



Energy research Centre of the Netherlands

## ***DG-RES transition technologies and the role of flexibility***

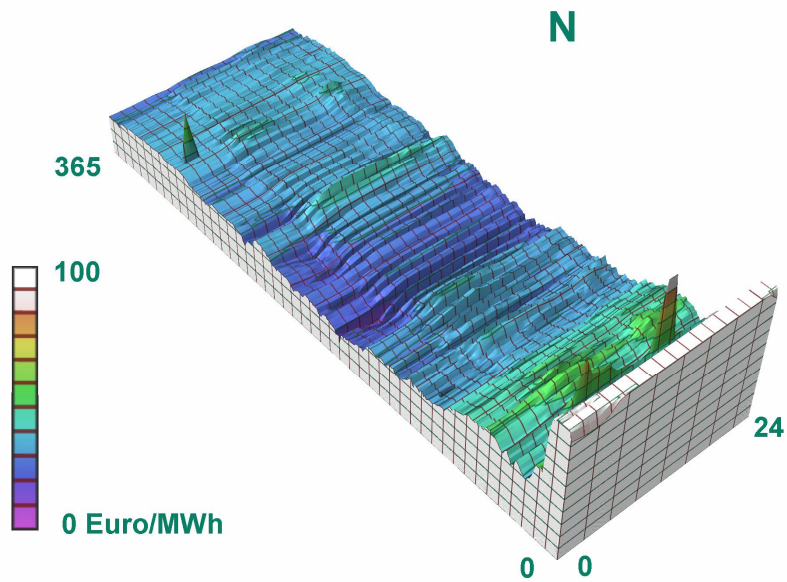
**René Kamphuis, ECN, Petten, the Netherlands**



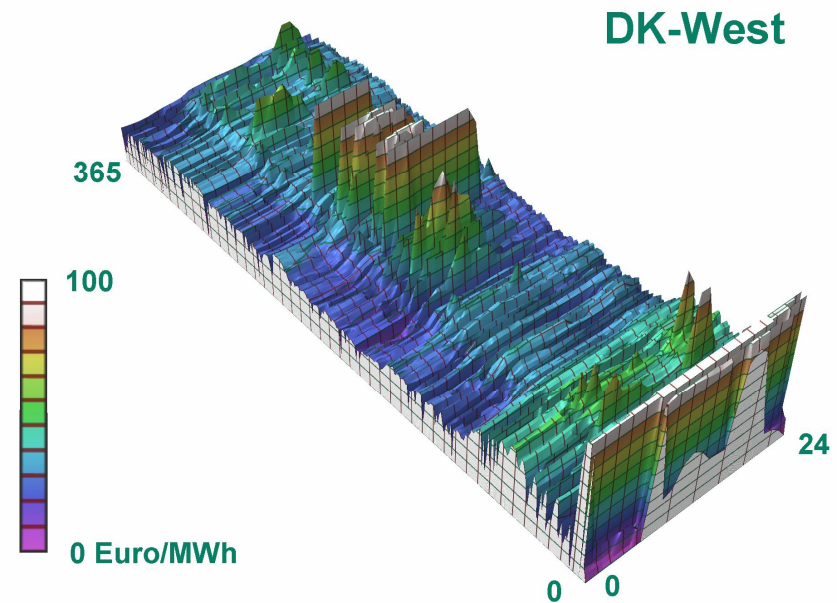
## Contents

- Market context
- Dutch context for DG-RES, DR and Storage
- Past field-tests
- EU-Integral project fieldtest

## Fingerprinting markets: the NORDEL and Western Danish system

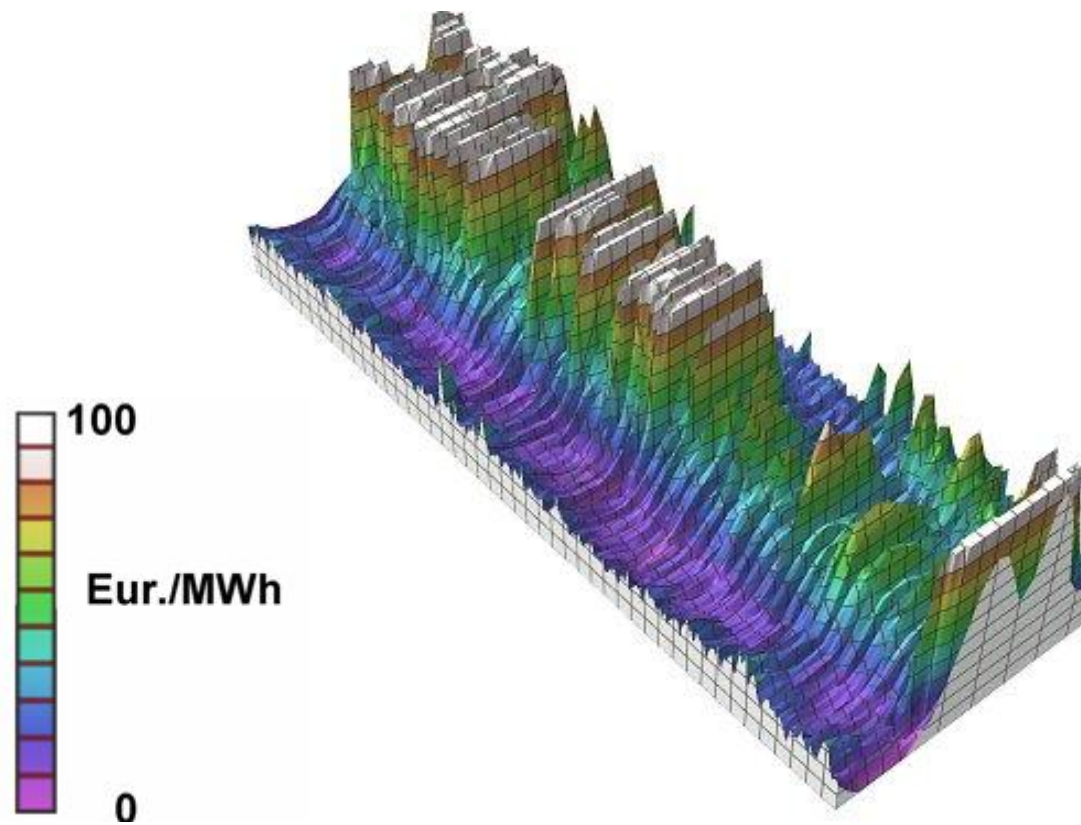


Hydro in winter exhausted  
After dry summer



Connected to N-system  
Summer wind-deficit

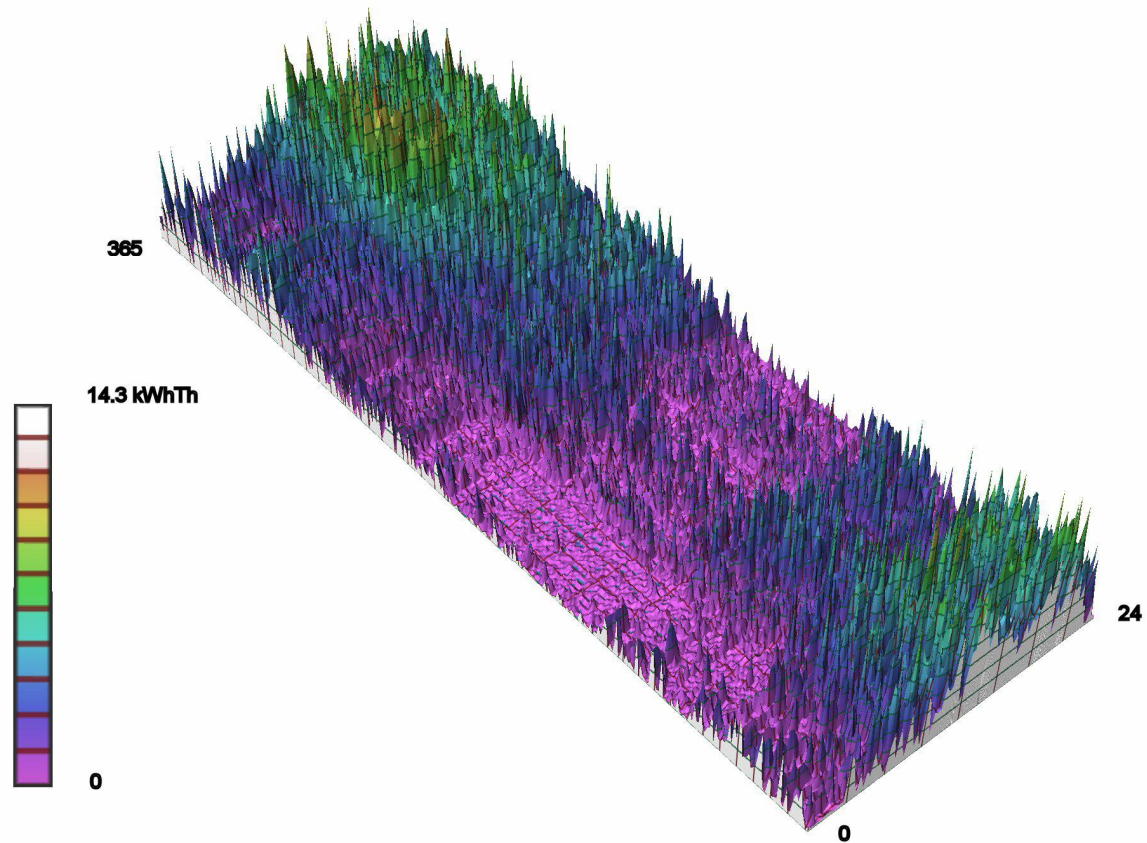
## Fingerprinting the Netherlands: Electricity APX-NL Day-ahead Market electricity price



- 10-15 hour peak in summer
- 16-18 hour peak in winter

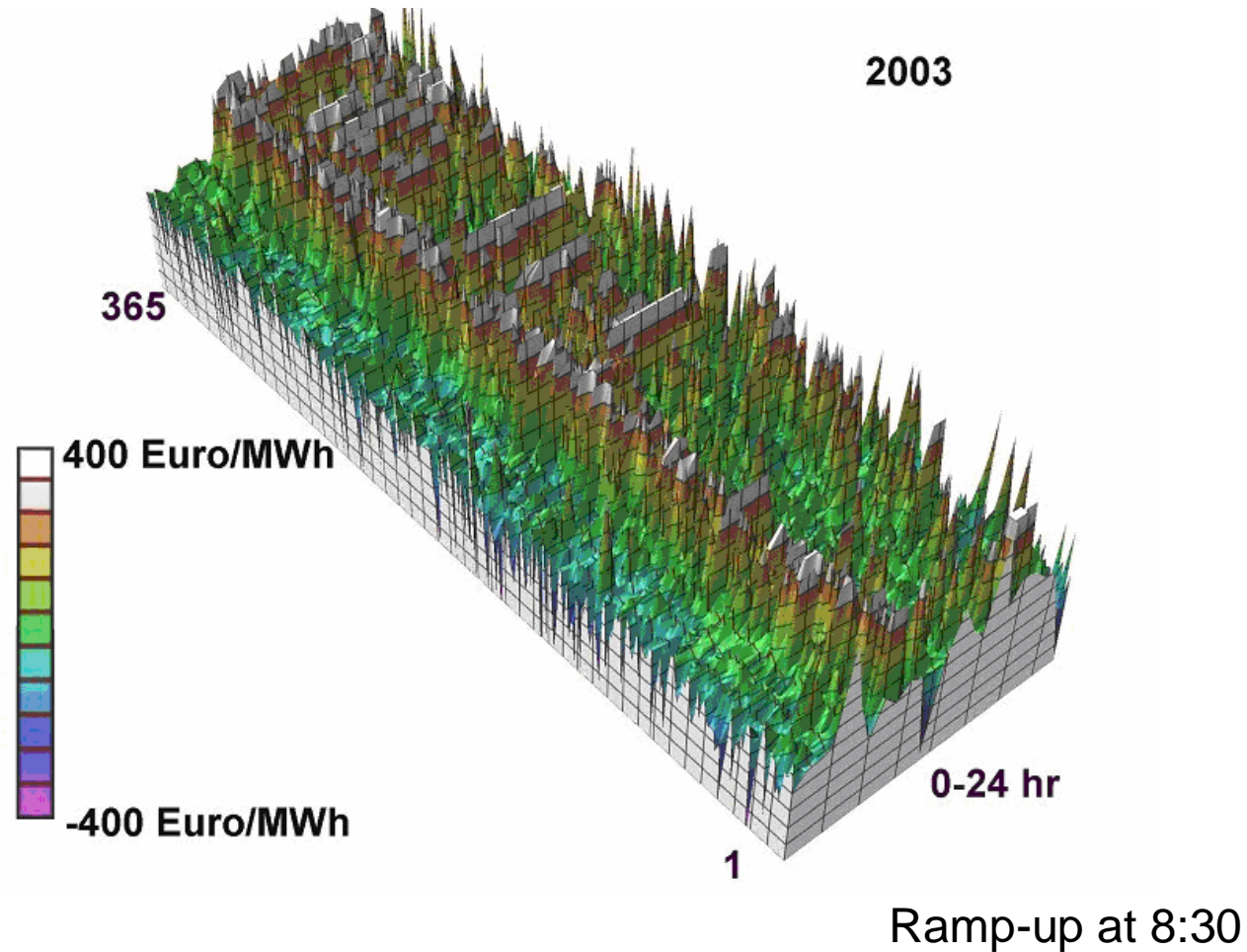


## Fingerprint-3: 8 Dutch homes measured heat demand



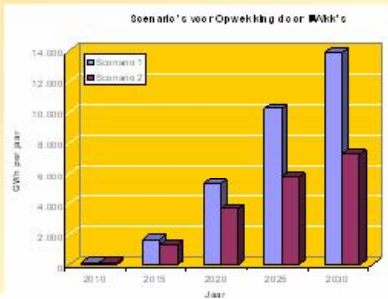
Heat demand following  $\mu$ CHP co-generates at peak prices

## Fingerprinting-4 : Imbalance Market electricity price



## Gas- NL

micro CHP's  
- start of roll-out expected in 2009

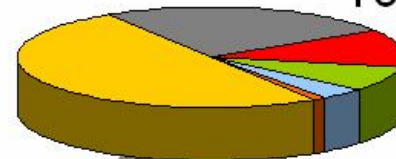


### Flexibility in Production by

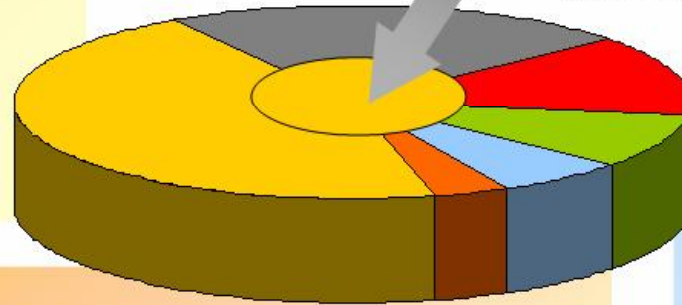
- Energy Storage
- Load Management
- Smart Comfort

**Solar**  
Compensate "Unpredictable" Fluctuations

Today

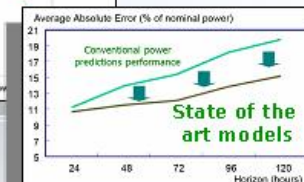
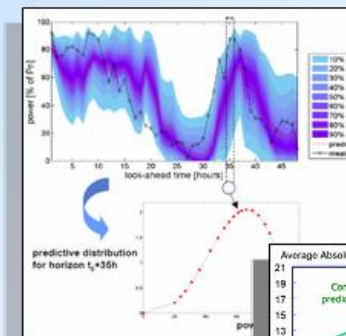


Transition



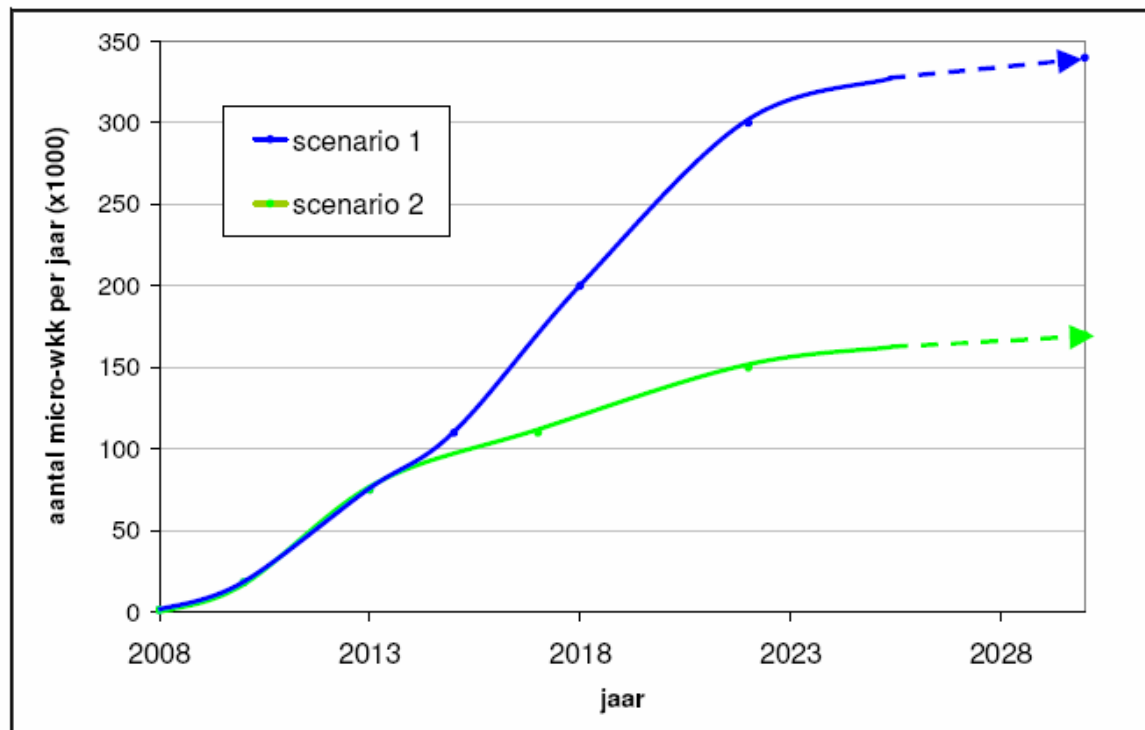
## Wind

- Fluctuations 5 – 13% in predictions
- Large variations at short time scales



Micro-CHP as a transition technology:

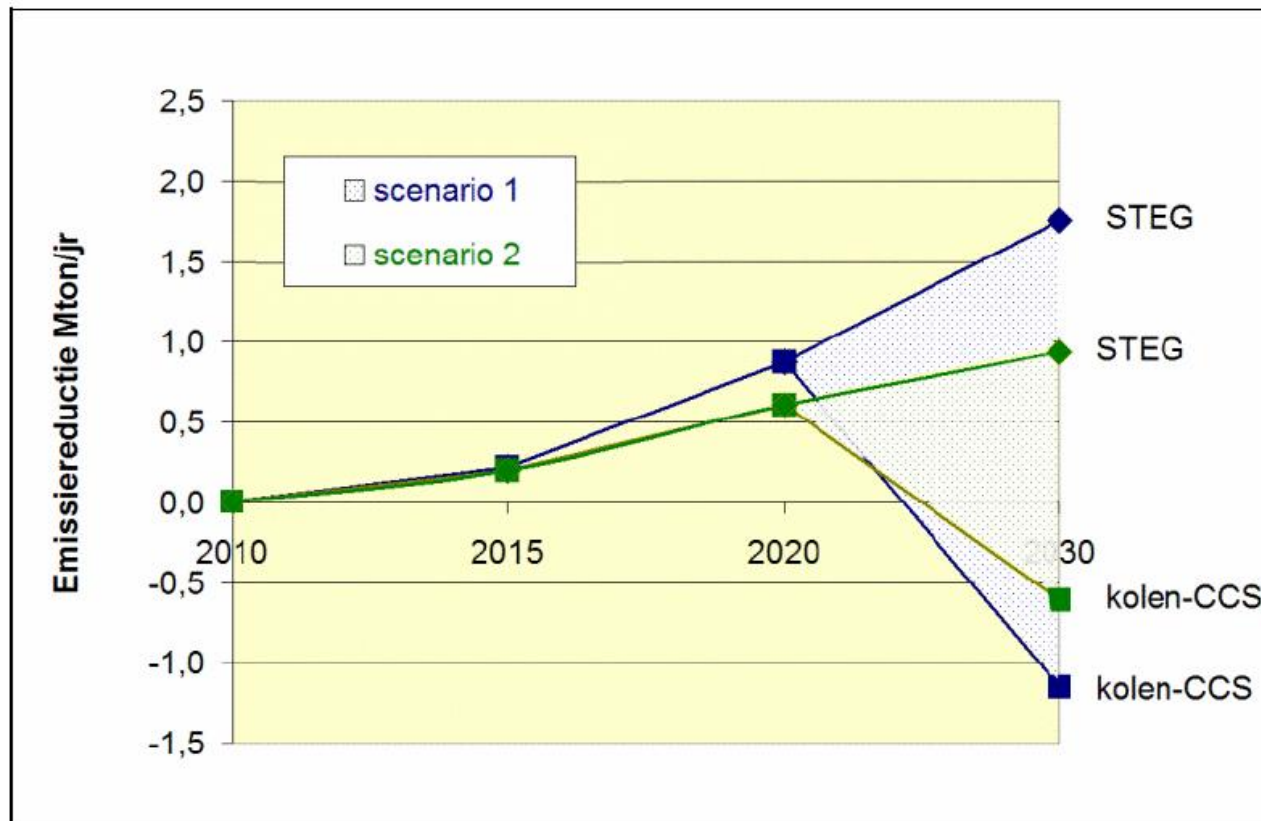
- Current rollout schedule (units/yr)
- Price 6000 Euro ->>> 2500 Euro in five years; i.e. 5 years payback time



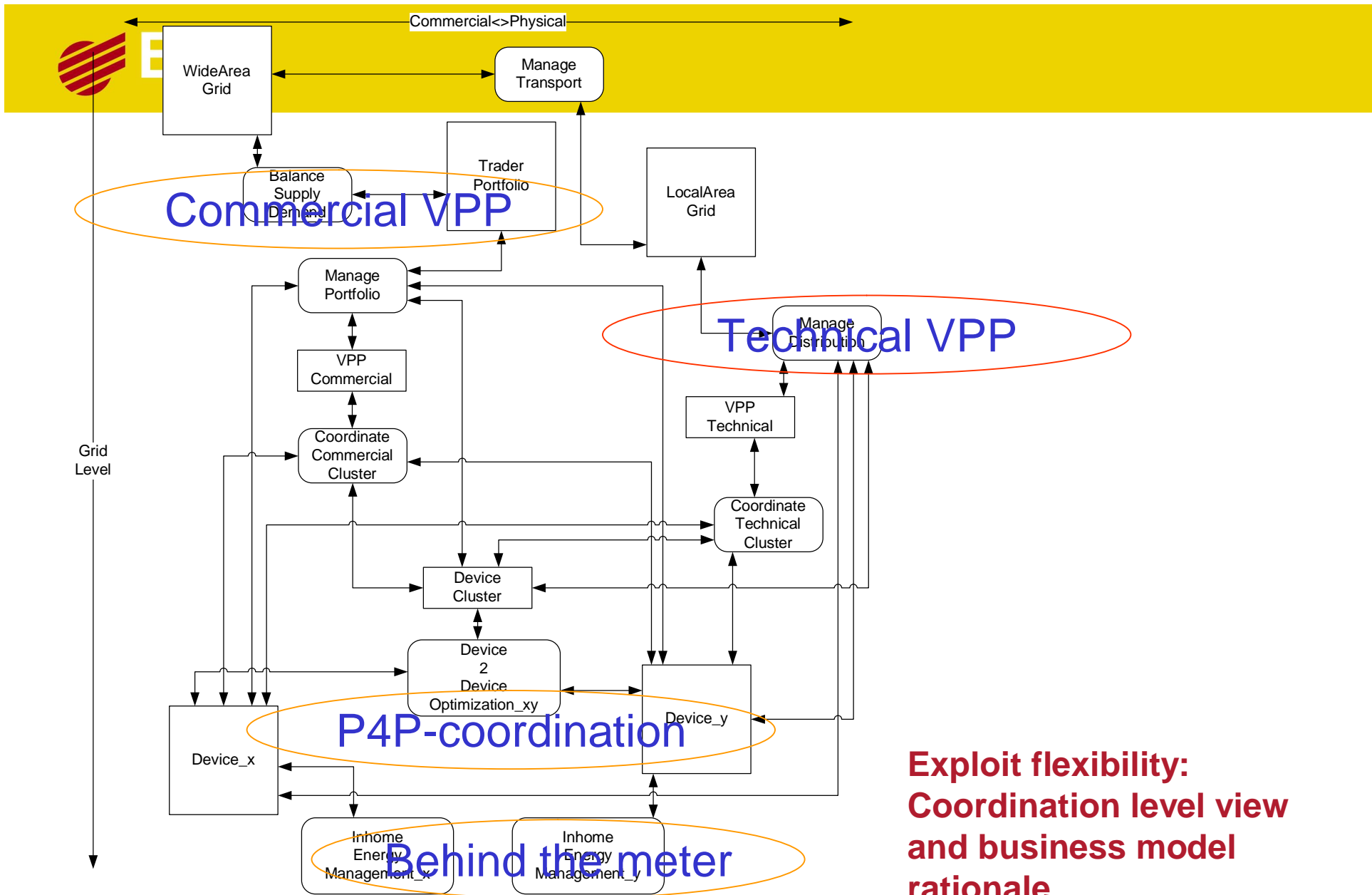
Figuur 1.1: Twee marktscenario's voor micro-wkk in Nederland



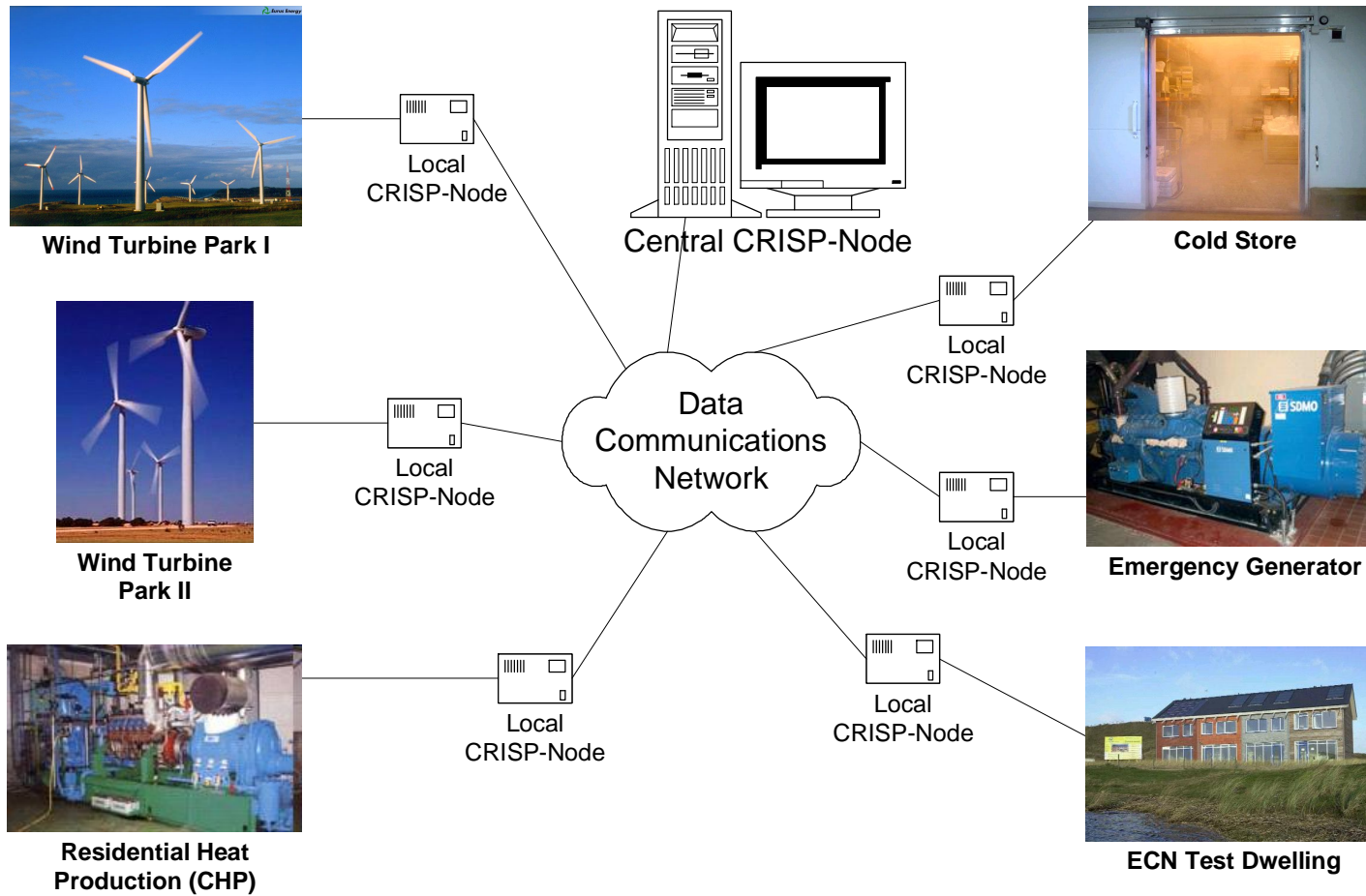
- Window of opportunity as a transition technology until 2020
- Carbon dioxide emission reduction

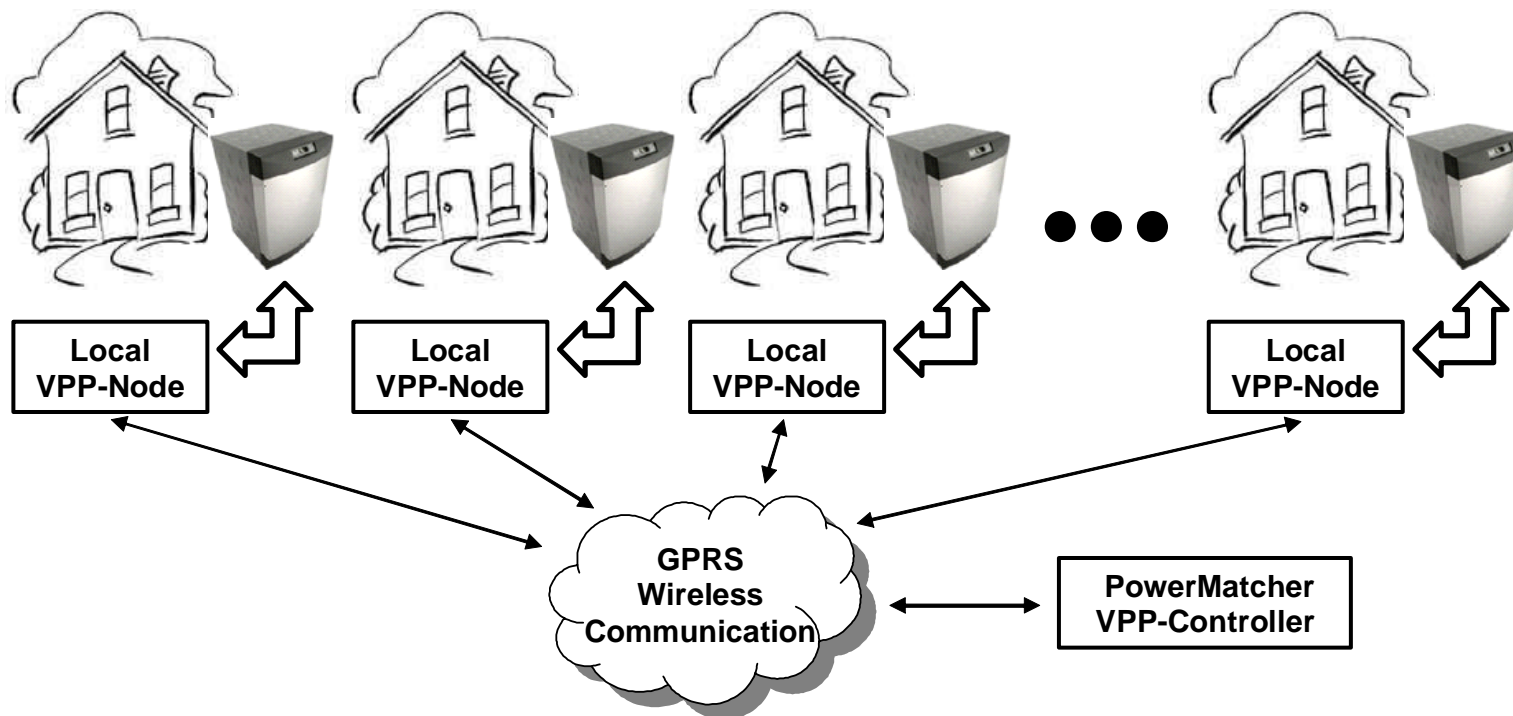


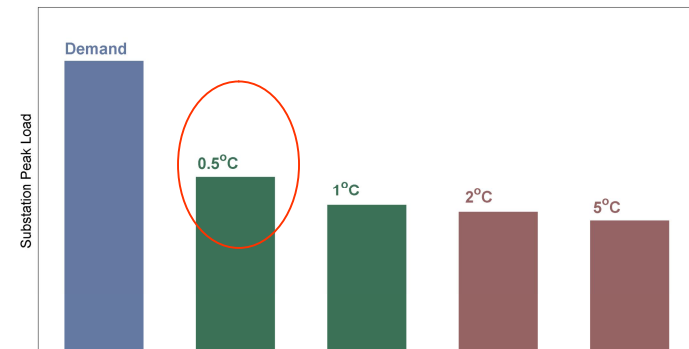
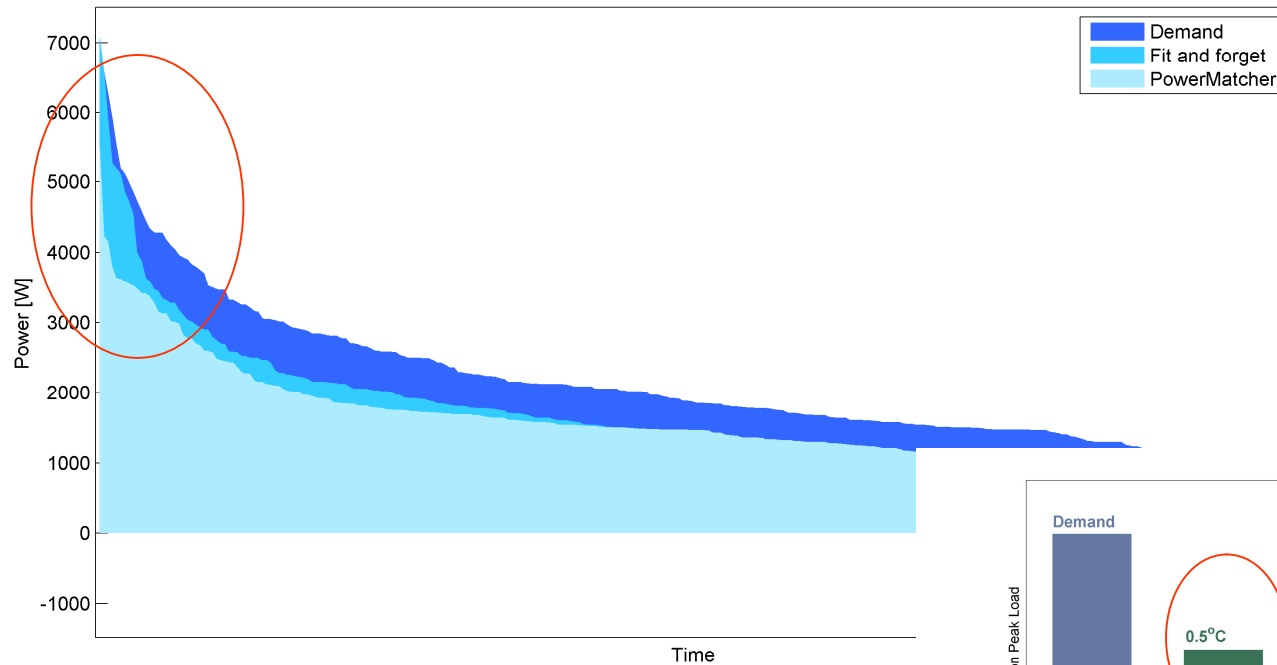
Figuur 1.3: CO<sub>2</sub>-emissiereductie met micro-wkk in Nederland tot en met 2030



# PowerMatcher CRISP Fieldtest-1: Portfolio imbalance reduction Commercial VPP $\leftrightarrow$ approximately 40 percent







- In a summer situation (May 2007), the substation peak load is reduced by 30%. In winter, the reduction is 50%. Increase of thermostat bandwidth by 0.5 degr. suffices
- A conventional “fit-and-forget” control strategy does not reduce the substation peak load.

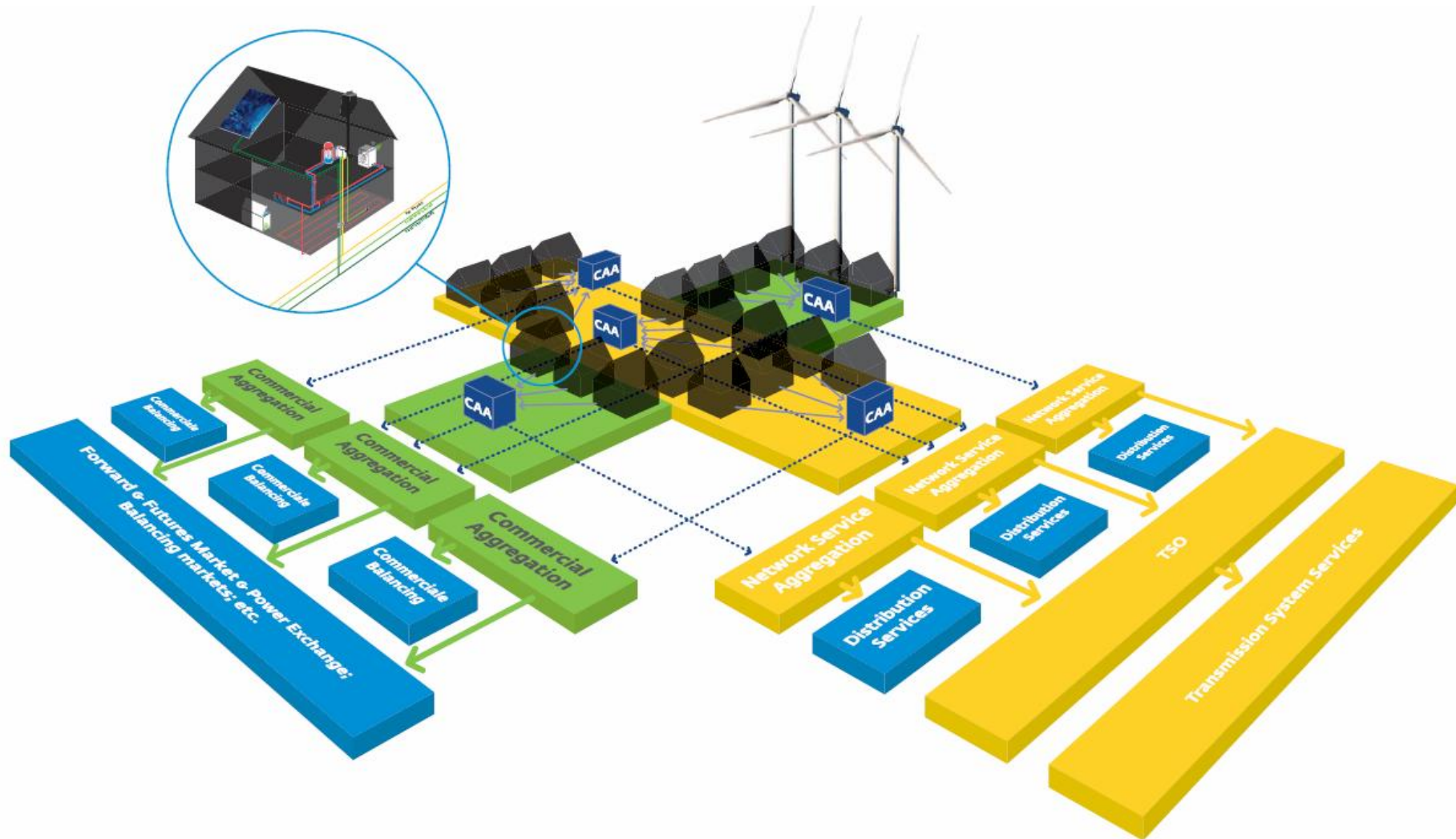


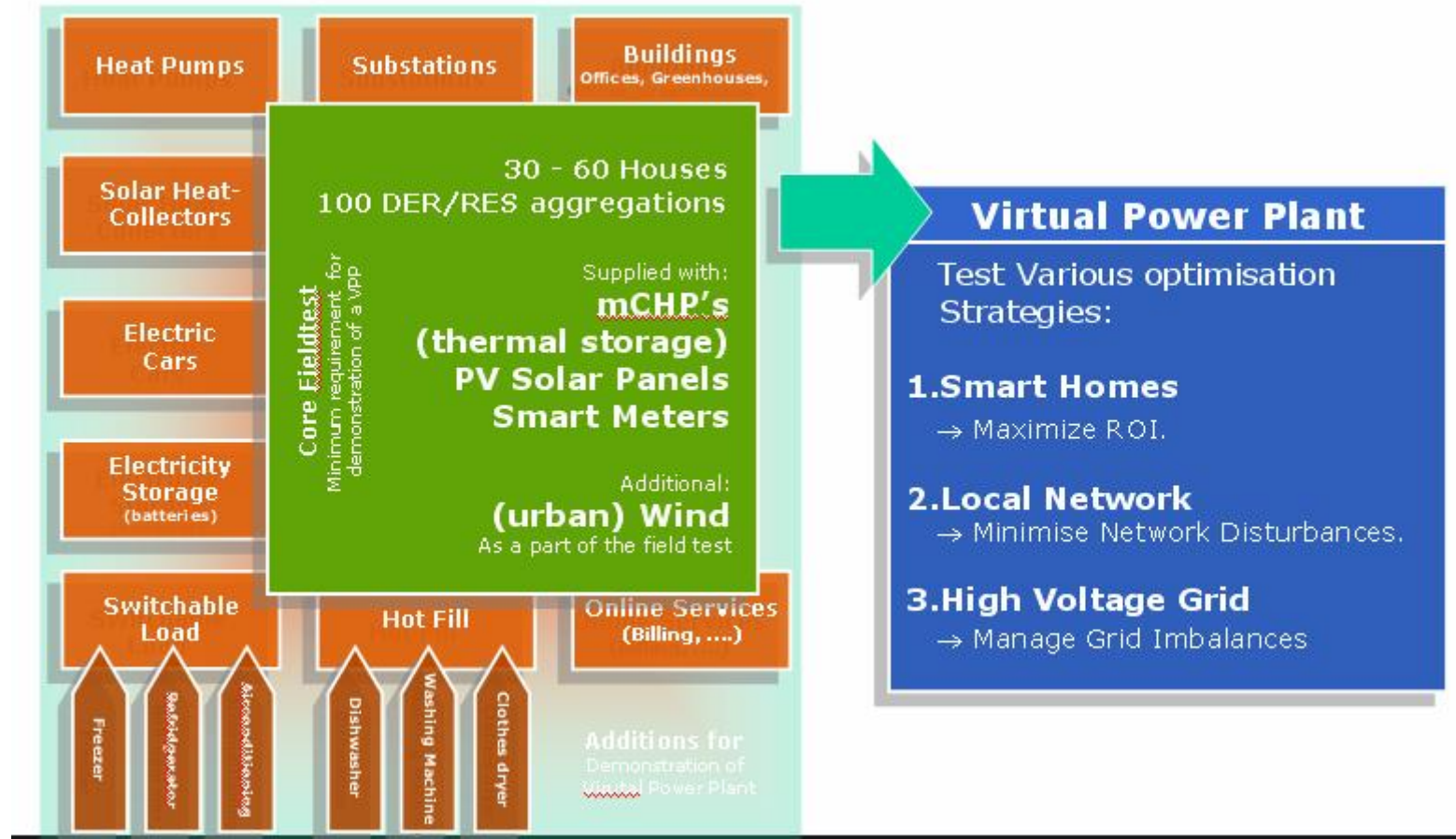
## Integral-project (EU-FP6 framework)

### Role of demand side integration for grid operational functions

- Normal operation
- Critical operation/microgrids
- Emergency operation/recovery

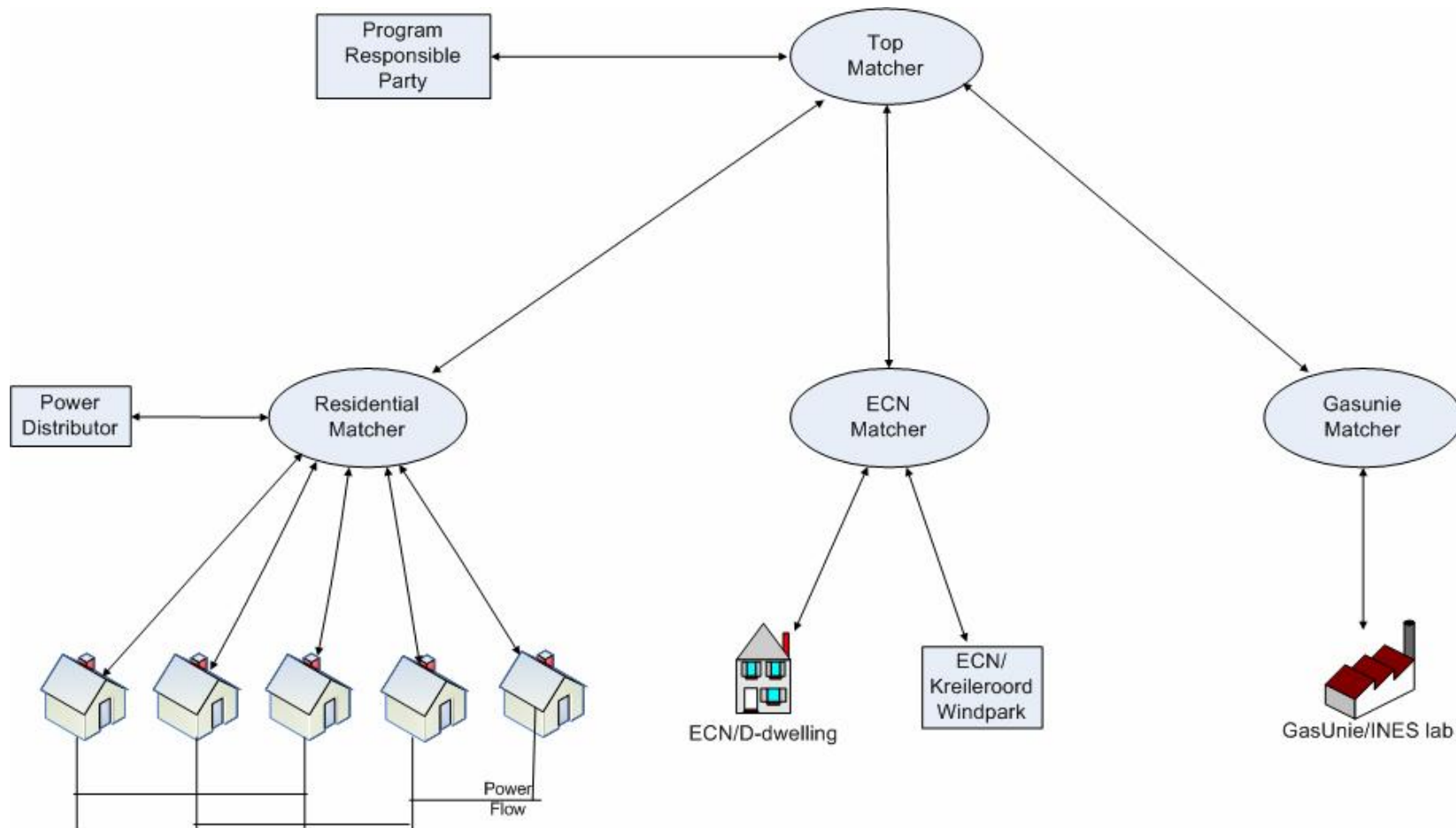
## Multiple control targets; commercial and distribution problem mitigation





## Cluster composition

## Fieldtest A ICT-configuration





## Cluster composition Integral Fieldtest A

- LV-Grid level
  - Hybrid systems (electrical heatpump with gas-fired peak burner)
  - Small scale co-generation
  - Electricity and heat Storage
  - Electricity storage for 'scooter' filling stations
  - Domestic appliances (dryer, cooling loads)
- Connected to
  - Wind generation (ECN facilities)
  - Large scale solar (Gasunie facilities)