Project DINAR – Pooled BEMI (Bidirectional Energy Management Interface), Germany

Undertaken by *CIRED*, Centre International de recherche sur l'Environnement et le Développement
and *ISET*, Institut für Solare Energieversorgungstechnik

problem: Managing fluctuating DG. There is still potential for demand response in small consumer sector, since half the consumption takes place in the LV grid.

solution:

- Introduce energy management at the household and commercial levels.
- This is specifically done so that the customer barely notices it
- Price-based control, not direct control. Customer decides.

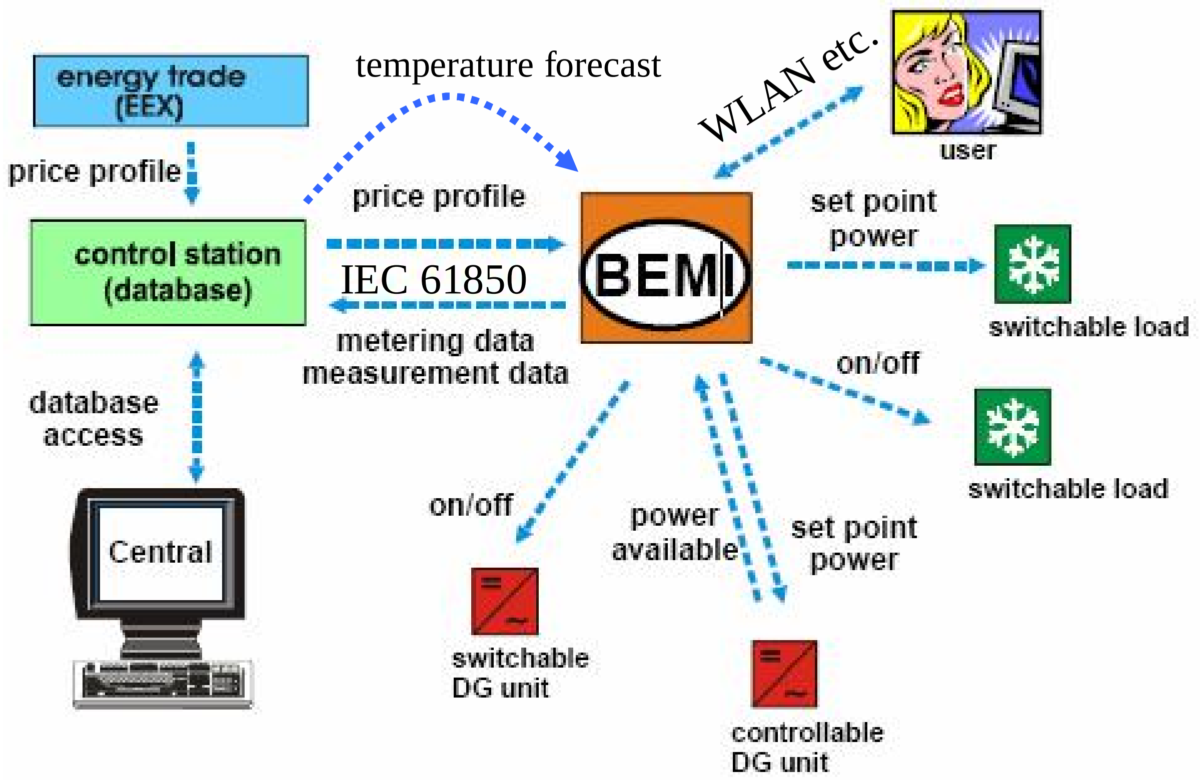
BEMI functioning

Price profile sent to BEMI once a day (permanent connection not required)

BEMI schedules and manages the local energy resources

Three basic types of controllable loads:

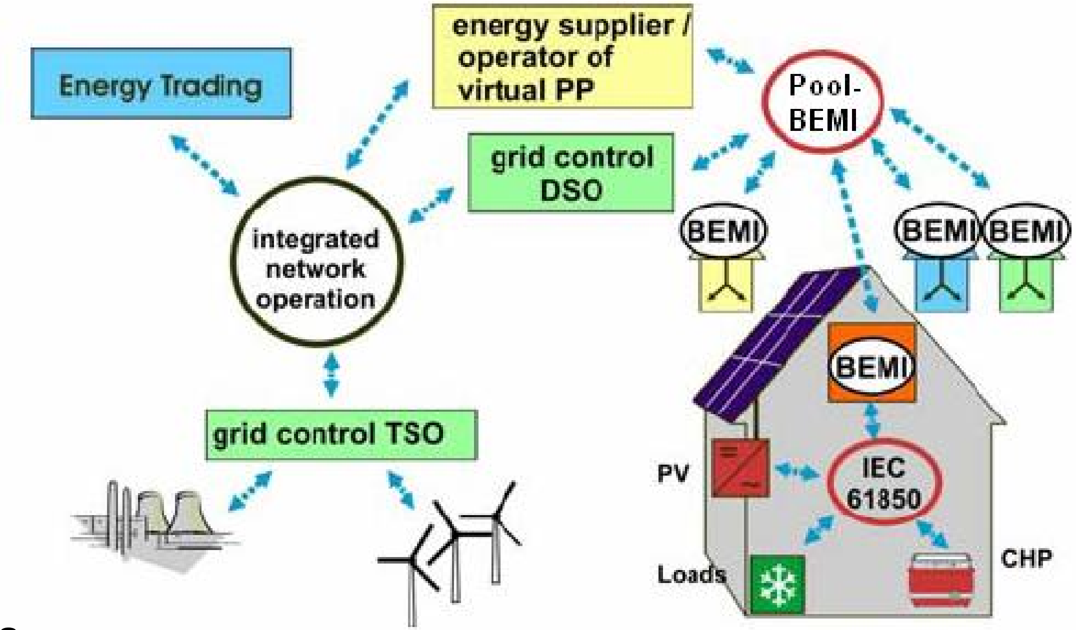
- loads with thermal or battery storage
- fixed program with shiftable starting time (e.g. washing machine)
- loads which can be reduced during high electricity prices (e.g. dimmable lighting)



DINAR – Pooled BEMI

Pooled BEMI is a platform managing several BEMI units.

It can give different daily price schedules to different BEMI units.



Status

BEMI: Implemented and tested with satisfying results.

Pooled BEMI: Has not been tested yet.

More info: http://www.iset.uni-kassel.de/abt/FB-A/publication/2007/BEMI_CIRED07-Final.pdf

Microgrids

Project funded by the EU, 7 countries participating

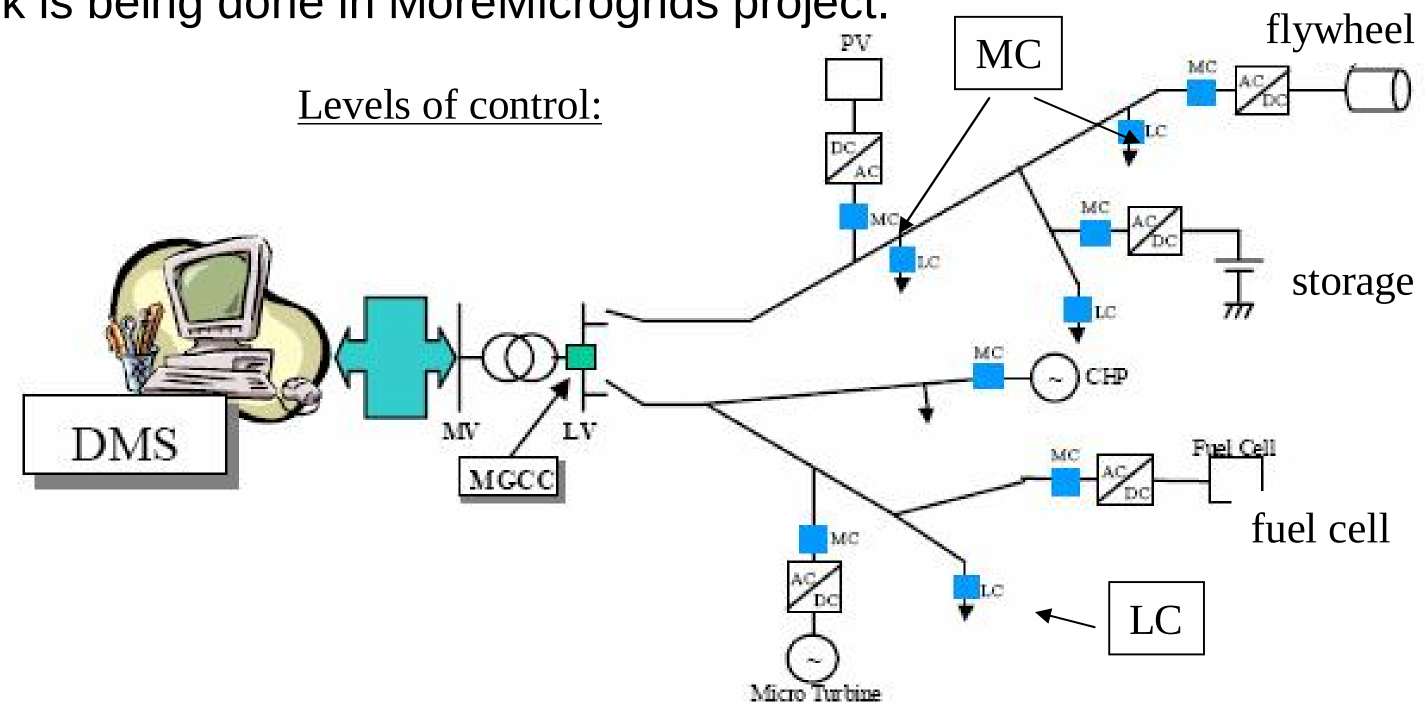
- Concept similar to the Pool-BEMI, but can also use local voltage and frequency control; can work islanded.
- Tests for 5 months were performed with an installation in Portugal.
- Tests on Kythnos island since 2003, Greece (islanded operation)
- Further work is being done in MoreMicrogrids project.

DMS: Distribution Management System

MGCC: MicroGrid System Central Controller

MC: Local Microgenerator Controller

LC: Load Controller



Microgrids - objectives

- Development of the Microgrid Central Controller (MGCC)
- Development and enhancement of microgenerator controllers to support frequency and voltage based on droops
- To define, develop and demonstrate control strategies for loads and microgenerators
- To identify the needs and develop the telecommunication infrastructures and communication protocols required
- Investigation of alternative market designs for trading energy and ancillary services within a microgrid

Microgrids

Benefits: Increased service and power quality

Reduced connection costs for micro generation

Increased efficiency of entire system operation including loss reduction

Reduced investment in system reinforcement

Reduced price and increased choice for end customers

Results from lab tests and experiments:

In tests, the annual interruption time went down by 60 % and annual estimated losses by 75 %.

Microgrids could be an option for managing future LV networks, but there are still technical and regulatory challenges.

More info: http://microgrids.power.ece.ntua.gr/micro/micro2000/presentations/46.pdf

Project Dispower – tests in Am Steinweg, Germany

Part of IRED, Integration of Renewable Energy Sources and Distributed Generation into the European Electricity Grid

Concept similar to Pool-BEMI and Microgrids: one central unit manages several dispatched units.

Price-based control and sun-based control have been considered

E.g. virtual islanding tests were performed, where the power flow over transformer were reduced to near zero.

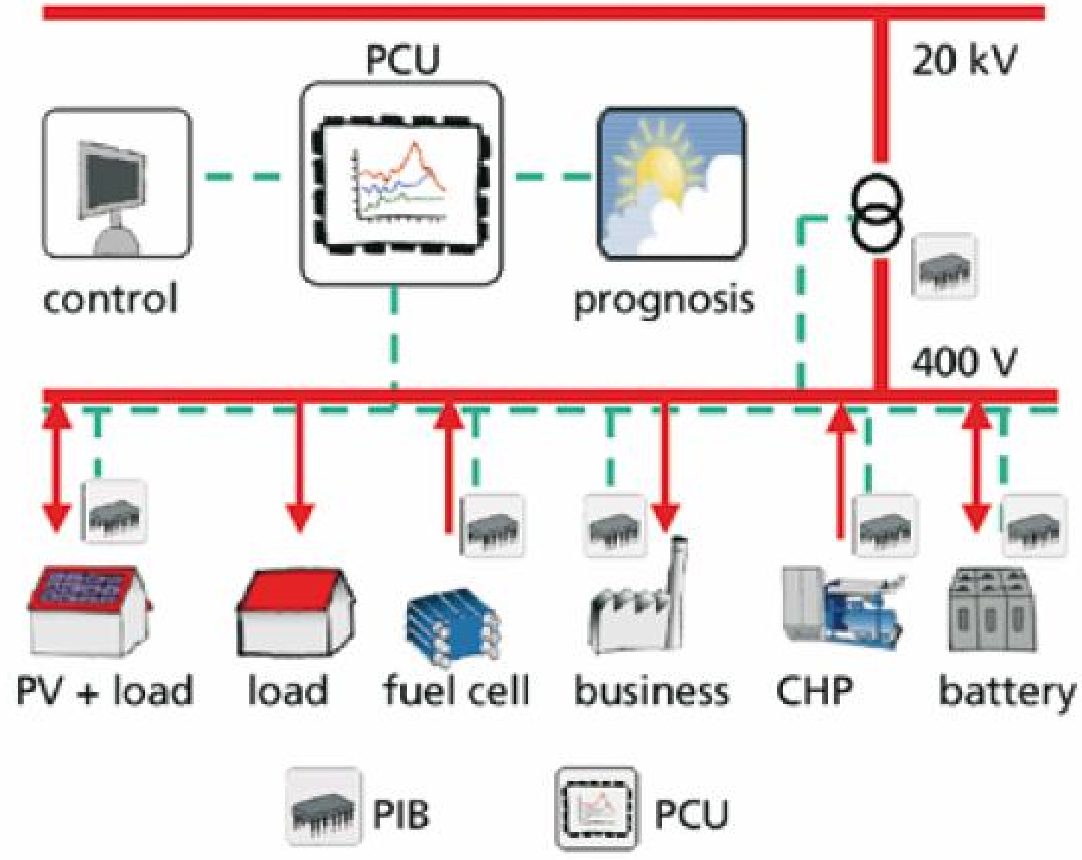


Fig. 1: General structure of PoMS integrated in a LV grid with central unit PCU, decentral interface boxes (PIBs) and communication bus (green lines)

Dispower – Am Steinweg

LV network with 3 energy sources:

- CHP, 28kWel
- PV, nominal power of 35kW
- Lead-acid battery with bidirectional inverter, 880Ah

Demand response:

Washing with the sun program. It gives a financial bonus to families which use their washing machine in times an expected high output from PV.

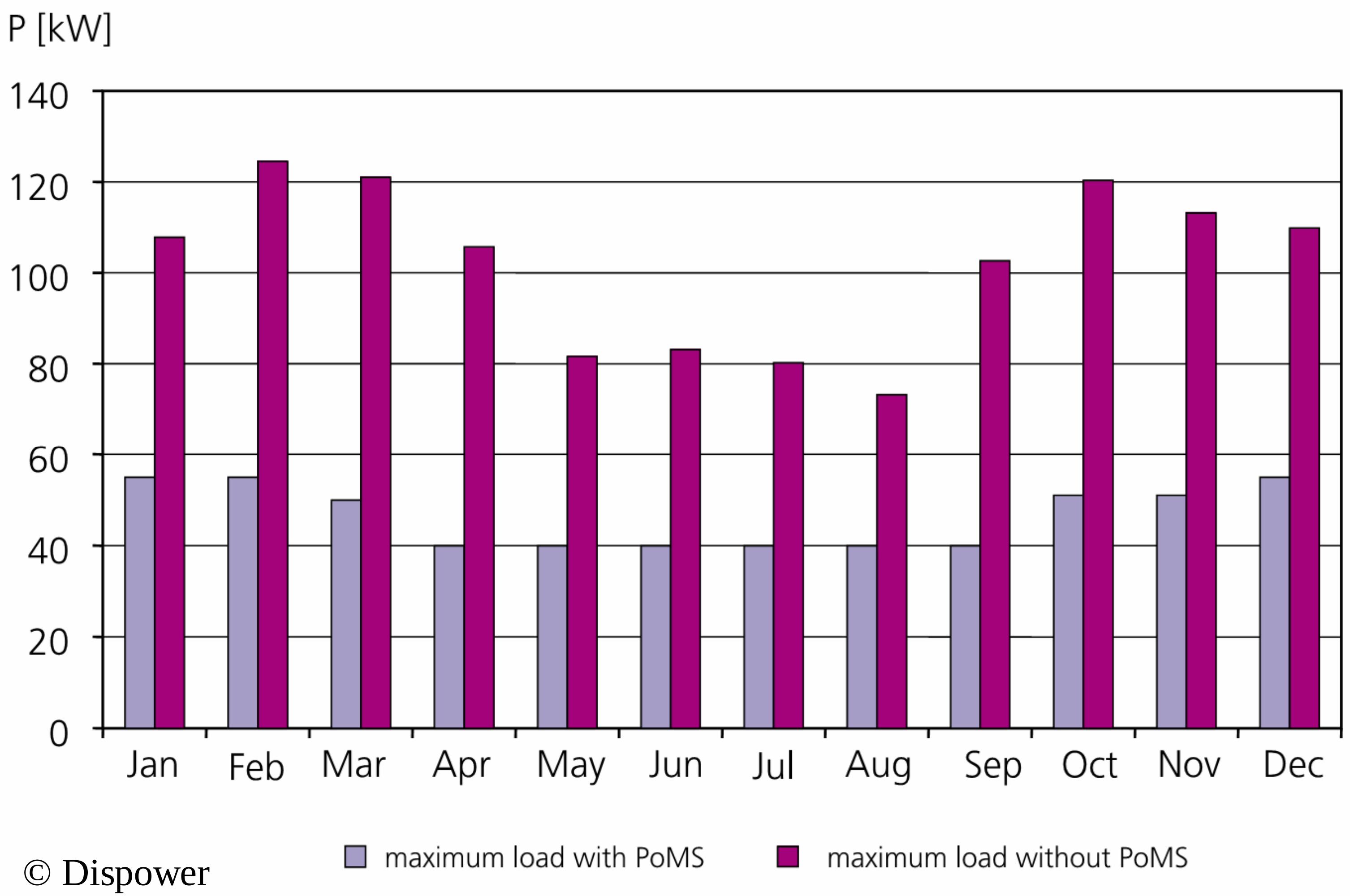
The families react very well to this system.

For now, they are warned by phone message or by email, but they are planning to start using intelligent control devices.

Goal: reduce to a minimum the imports of energy from the MV level at high electricity price periods. That goal has been achieved at the pilot installations

More info: http://www.iset.uni-kassel.de/dispower_static/documents/fpr.pdf

Max power input to the settlement Am Steinweg with and without load and generation control



Energy Response

Australia

Energy Response is an aggregator of demand response, which offers services to energy retailers, DNOs and TSOs or reserve capacity to the NEMMCO Pool.

The energy retailers, DNOs or TSO can then use these aggregated demand responses in combination with distributed generation or storage capacity to act on the different markets.

In its first 10 months of operations Energy Response has formed sales contracts with several retailers and registered over 170MW of demand response nationally.

More info: http://www.energyresponse.com/

Smart-A

Smart-A, smart management of domestic appliances and generation, Germany, Austria, UK. Started last year.

- The project assesses the overall potential for load-shifting by domestic appliances and compares this with requirements from sustainable energy generation both on the local level as well as in larger electricity systems
- detailed assessment of the acceptance of a smart appliances operation by users
- evaluation of the usability of available control technologies and communication standards

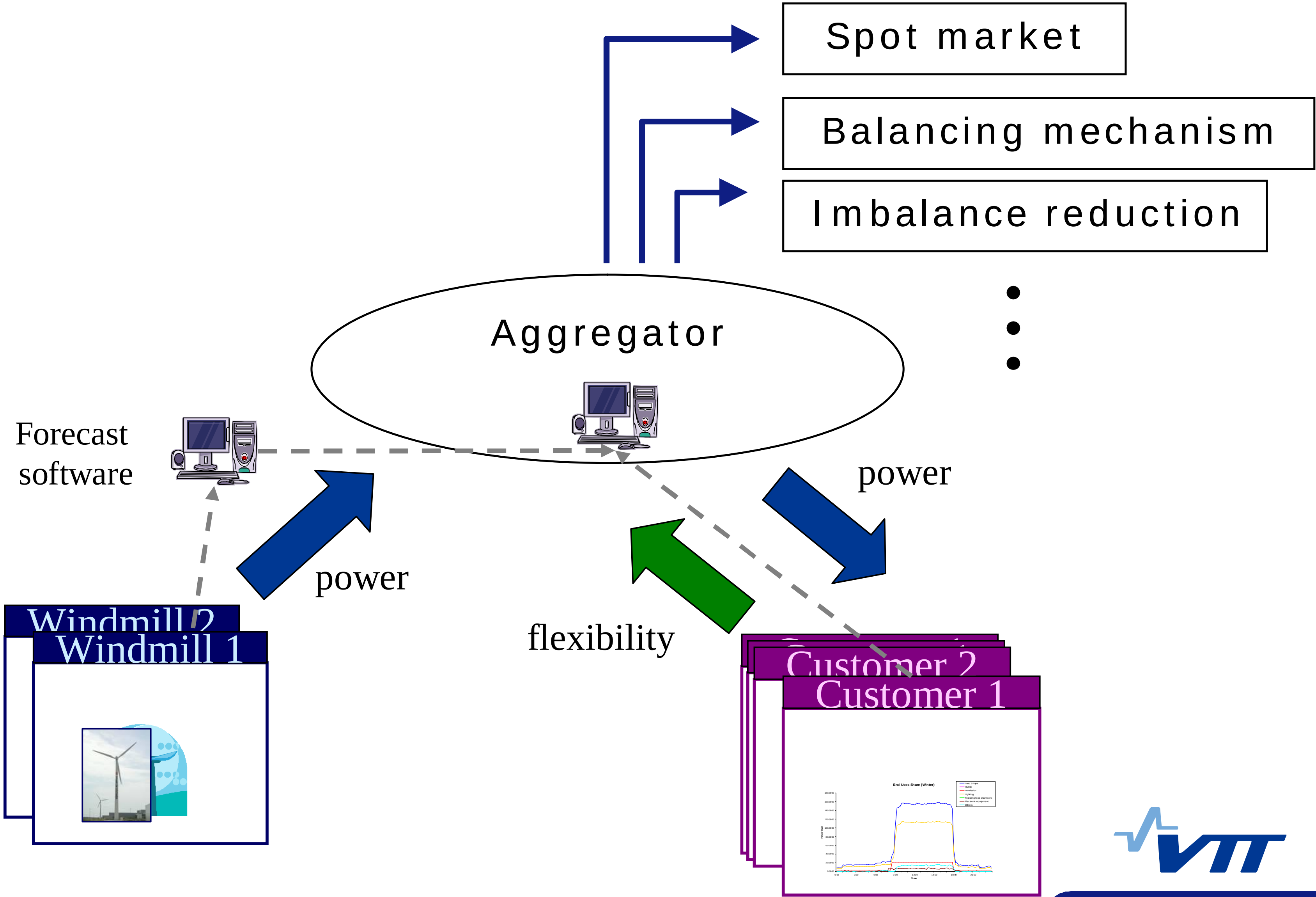
EU-DEEP (European distributed energy partnership) task forces

- The task forces 1,2 and 3 were created to concretely study different business models related to demand response and distributed generation and energy storages
- Both simulations and experiments are used in the study

Business model 1: renewable energy sources balancing

- An aggregator collects together many controllable customer loads and makes investments into demand response automation
- It then uses these demand responses for
  - Balancing its balance account with demand response
  - Selling the load reductions to the spot market
  - Offering the load reduction to TSO's disposal in balancing mechanism
  - Reducing transmission charges by recuding load during system peak demand
- Test sites in England

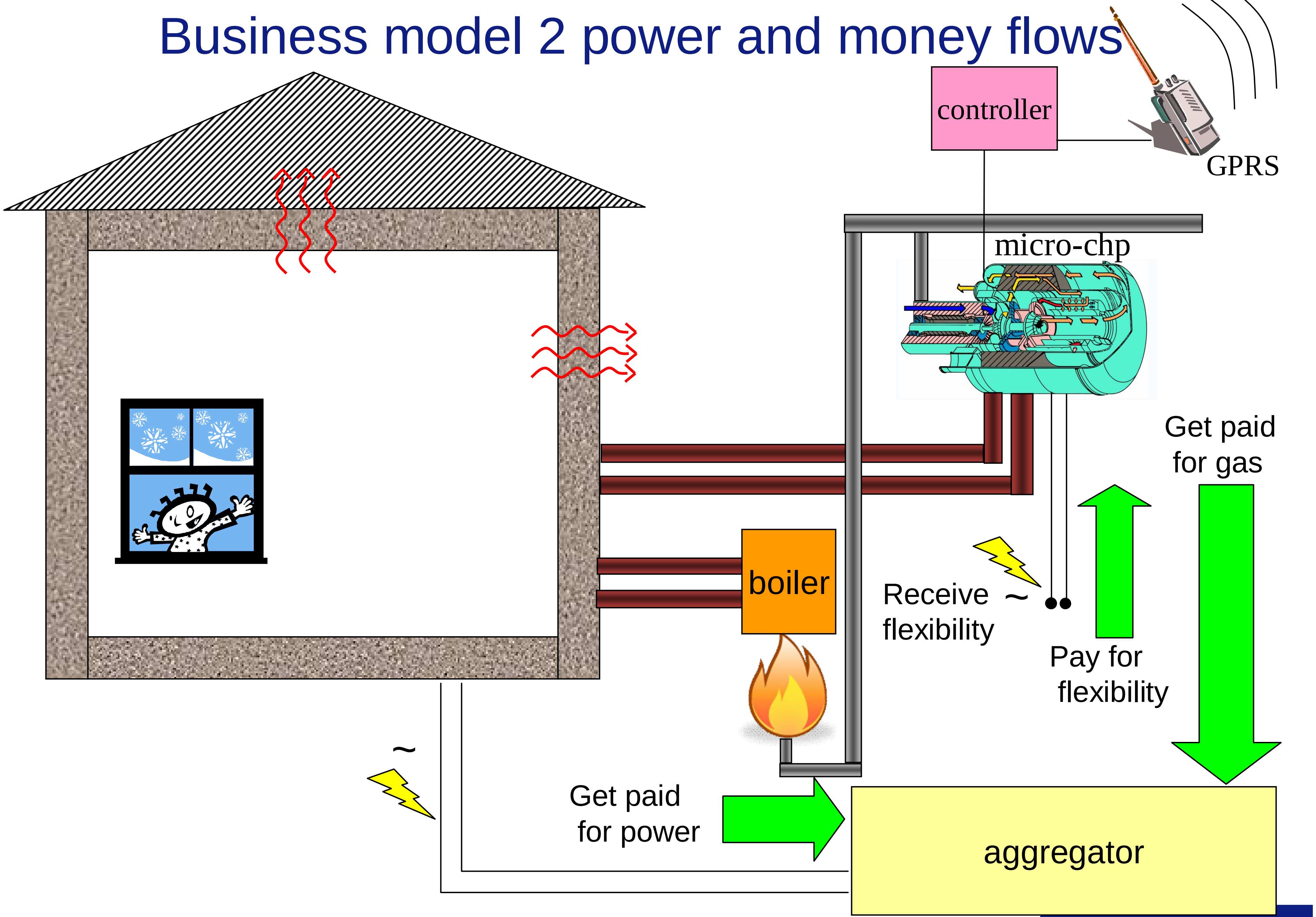
Business model 1 power flows



Business model 2: residential micro-chp

- An aggregator, which provides customers their heat and electricity
  - Heat from CHP and boiler
  - Electricity from CHP and market
- The aggregator is a supplier which first targets its own customers
- Customers are individual homes with few kW of heat demand
- Customers install micro-chp's at their sites at their cost
- Aggregator installs a controller and communication connection
- Test sites in Germany

Business model 2 power and money flows



Business model 2 benefits

- Benefits to customers:
  - Lower energy cost
- Benefits to aggregator:
  - Possibility to take advantage of co-generation without building a district heating network
  - Depending on who the ESCO is, it could take advantage of the power generation in the same way as aggregator in business model 1
- Profitability depends on standardization
- Smart meters could already include functions which allow the control of micro-chp

Business model 3: energy service company with combined heat and power

- An energy service company, which provides customers their heat and electricity
  - Heat from CHP and boiler
  - Electricity from CHP and market
- Customers are larger buildings with few hundred kW of heat demand
- The energy service company installs the CHP units at its own cost
- The energy service company controls the CHP units and boilers according to heat demand and electricity prices (and possibly their own imbalance)