



- IDE4L project overview and ANM concept
- Aggregator concept
- Developed functionalities
- Distributed automation system
- Demonstrations
- Conclusions



# Congestion management



# IDE4L Solutions

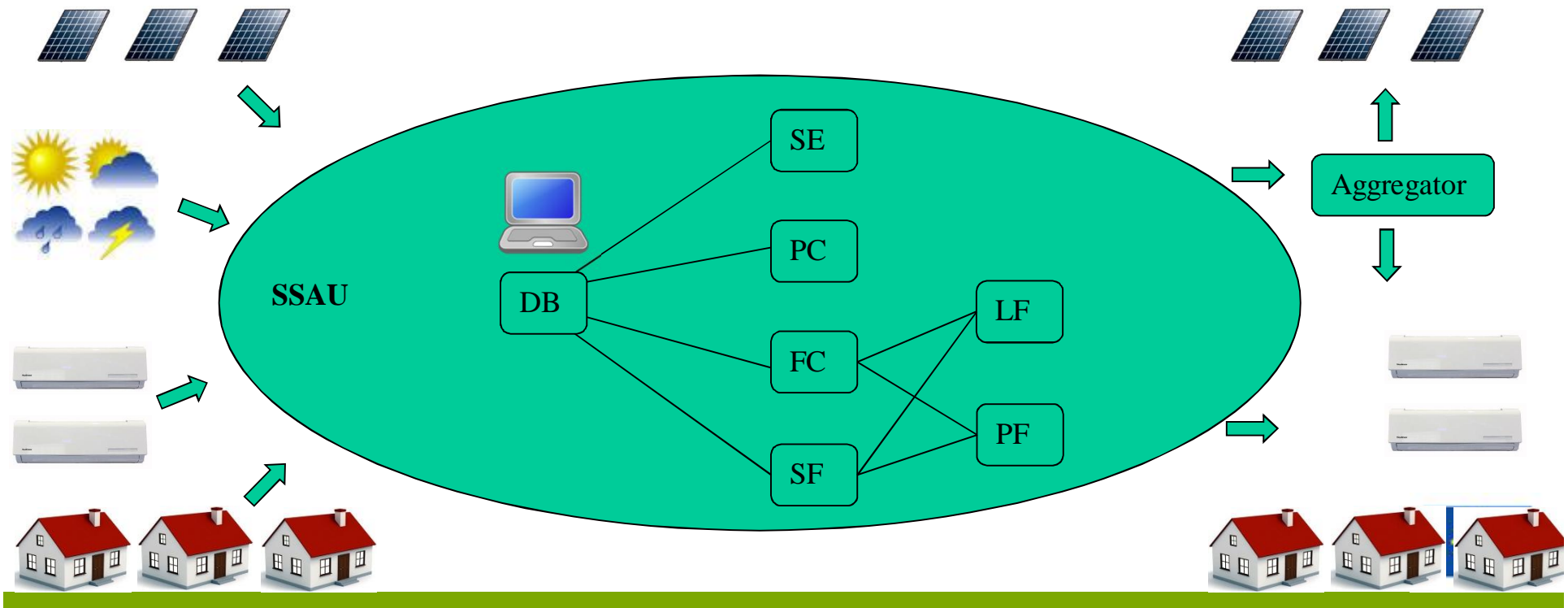
- Active network instead of a passive network
  - Decentralized
  - Automated
  - Hierarchical
- Postponing the costly traditional solutions
- Using the full capacity of distribution networks
  - Monitoring the state of the network
  - Automatic decentralized solutions to solve congestions
  - Better use of distributed energy resources – e.g. through market place

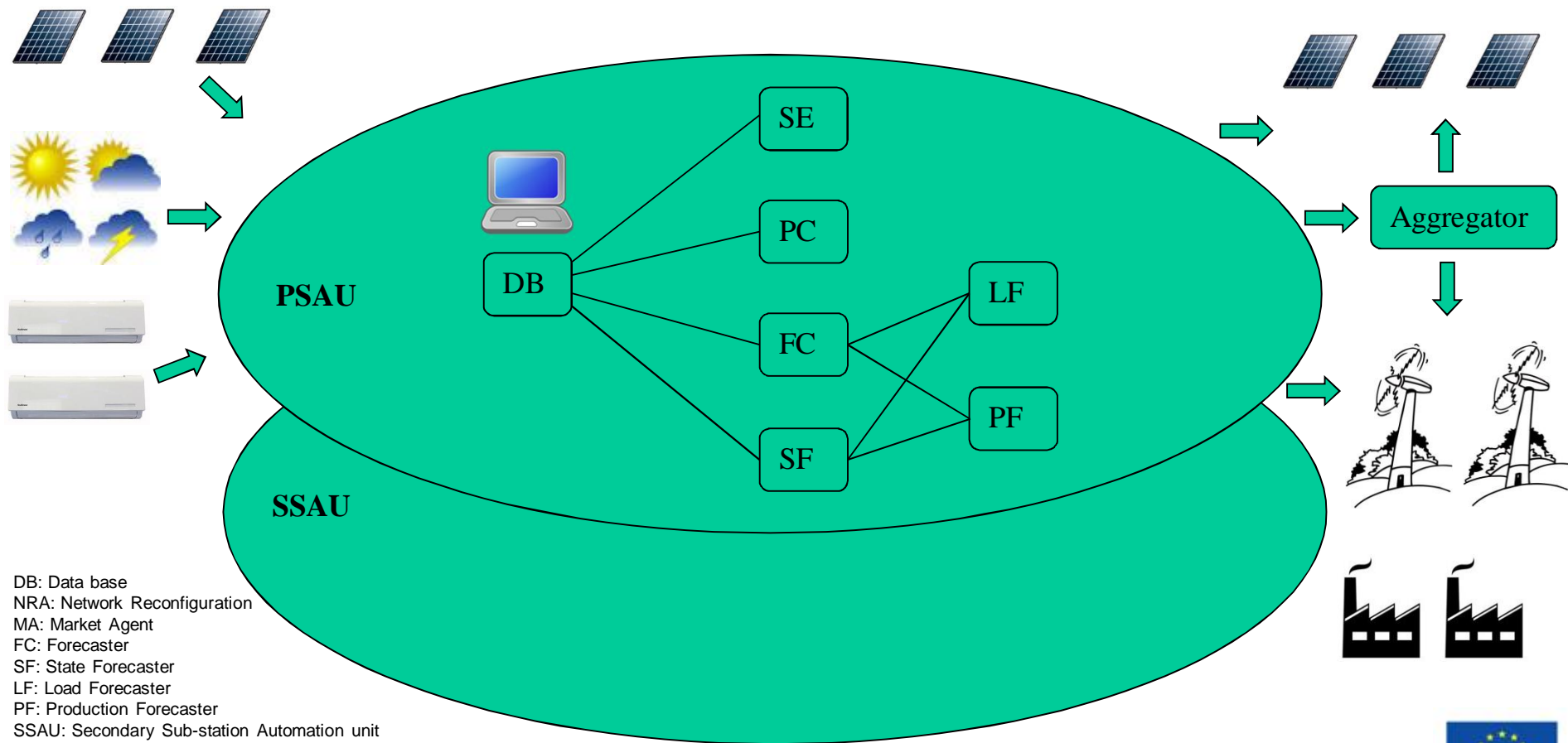
## Developed algorithms

- *State Estimation*
- *Forecasting + State Forecasting*
- *Secondary Power Control*
- *Tertiary Control*
  - *Network Reconfiguration*
  - *Market Agent*
  - *Dynamic Tariff*



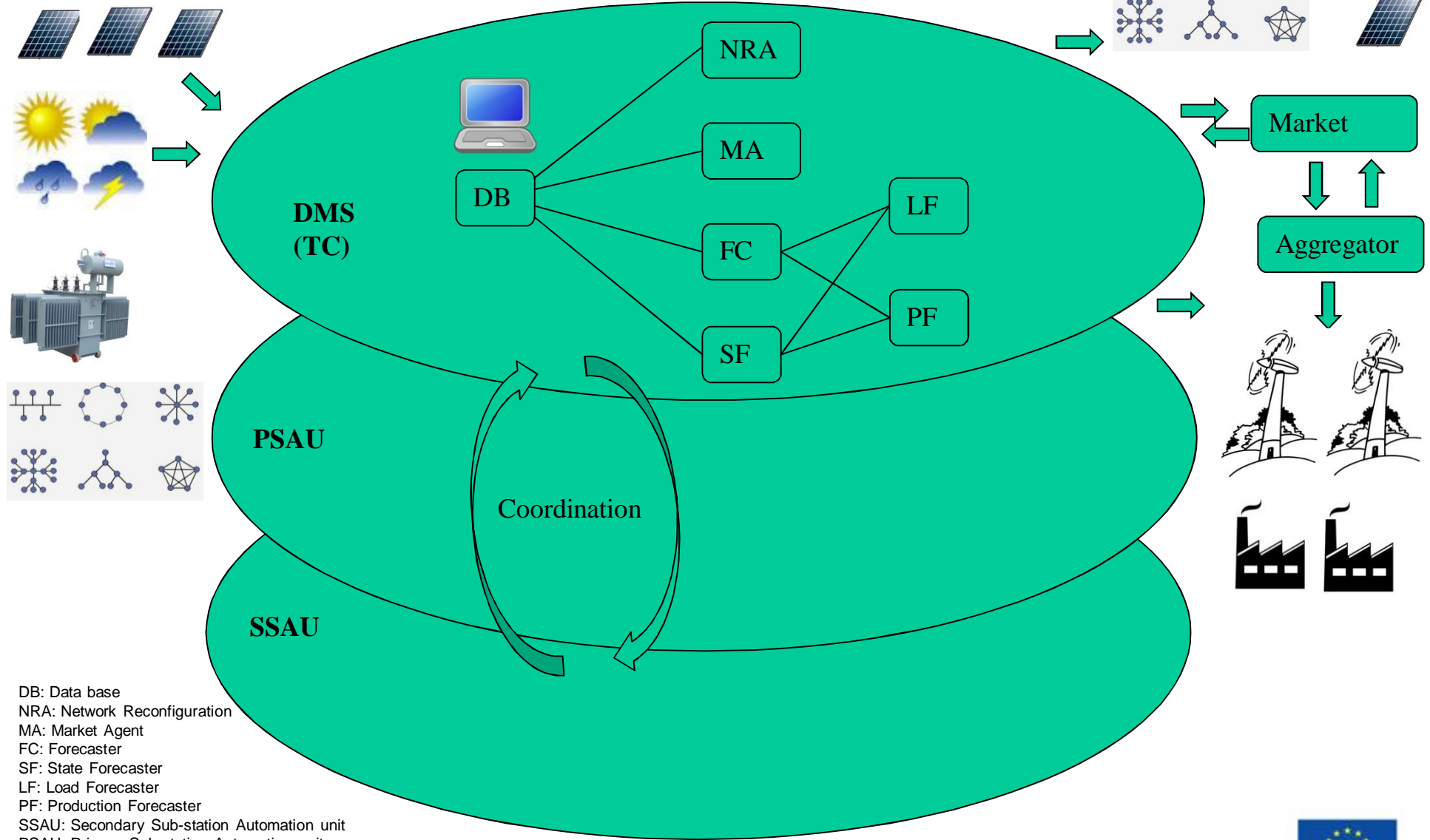
DB: Data base  
 NRA: Network Reconfiguration  
 MA: Market Agent  
 FC: Forecaster  
 SF: State Forecaster  
 LF: Load Forecaster  
 PF: Production Forecaster  
 SSAU: Secondary Sub-station Automation unit  
 PSAU: Primary Sub-station Automation unit  
 DMS: Distributed Management System  
 TC: Tertiary Controller





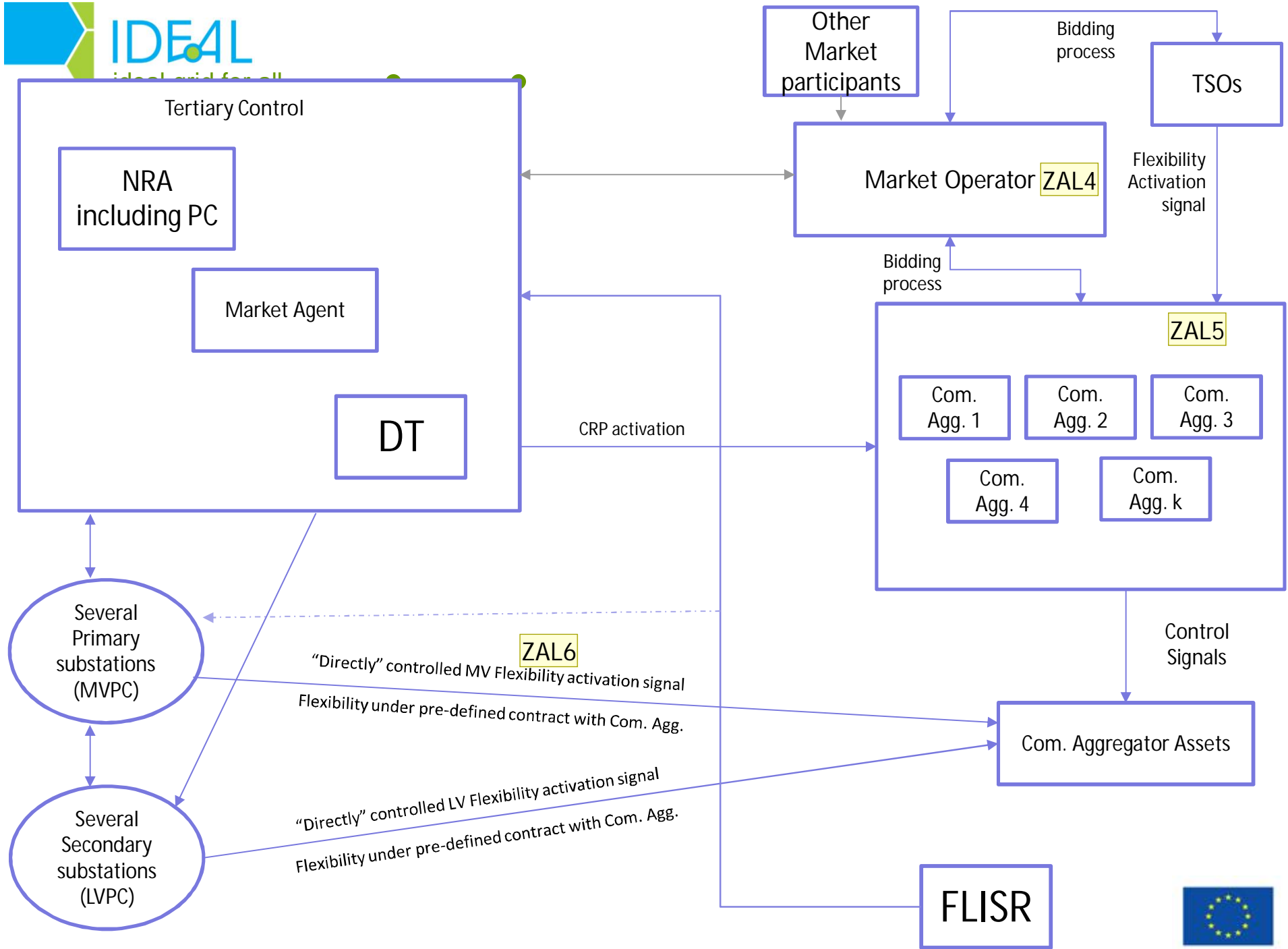
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ZAL4 I would rather call it a market place. A market operator will need a market to operate, thus another box would might be needed.  
Zaid Al-Jassim; 8.1.2015

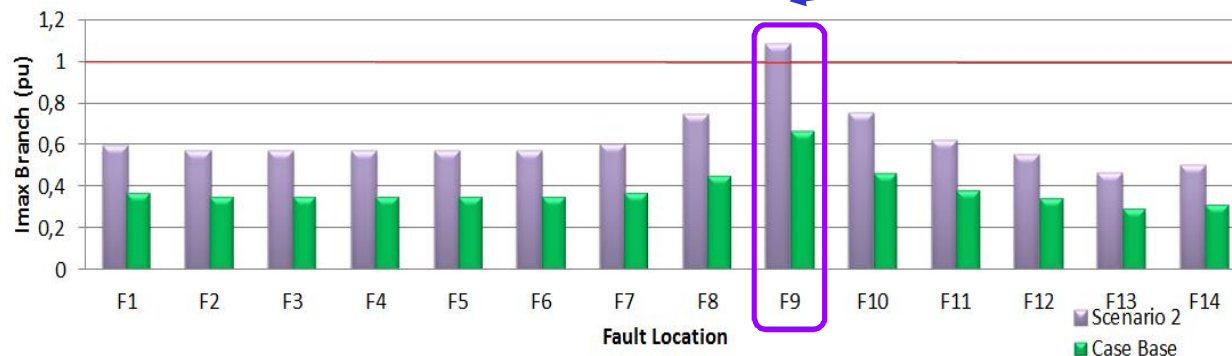
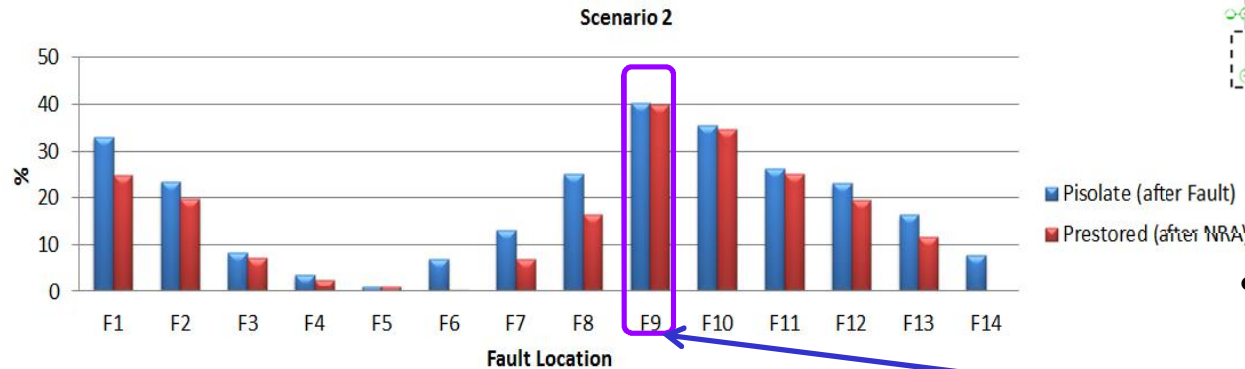
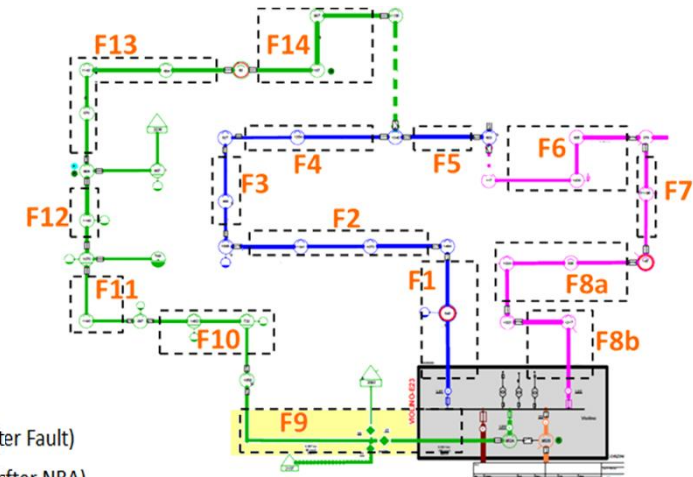
ZAL5 1. The C- aggregator and T- aggregator will still need the external inputs such as weather data and so on. why its not included?  
2. The T-aggregator will still need the DER schedule. Why its not included?  
Zaid Al-Jassim; 8.1.2015

ZAL6 I would rather call it DER because its only DER that we are controlling here. Flexibility is a little bit wider concept.  
Zaid Al-Jassim; 8.1.2015



# Real-Time Operation in the A2A Network: FLISR signal +high demand

## Tertiary Control: Network Reconfiguration Algorithm (NRA)



- After a fault at F9 (high demand) NRA restores the isolated load appearing an overloading in some branches of the new topology.

- After a fault at the rest of sections (F1...F14) NRA restores the isolated without congestion.



## Real-Time Operation in the A2A Network: high demand + fault at **F9**

### Tertiary Control: Market Agent Algorithm

- § After Faults at F9 (high demand) NRA restores the isolated load, but line E23L01-SS545 remains congested in a 108% (new topology).
- § The market agent makes use of the available CRPs already contracted (shown in the table).

#### § Solution found:

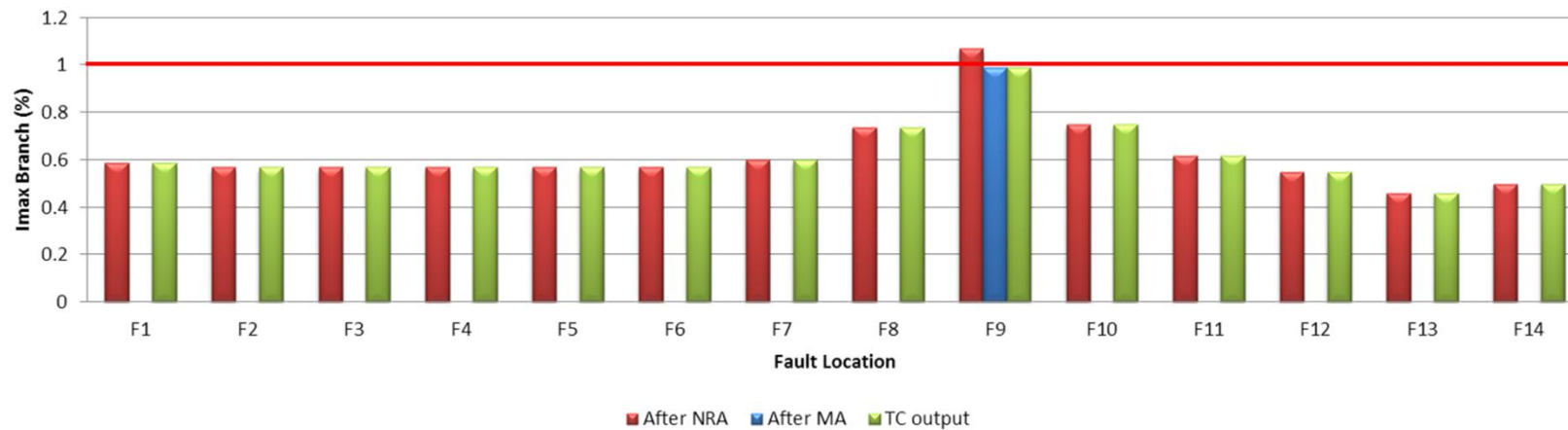
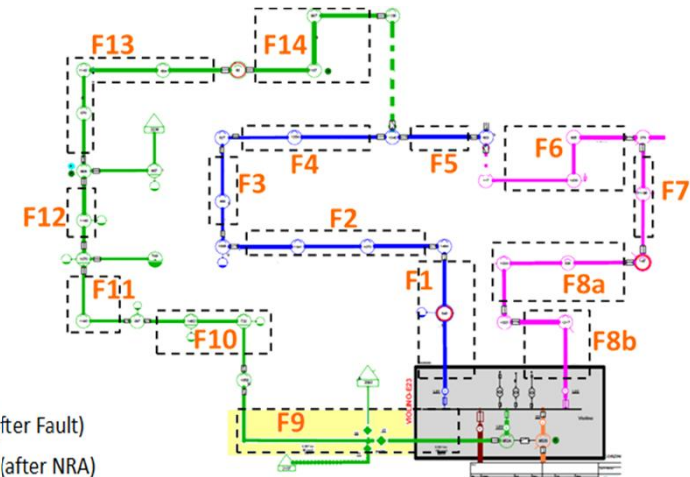
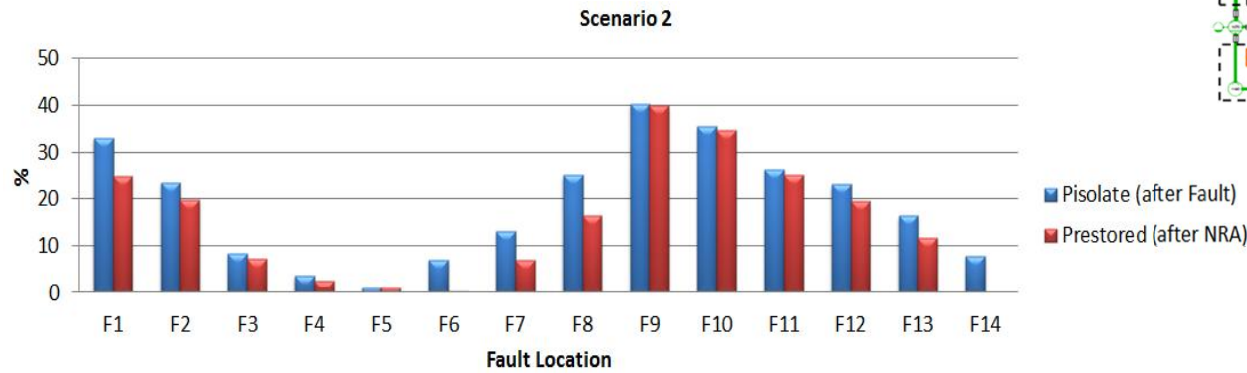
- Flexible loads at nodes 297 and 1006 should decrease in 150 kW.
- Aggregated LV load at node 1056 should decrease in 106 kW.
- Cost of the activated flexibility: 28.95 €/h (per activation).

Node	Quantity (↓ demand) [kW]	Activation Price [€/MWh]
<b>297</b>	150	70
<b>1006</b>	150	70
<b>1056</b>	110	75
<b>1512</b>	150	70



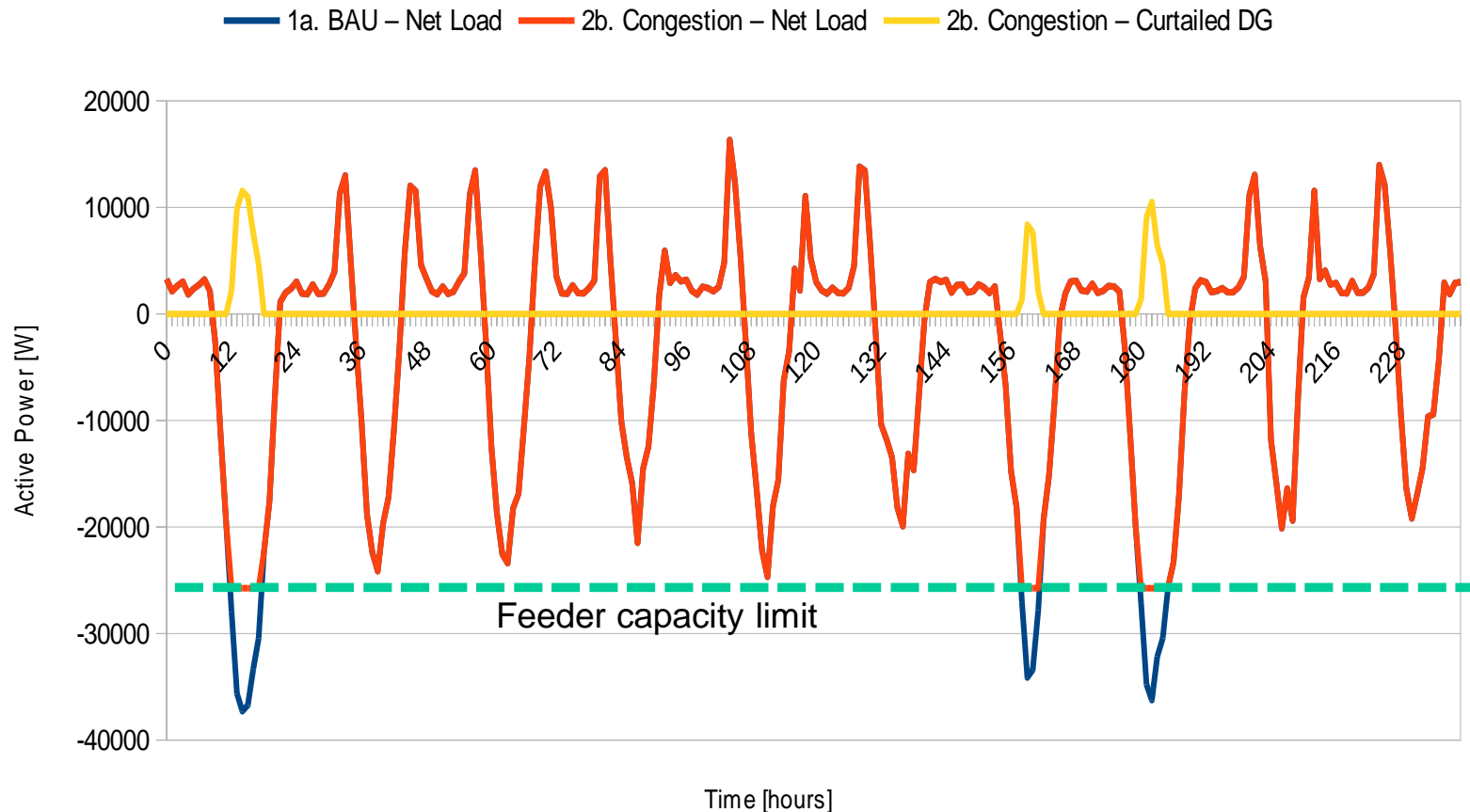
# Real-Time Operation in the A2A Network: FLISR signal +high demand

## Tertiary Control Output

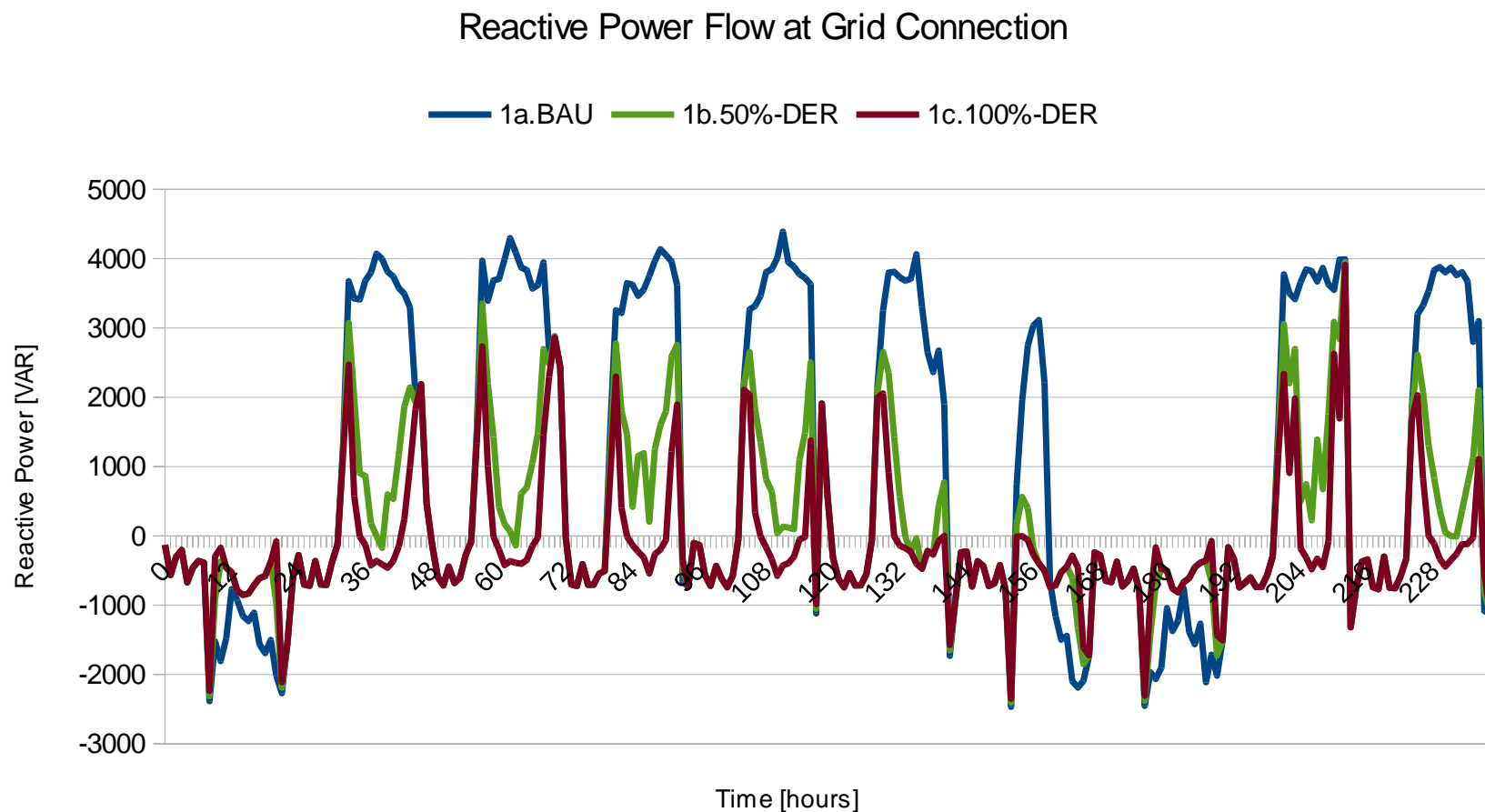


# The Low Voltage Power Controller is effective in curtailing active from PV units...

Active Power in Congested Network

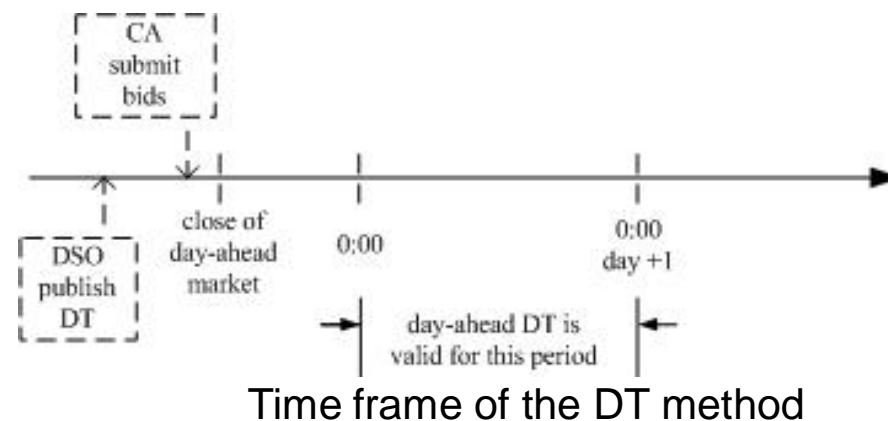


# The LVPC is also effective at minimizing reactive power flows:

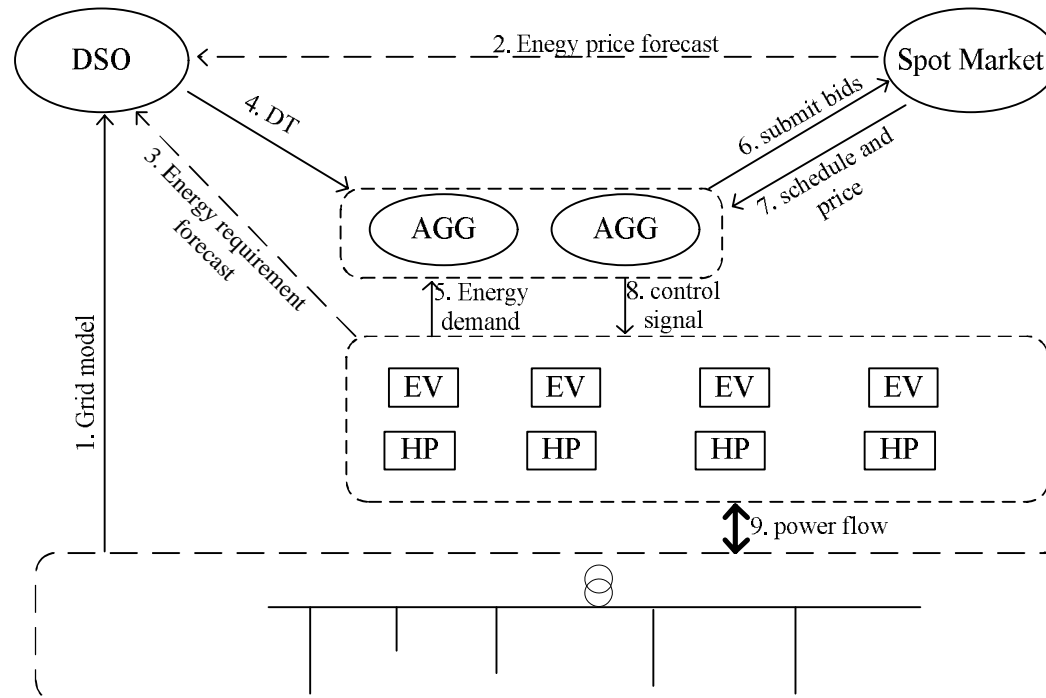


# Dynamic Tariff (DT)

- Dynamic tariff is changeable at different time and different node, implemented by the following procedure:
  - Step 1: DSO collects information for day-ahead energy planning
  - Step 2: DSO calculate and publish DT before closure of spot market
  - Step 3: DR at the commercial aggregator side - Aggregator make energy plan based on DT and energy price
  - Step 4: Commercial aggregator submit energy bids to spot market



# Concept of DT Method for Congestion Management



Information flow of the DT method for congestion management

—→ Info. with high reliability  
 - - -→ Info. with low reliability  
 ↔ Power flow

Main features:

- Decentralized control framework
- The DSO has the chance to maximize the social welfare
- It can be easily integrated into the existing market



## How breakthroughs will be achieved

- Development of algorithms
- Test of algorithms as individuals as well as one whole system
- Analysis of functionality and performance
- Promoting economical values for DSO
- Integration to the other pieces of the developed concept
- Promoting an IDE4L concept

