PolyGrid – A two-vector energy independent microgrid at University "Politehnica" of Bucharest

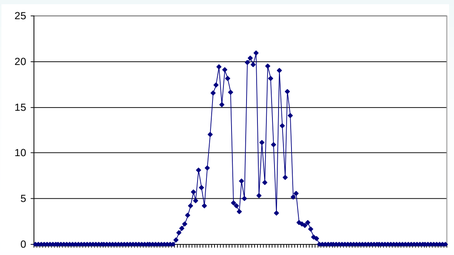
Lucian Toma [1], Dumitru Popescu [2], Mihaela Albu [3], Constantin Bulac [1], Ion Necoara [2]

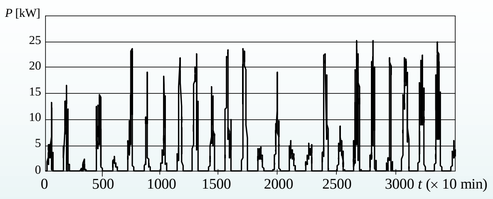
1. University "Politehnica" of Bucharest, Faculty of Power Engineering
2. University "Politehnica" of Bucharest, Faculty of Automation and Computer Science
3. University "Politehnica" of Bucharest, Faculty of Electrical Engineering

Abstract: **With the advent of new technologies running on renewable energy sources (e.g. wind and solar) and small size but highly efficient fossil fuelled power plants (i.e. natural gas and petroleum), the number of distributed generators in the low voltage and medium voltage networks has significantly increased in the last decade and will continue to increase in the near future. The electrical grid of the campus of University POLITEHNCA of Bucharest is connected with the main distribution grid of the Bucharest City through two 10 kV cables from a central substation owned by the university. Since this substation acts as a hub, the electrical grid of the campus can be seen as a microgrid**

Index Terms: Microgrid, Distributed Generation, Virtual Power Plant, Controllable Load, Independent Consumer, Active Network, Smart Grid, Educational Platform

Photovoltaic Power Plant





Commissioned: 26 May 2006

P_{inst} = 30 kW

E_{av} = 6 kWh/h

CF = 20%

Payback time >> Lifetime

Gas Engine Power Plant

Commissioned: 25 March 2010

Fuel: Natural Gas

Jenbacher Engines

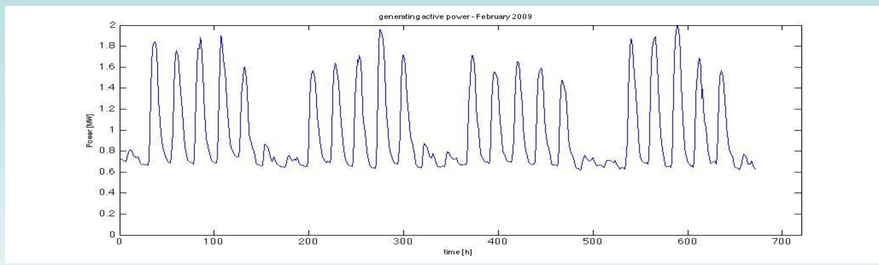
Hoval boilers

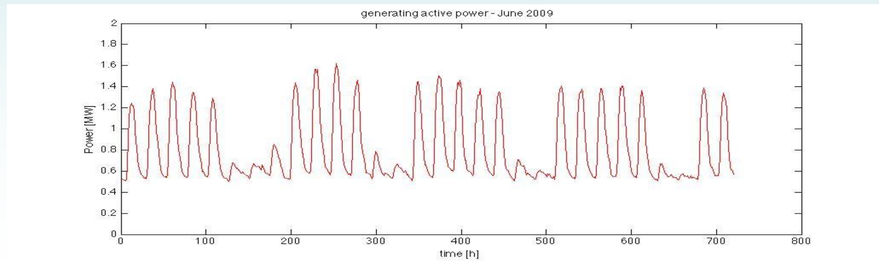
2 x 800 kWel

3 x 1200 kWth

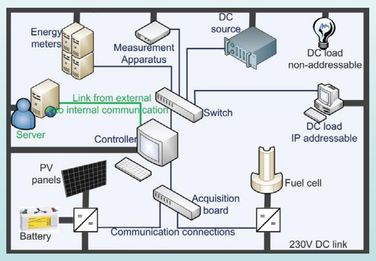
η_{el} = 38% η_{th} = 42% η_{total} = 80%

Total Load

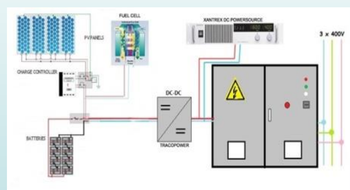




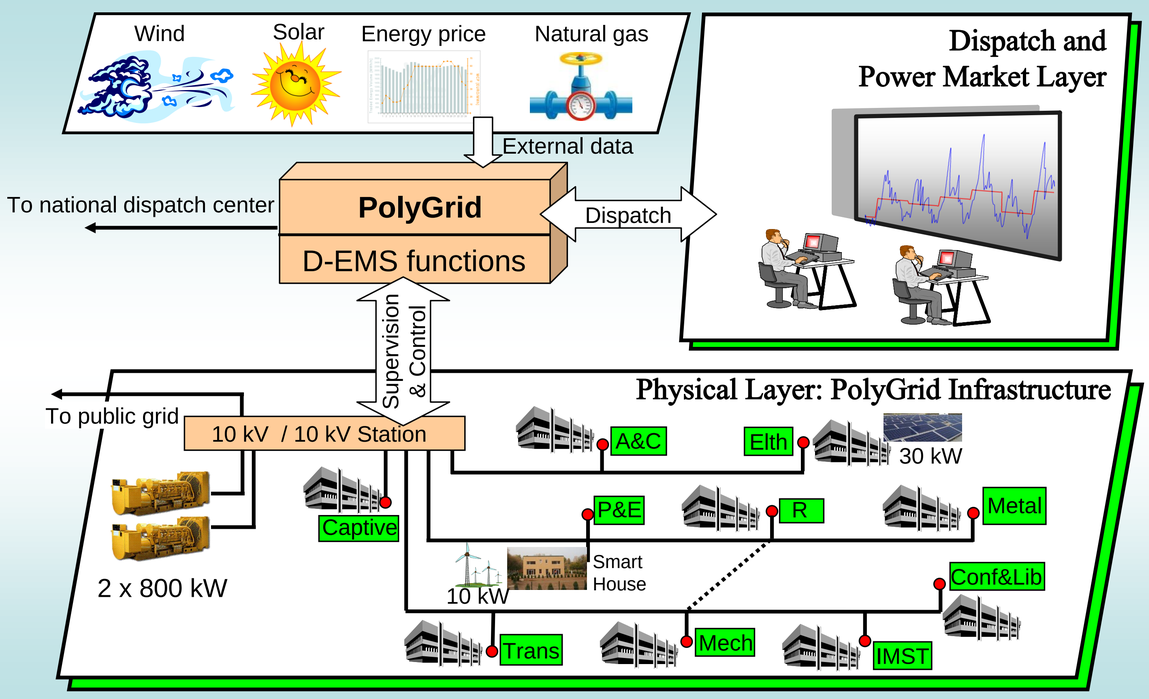
Controllable Load – Smart House

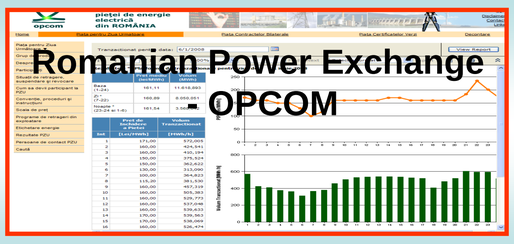


Small Wind Turbines



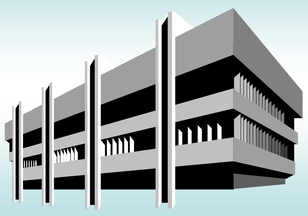
DC ring @ 230 V, 5 kW laboratory and classroom





Selling Electrical Energy

Selling Thermal Energy



Bucharest District 6 (the neighborhood)

- Lucian Toma, Mircea Eremia, Dorin Bică – *Economic operation of distributed energy resources in a microgrid*, Proceedings of 2013 IEEE Grenoble PowerTech, Grenoble, France, 16-20 June 2013.
- Mihai Sănduleac, Mircea Eremia, Lucian Toma, Paul Borza – *Integrating the Electrical Vehicles in the Smart Grid through Unbundled Smart Metering and multi-objective Virtual Power Plants*, IEEE PES Innovative Smart Grid Technology Europe, ISGT-2011, Manchester, 5-7 December 2011.
- Mihaela Albu, E. Kyriakides, G. Chicco, M. Popa, A. Nechifor -- *Online Monitoring of the Power Transfer in a DC Test Grid*, IEEE Trans. on Instr. and Meas., vol. 59 , Issue: 5 , 2010