

WP3.2 Algorithms for Distributed Monitoring, Prediction and Control of Smart Grids (Project C)

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Main objectives of the project C

The **main objective** of this research project C is to enhance the monitoring, prediction and control of both prosumer behavior and the state evolution of the underlying grid (smart grid).

- WP3.1 User-Centric Sensor Data Mining for Smart Energy Systems
- WP3.2 Algorithms for Distributed Monitoring, Prediction and Control of Smart Grids

Objectives of the WP3.2

1. Develop advanced mathematical models of the changing grid and its counterparts
 - ▶ *Model new grid elements and functions such as storage devices, renewable energy resources and electrical vehicles*

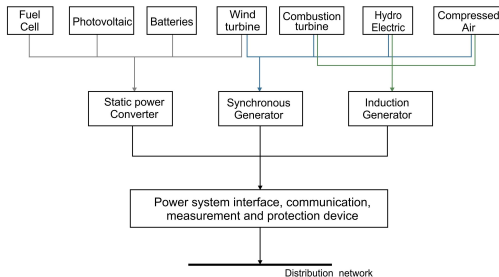
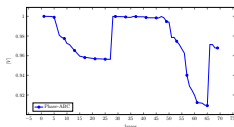


Figure: Combination of power converters and energy sources

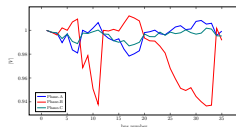
Objectives of the WP3.2

2. Develop real-time, fast and robust solution methods

- Power flow computations



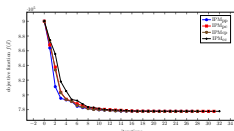
(a) Balanced network



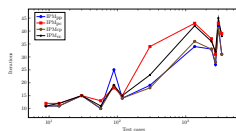
(b) Unbalanced network

Figure: Numerical result of the Newton power flow methods

- Optimal power flow computations



(a) Objective functions



(b) Iterations

Figure: Numerical result of the Interior Point Methods

Objectives of the WP3.2

3. Implement all solution methods on the modern accelerators like GPU and FPGA

Conclusions

- Developed/Studied the mathematical model of new electrical components in the power system
- Developed the power flow solution methods
 - ▶ *Submitted a paper for balanced transmission and distribution networks in "Journal of Computational and Applied Mathematics"*
 - ▶ *Published a paper for unbalanced distribution networks in the journal "Energies"*
- Developed the optimal power flow solution methods
 - ▶ *Submitted a paper for balanced transmission networks in the journal "IEEE Transactions on Power Systems"*

Thank you!