



HAL
open science

Hierarchical Energy Management System for Optimising Self-consumption in Building MicroGrids

Daniela Yassuda Yamashita, Ionel Vechiu, Jean-Paul Gaubert

► To cite this version:

Daniela Yassuda Yamashita, Ionel Vechiu, Jean-Paul Gaubert. Hierarchical Energy Management System for Optimising Self-consumption in Building MicroGrids. Conférence des Jeunes Chercheurs en Génie Electrique du Groupe GDR SEEDS, Jul 2019, Ile d'Oléron, France. hal-02454923

HAL Id: hal-02454923

<https://hal.science/hal-02454923>

Submitted on 24 Jan 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

GT Micro-Réseau

Hierarchical Energy Management System for Optimising Self-consumption in Building MicroGrids

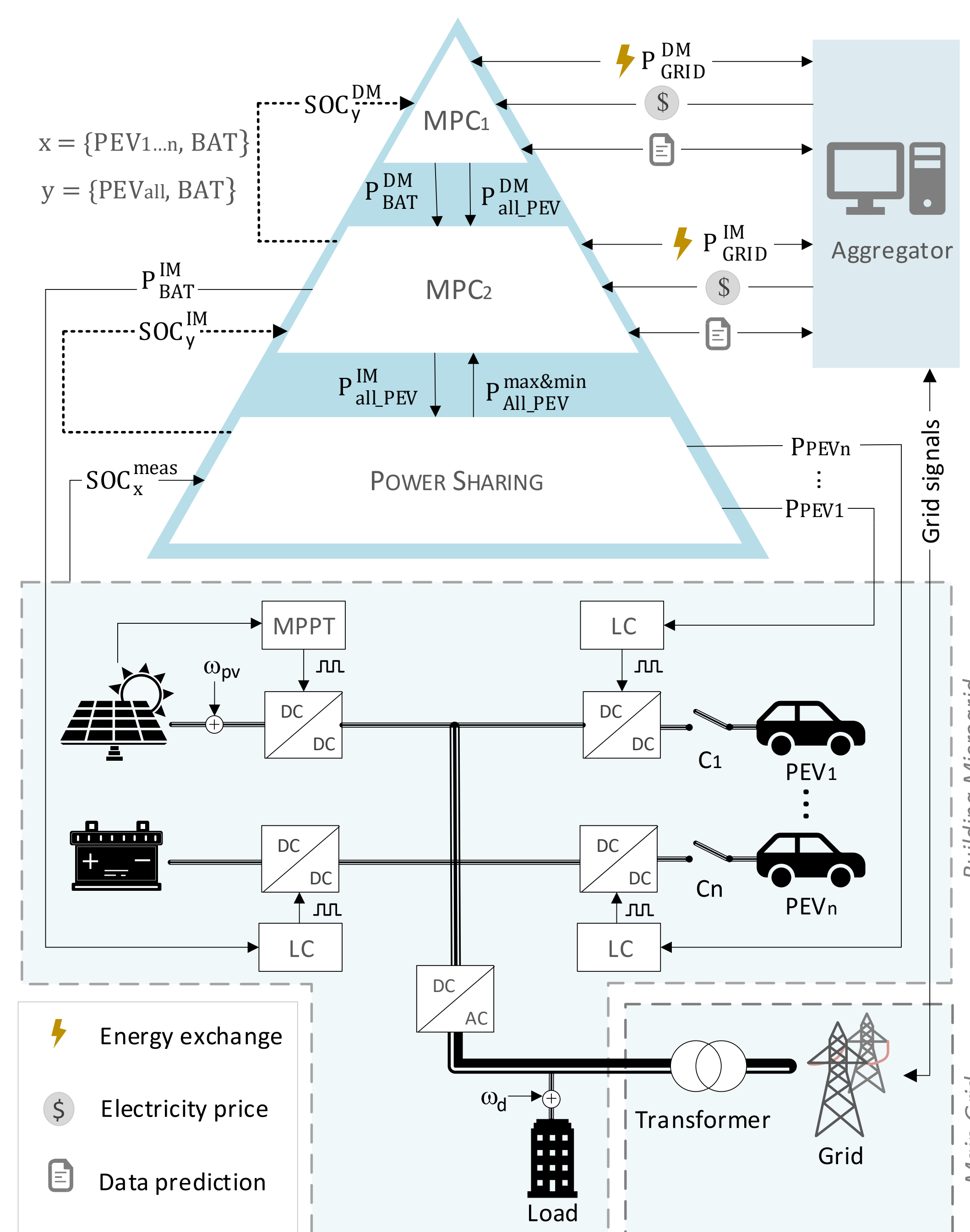
 D. Y. Yamashita^{1,2}, I. Vechiu¹, J. P. Gaubert²

(1) ESTIA Institute of Technology

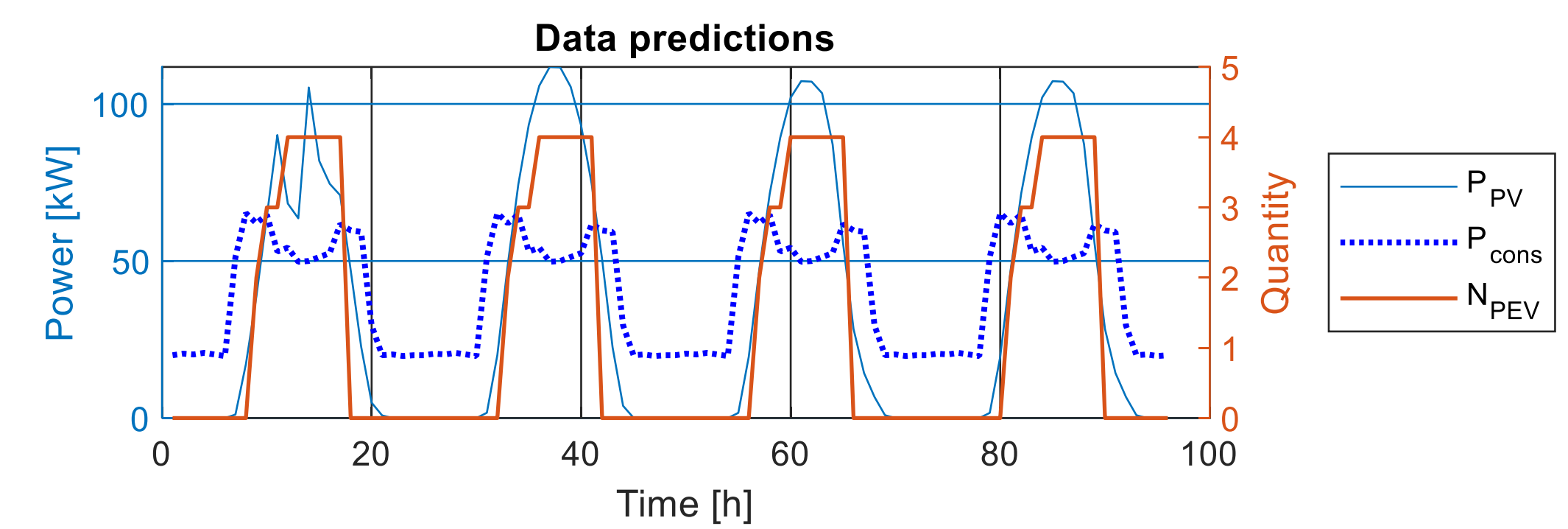
(2) Université de Poitiers, Laboratoire d'Informatique et d'Automatique pour les Systèmes (LIAS) – ENSIS

Building MicroGrid Overview

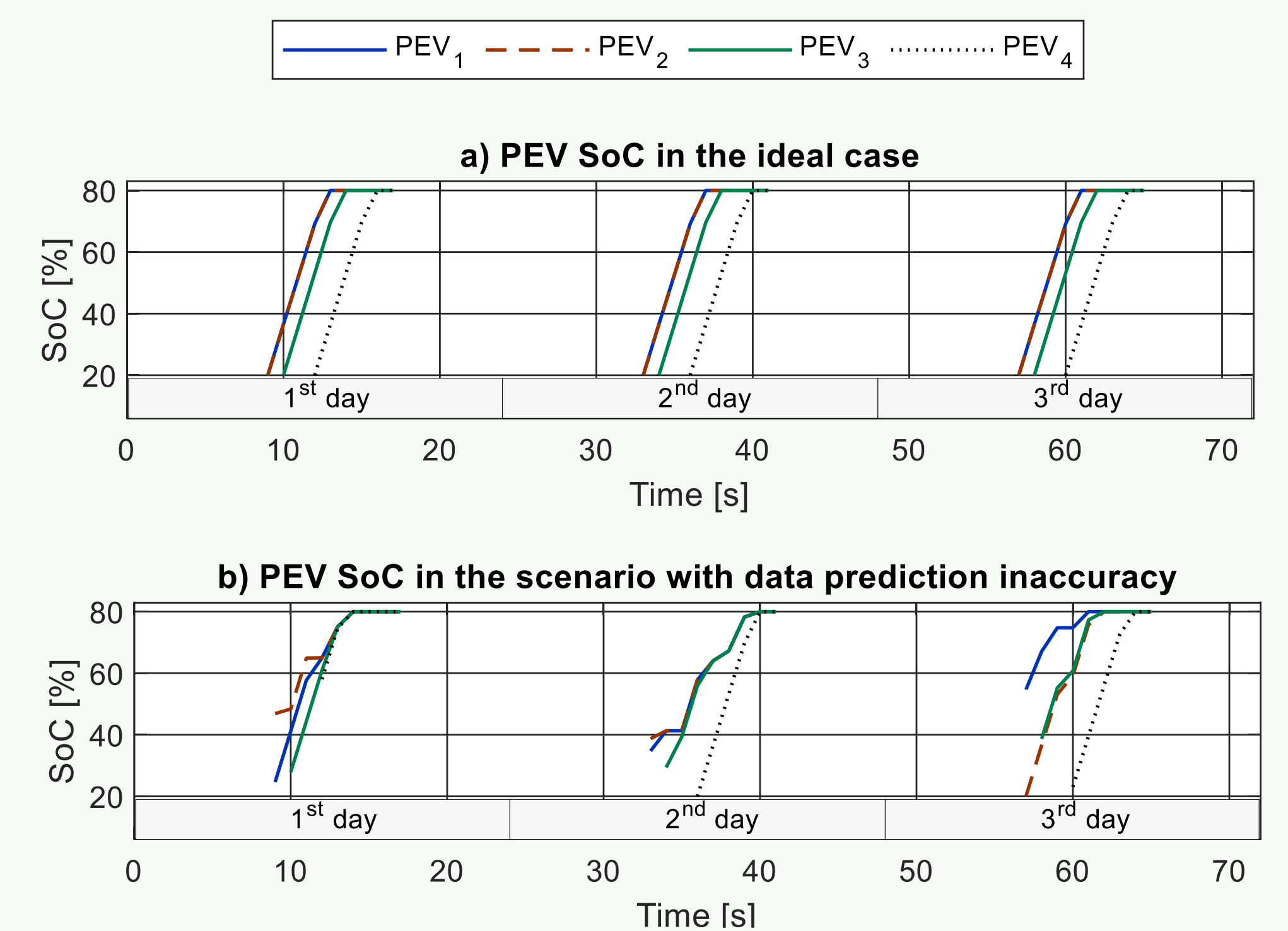
Renewable energy sources are increasingly deployed as distributed generators, restructuring the traditional electrical grid toward smart grids. Their intermittent power generation makes difficult the development of a complete carbon-free MicroGrid. The Hierarchical Control structure has demonstrated very suitable to manage multivariable systems with different time frames like those of Building MicroGrids (BMG).



Three-level hierarchical control structure for a grid-connected building microgrid.

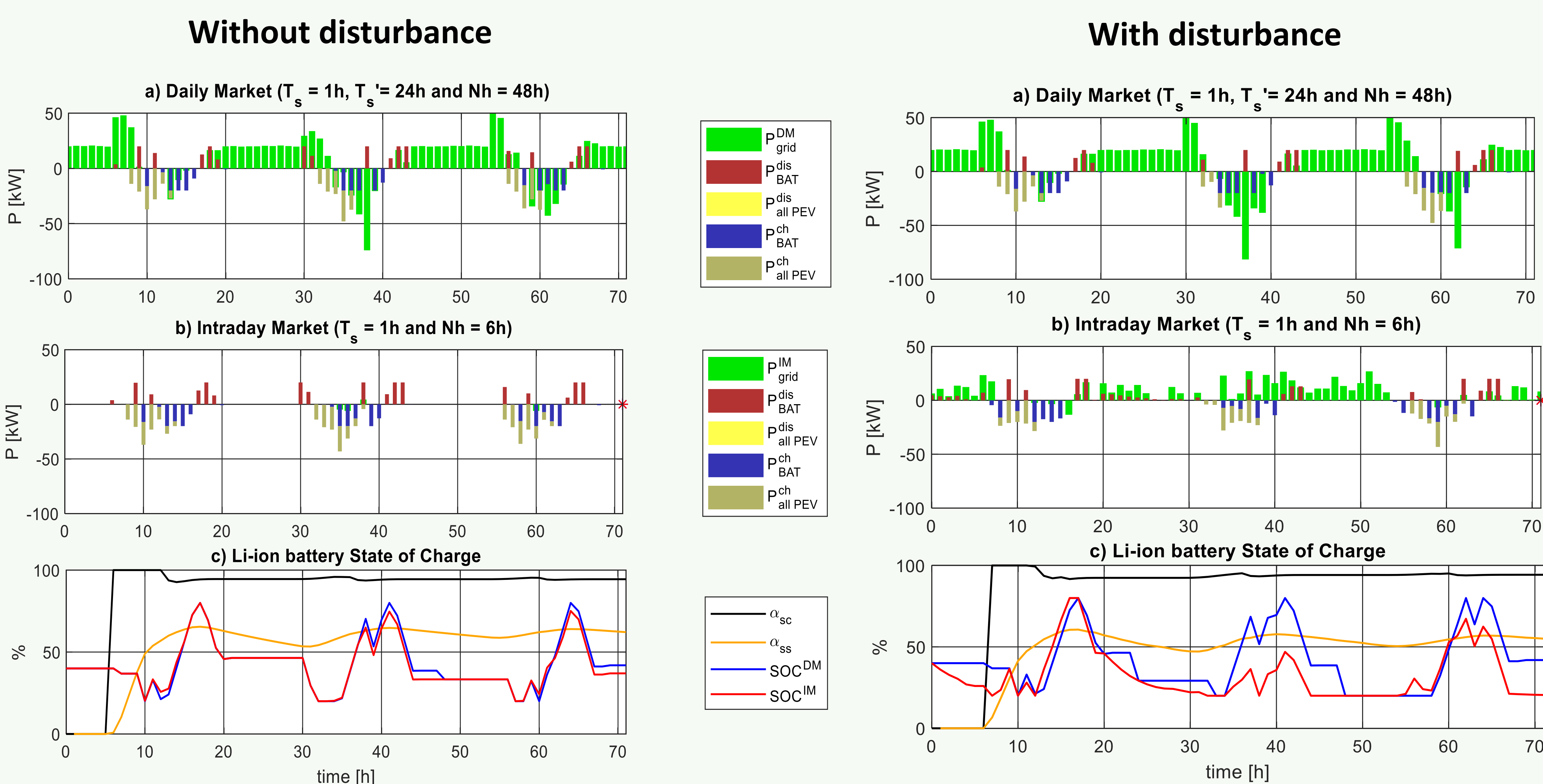

 Data prediction of PV power generation (P_{PV}), building power consumption (P_{cons}) and number of EVs plugged to the BMG (N_{PEV})

Power sharing



State of charge of each Plug-in Electric Vehicle (PEV). (a) Ideal case without any disturbance. (b) Case with error in data prediction.

Hierarchical MPC


 Hierarchical Control MPC. (a) MPC₁ variables in Daily Market time frame. (b) MPC₂ variables in Intraday Market time frame. (c) Li-ion batteries SoC, self-consumption and self-sufficiency index in the three days.

Control Strategy

Aiming to keep adequate ranges of **self-consumption** and **self-coverage** indexes under PV power generation and building power consumption uncertainties, the EMS was divided into three modules:

- Upper Model Predictive Control (MPC₁)
- Lower Model Predictive Control (MPC₂)
- Power Sharing Module with state machine