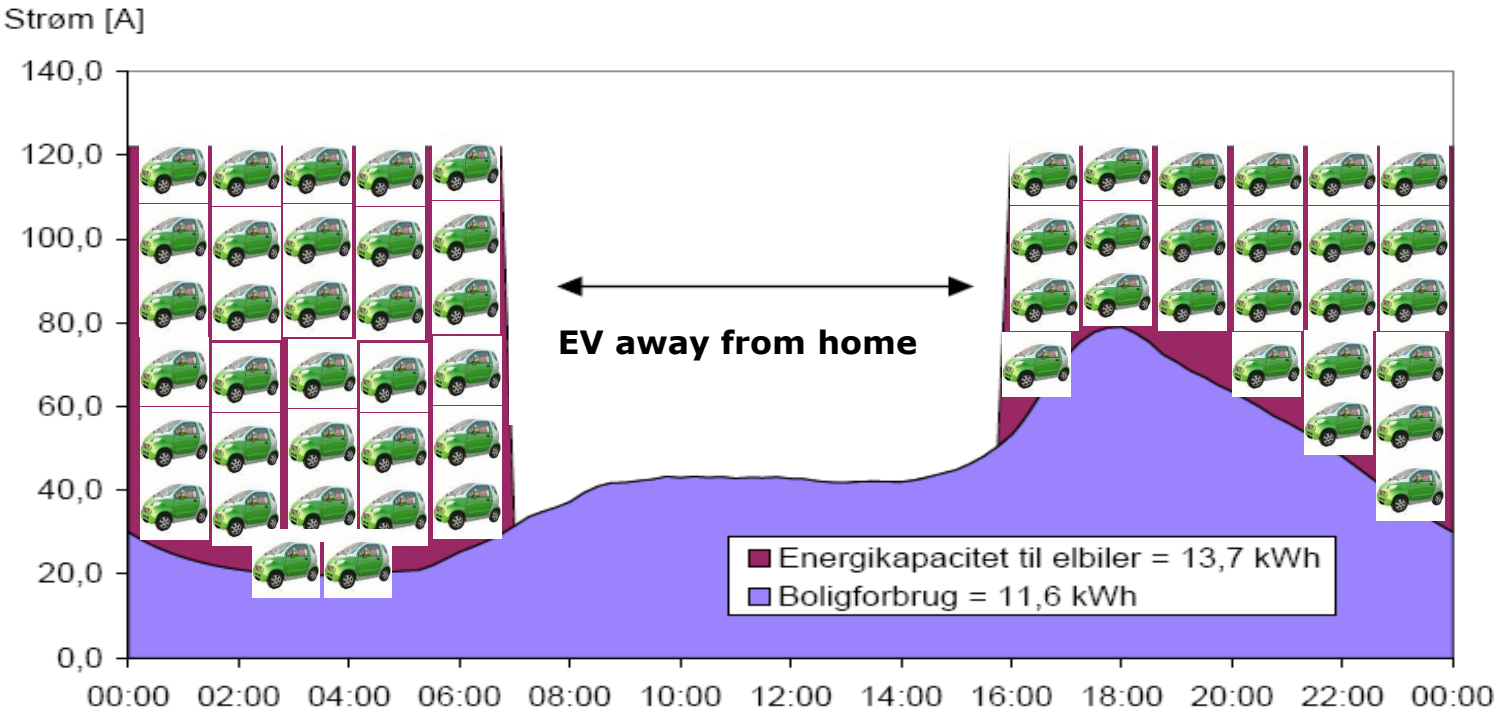
Challenge: Congestion Management

- Photovoltaics (PVs)
- Electric vehicles (EVs)
- Heat pumps (HPs)



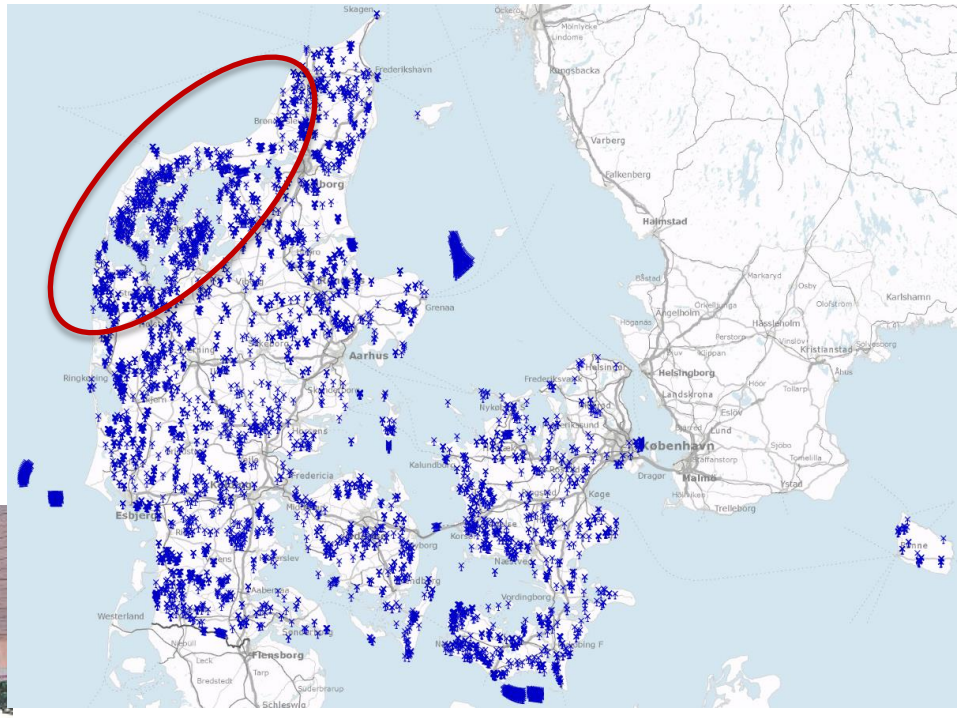
Energinet.dks Assumptions

Challenge: Congestion Management



Pilot case

- 30 summer houses
- Electric heated swimming pools
- Highly flexible consumption



Pilot partners

- Novasol - DER / sub-aggregator
- Eurisco - Control and metering
- Enfor - Forecasting
- DTU - Optimization
- ONE - Aggregator
- BRP - ?
- SydEnergi - DSO
- Energinet - TSO

Balancing market

Goal:

- Activation of DERs
- Optimal dispatch for solving balancing and grid congestion at once

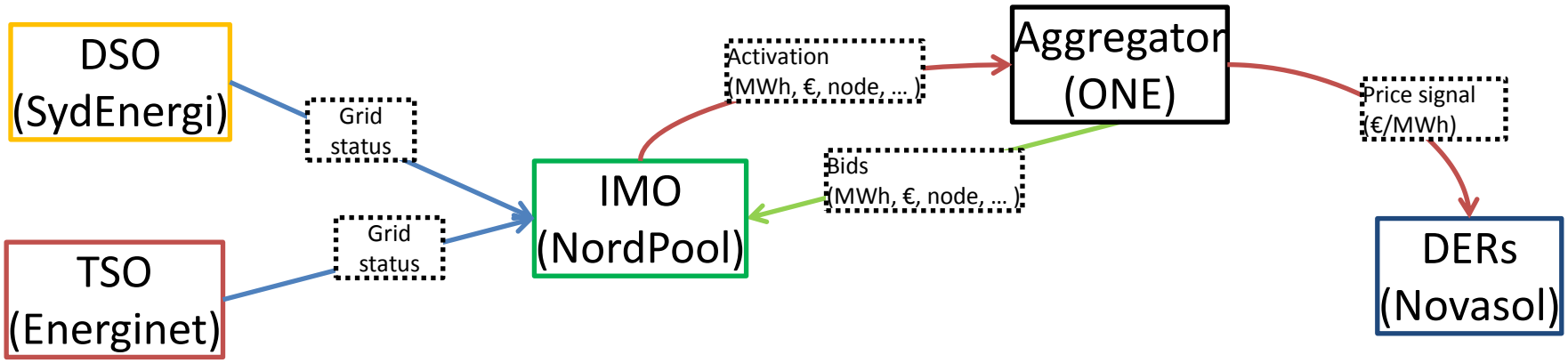
Means:

- Nodal pricing
- Marginal cost of grid use reflected in price formation
- 5 min time slots
- Advanced bid types
- Rolling optimization horizon

Balancing market – 5 mins before operation

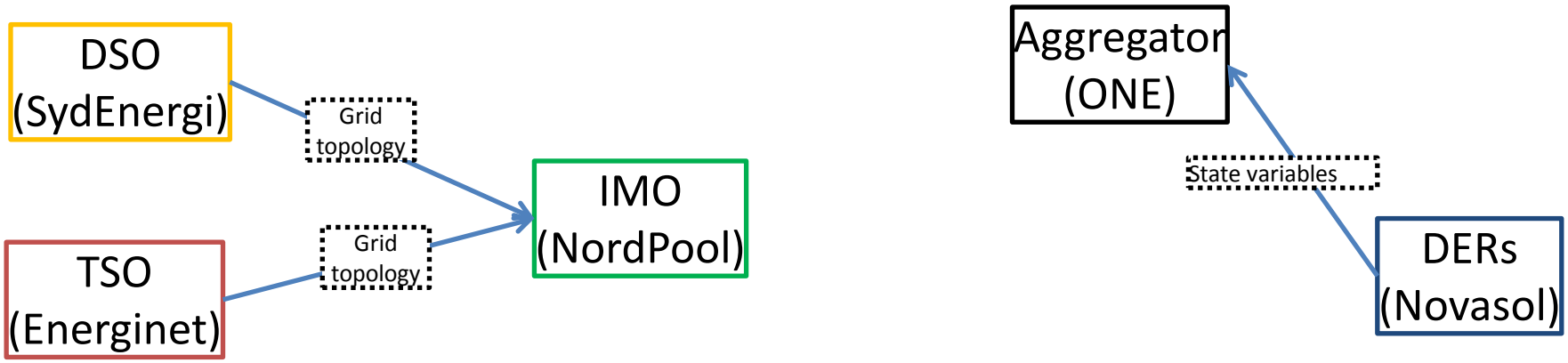
Local activation – Central optimization

1. TSO/DSO send current grid load to IMO
2. Aggregators send bids to IMO (MWh, €, node, …)
3. IMO calculates imbalance and activates necessary bids with the objective of **minimizing activation costs + marginal grid costs.**
4. Activation prices are passed on to DERs

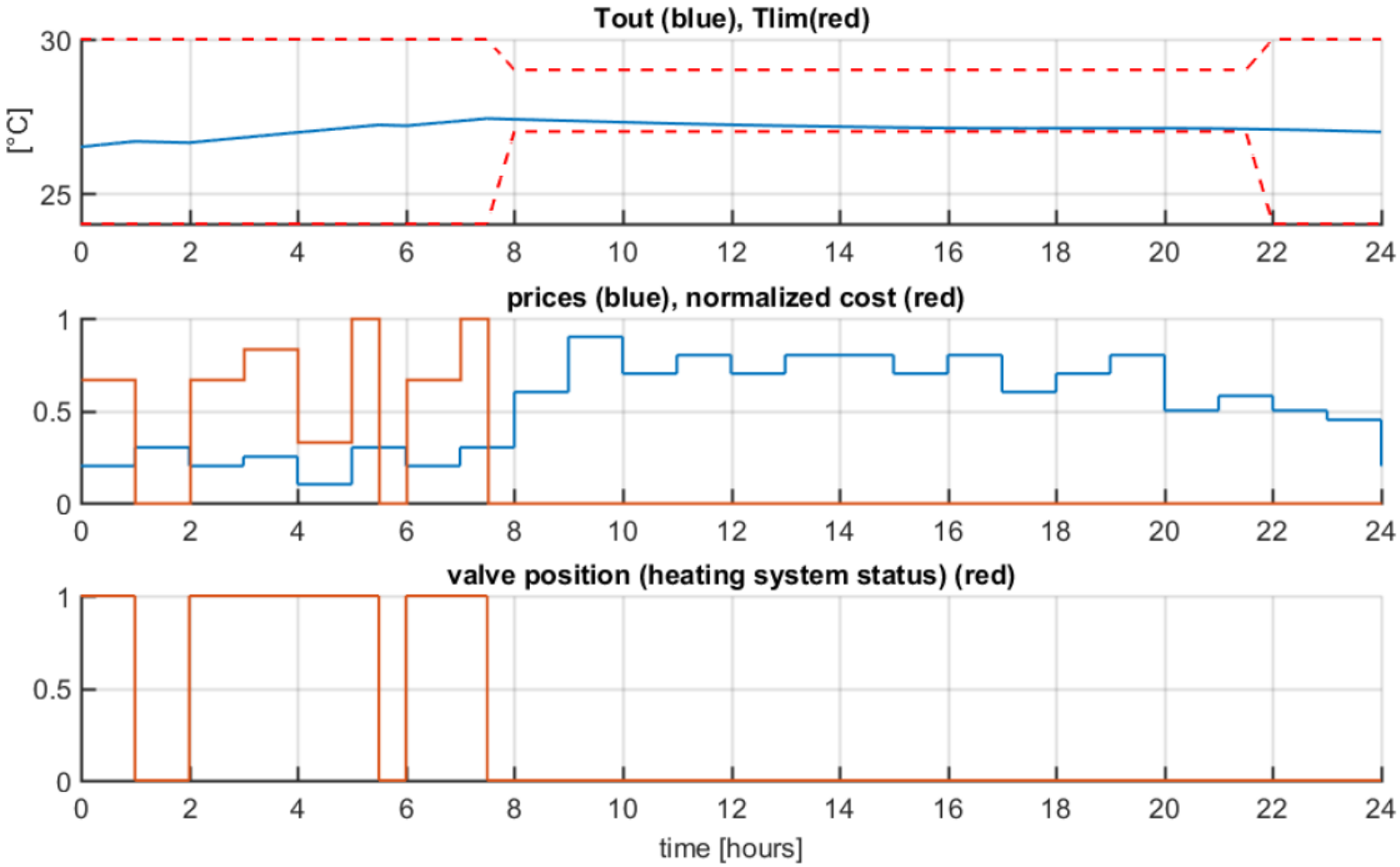


Balancing market – on beforehand

- TSO/DSO sends to IMO:
  - Grid topology
  - Maintenance schedules etc.
  - Marginal costs of use of each line/voltage level
- Aggregator calibrates model of DERs



eMPC modeling



Thank You

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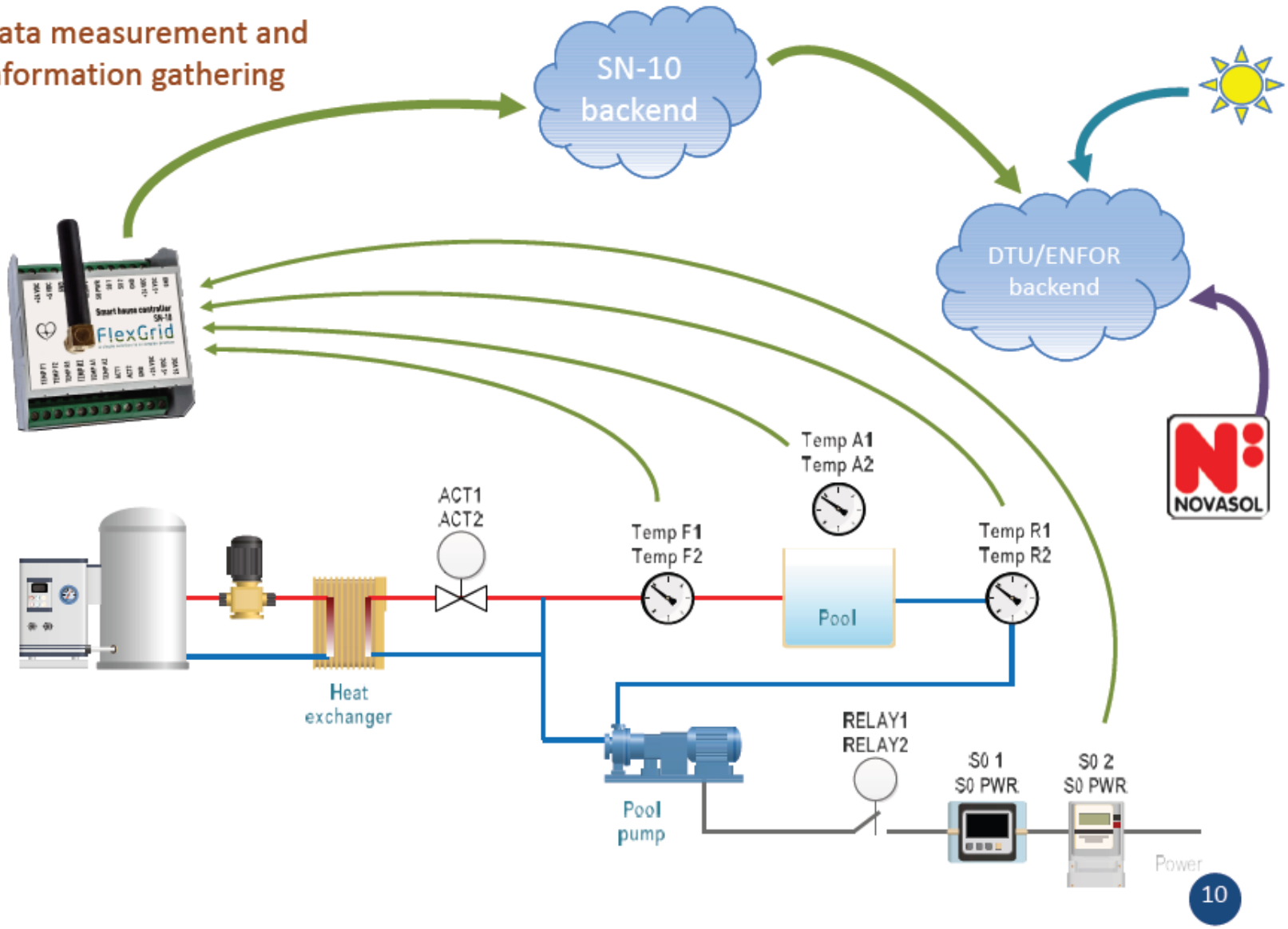
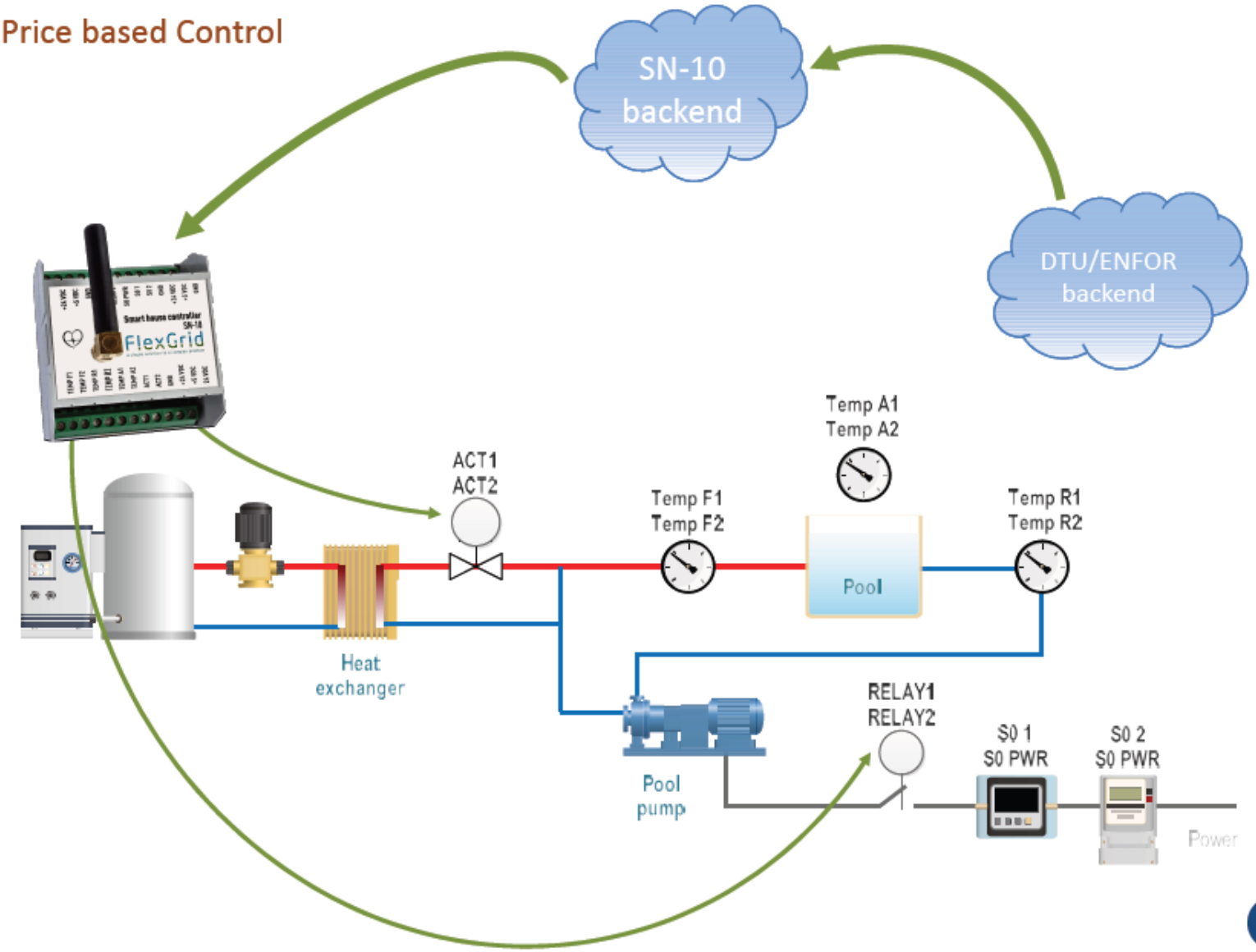
How does it work?

Data measurement and information gathering

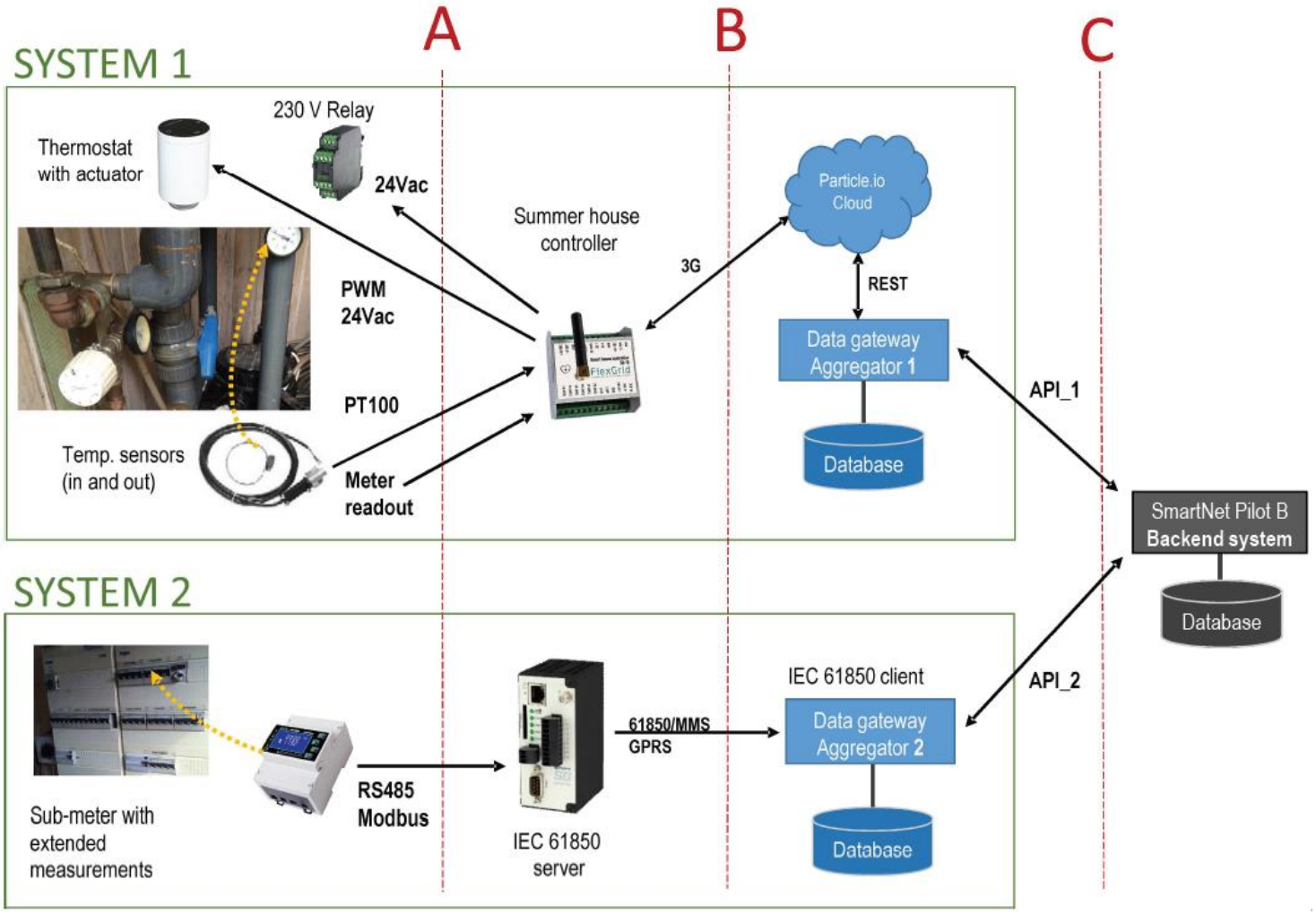


How does it work?

Price based Control



System Interfaces



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