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- Integral project EU 7th framework project (11 partners)
- PowerMatchingCity: SmartGrid in Hoogkerk
  - Embedding of DG-RES electricity (Wind and Solar)
    - What can fossil fuels and heat storage contribute in the form of flexibility
    - Demand response via μ-CHPs, heat pumps and consuming appliances
    - Role for electric vehicles
    - 25 heat pumps and μ-CHPs
- How to involve Information and communication technology?
  - Monitoring; extended to lowest levels of distribution?
  - Coordination; how are powernodes made aware of the rest of the system?
- Use cases/ possible future grid functionality
- Some first results
- Conclusions
ICT in electricity grids

ICT Functions for market and network operations

Network operations
Market operations

HV/EHV
MV
LV

Physical
Dedicated

In ICT-‘cloud’
Loosely coupled

Interoperable Service Provider

Smart Grids: ICT + distributed intelligence and automated operational processes

ICT supported energy trade

Smart Grids: ICT + distributed intelligence supporting demand response and (real time) participation in energy markets

How to fill in the loosely coupled software layer:
Implementation with PowerMatcher-3 buildingblocks

• Agent based
• Minimal message overhead
• Primary process/user in control
Scope of test: Residential area and test-sites

MTA Brussels 28-5-2009
Hot water as energy storage & dual operation modes (electricity/gas) to create demand/supply flexibility

- Hot water storage for:
  - Heating system
  - Tap water
- Extra flexibility via electricity, gas operation modes
- Micro-CHP:
  - Usage of peak burner
- Hybrid Heat pump
  - High efficiency gas heater as peak support

Storing heat to support electricity system

SOC_desired

ComfortLimits

1 kW HRe instel F = 7+6 kW

120 W

55°C

Tko, Tbu, Tcv

Crouzet regelaar

wa

cv-pomp 80W

radiatoren
Use case / Operate cluster on electricity trade floor

- Commercial-VPP
  - Now in the Netherlands already for horticultural CHP
    - Day-ahead, intra-day
    - Imbalance market
  - Reduce or direct imbalance in portfolio
  - Dispatch and support of conventional power within PTE within portfolio; compensate for ramp-up/ramp-down large generators
  - Take part in spinning reserve requirement for large generators

Illustration by 3D-price profiles

Netherlands: Power production profile and forecast – realization
Use case Imbalance Reduction
Netherlands electricity market 1 hour blocks: electricity price

Aggregated cluster can also be utilized on shorter time phenomena (15 minutes)

Ramp-up at 8:30
Heat demand homes, APX-price-development and tariff

Home Heating

EV charging

Portfolio profile optimization for trade dispatch

- Temperature forecast -> Heat demand
- Heat demand -> consumption/production pattern
- Price (d, t) -> Optimize use of heat buffers and charging of EV
- Realisation (d-1, t) -> scaling -> Forecast (d+1,t)
Operational bandwidth created

Follow forecasted profile
Follow forecasted optimized profile

Use Case / valorisation of renewables

Wind imbalance pattern is compensated if possible
Use case / Feedback to users

- Fine-grained metering scheme
  - Intelligent meter at every node; gas and heat
- User WEB-portal
  - Cluster Prices
  - Experience platform
  - Participative design
- New ‘Pricing Model’ for users; participation fee is attributed as an incentive
  - Market part
  - Contribution to congestion management; ‘grid friendliness’
- Socio-economic research-interventions on perception of the new technology and usability

Conclusions

Experiment now delivers ‘real-world’ clues on

- Value of heat/electricity storage in DG-RES context
- Flexibility of a VPP-cluster as an asset on short-timeframe electricity markets
- ICT connection possibilities to other operational operational modes (critical, emergency)
- User perception and possible retribution schemes
See
www.integral-eu.com
www.powermatchingcity.nl