



Smart Decentralized Energy Management (113)

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Fluctuation Requires Flexibility

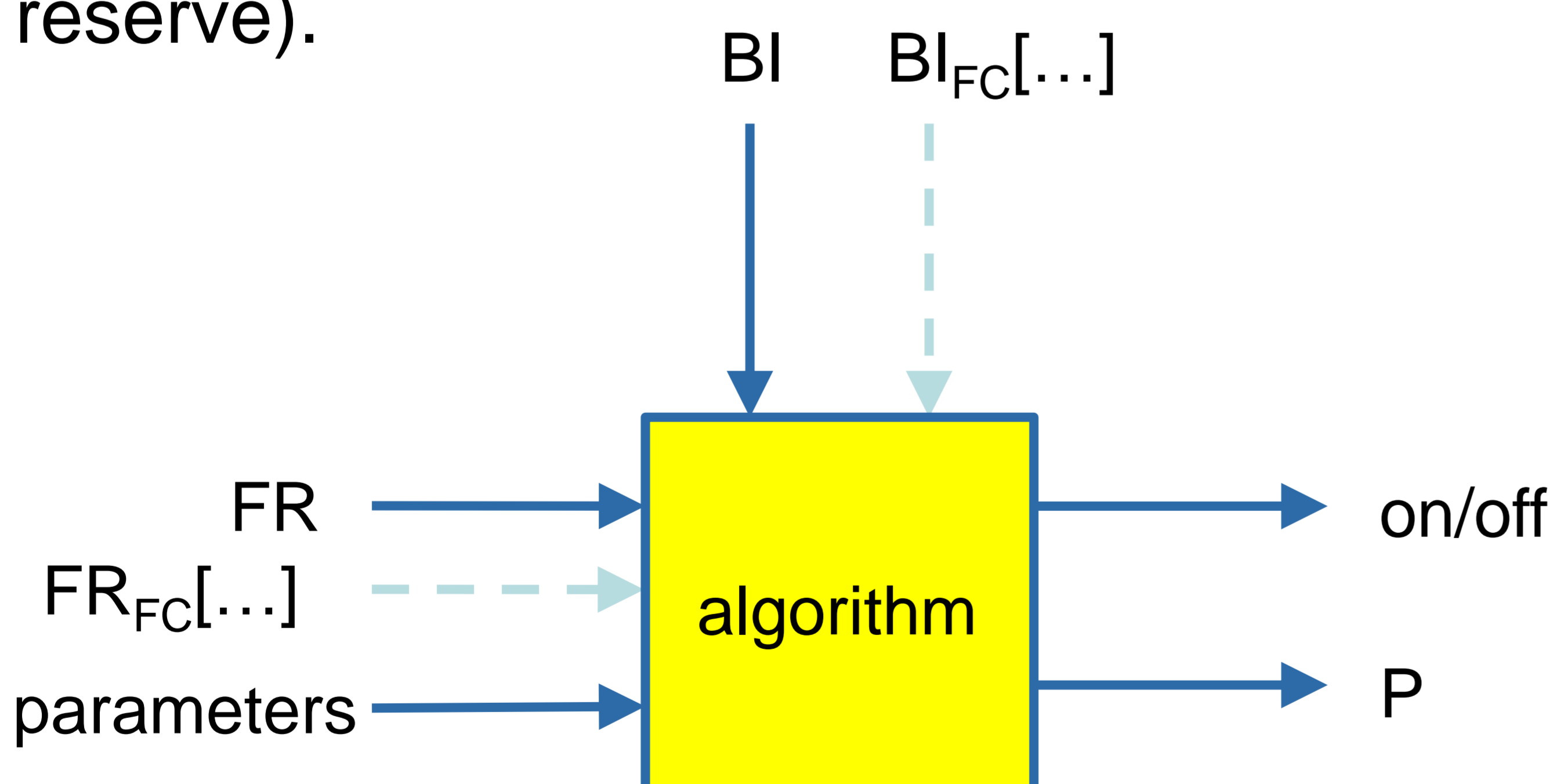
Strongly fluctuating generation and decentralized allocation of generators and consumers in future grids require vast and dynamic flexibility to maintain grid stability.

Complexity - and therefore transaction cost and exposure to failure with conventional centrally organized methods - grows with the number of participants.

Decentralized Energy Management

Decentral energy management via “soft control” generates price signals directly from locally measured grid state variables, like frequency, current or voltage, to ensure grid balance and avoid grid congestions.

Using the algorithms, developed in FUSE, devices can decide fully decentrally and independently when to switch on and at which power (P), based on the broadcasted common price signal (BI, balance indicator) and their individual flexibility (FR, flexibility reserve).



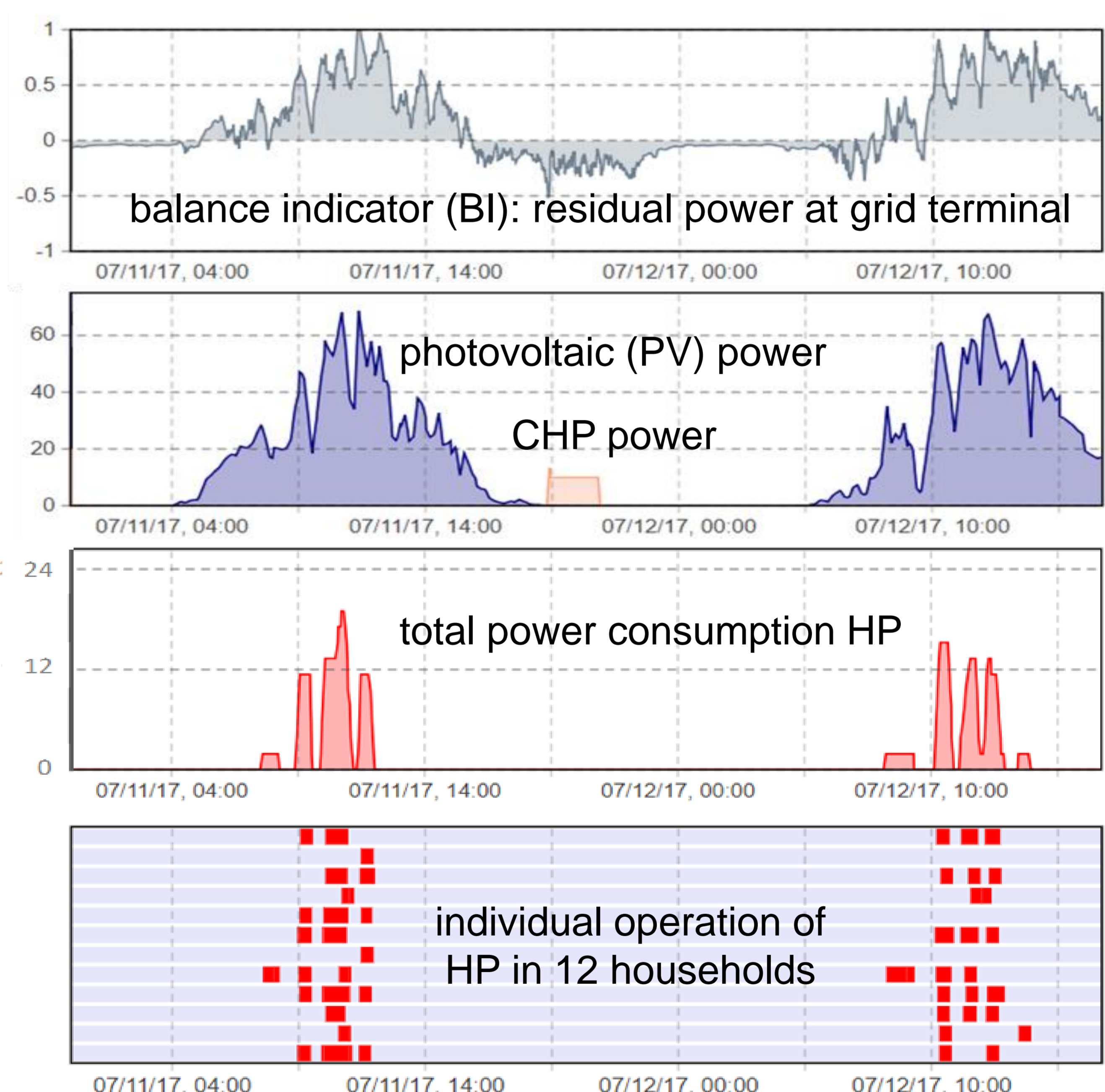
Optionally, external forecast time series for BI ($BI_{FC}[\dots]$) and FR ($FR_{FC}[\dots]$) can be utilized to enhance performance. The algorithm is self-optimizing, using well-known operation parameters of the devices.

The price signal BI can be directly translated to dynamic tariffs.

First Results

In the SENSE smart grid lab of Technical University Berlin, currently a microgrid is set up for FUSE, to implement and evaluate the algorithms in various, representative devices. Detailed results are expected in 2021.

However, the algorithms have already been pre-evaluated and subsequently successfully applied in a digital twin of a living quarter with 12 heat pumps (HP) and a combined heat and power generator (CHP) in the project “SoLAR” in Allensbach, Germany.



Conclusion

First evaluations on “soft control” in the projects FUSE and SoLAR have already successfully shown that decentral energy management is a promising alternative to fulfill the needs of stability in future electricity grids with 100 % renewable energies.