POLITECNICO MILANO 1863

DIPARTIMENTO DI ENERGIA

MG² MultiGood MicroGrid Lab

MOST CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

MG2Lab Experimental Campaign

From 25/09/2023 to 01/10/2023

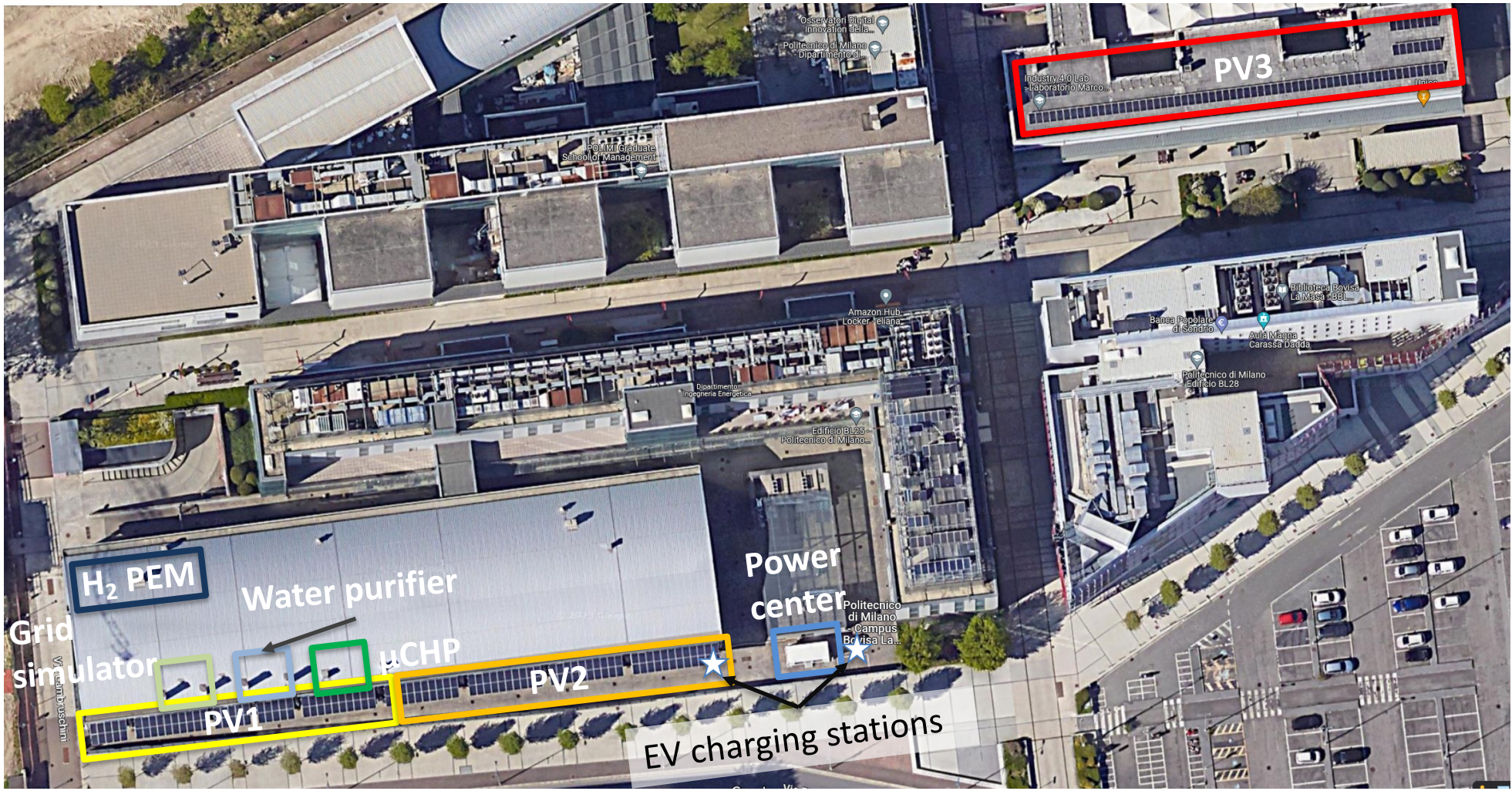
Centro Nazionale Mobilità Sostenibile
Spoke 13 – TASK 2.4

Department of Energy
Via Lambruschini, 4A
20156 Milano

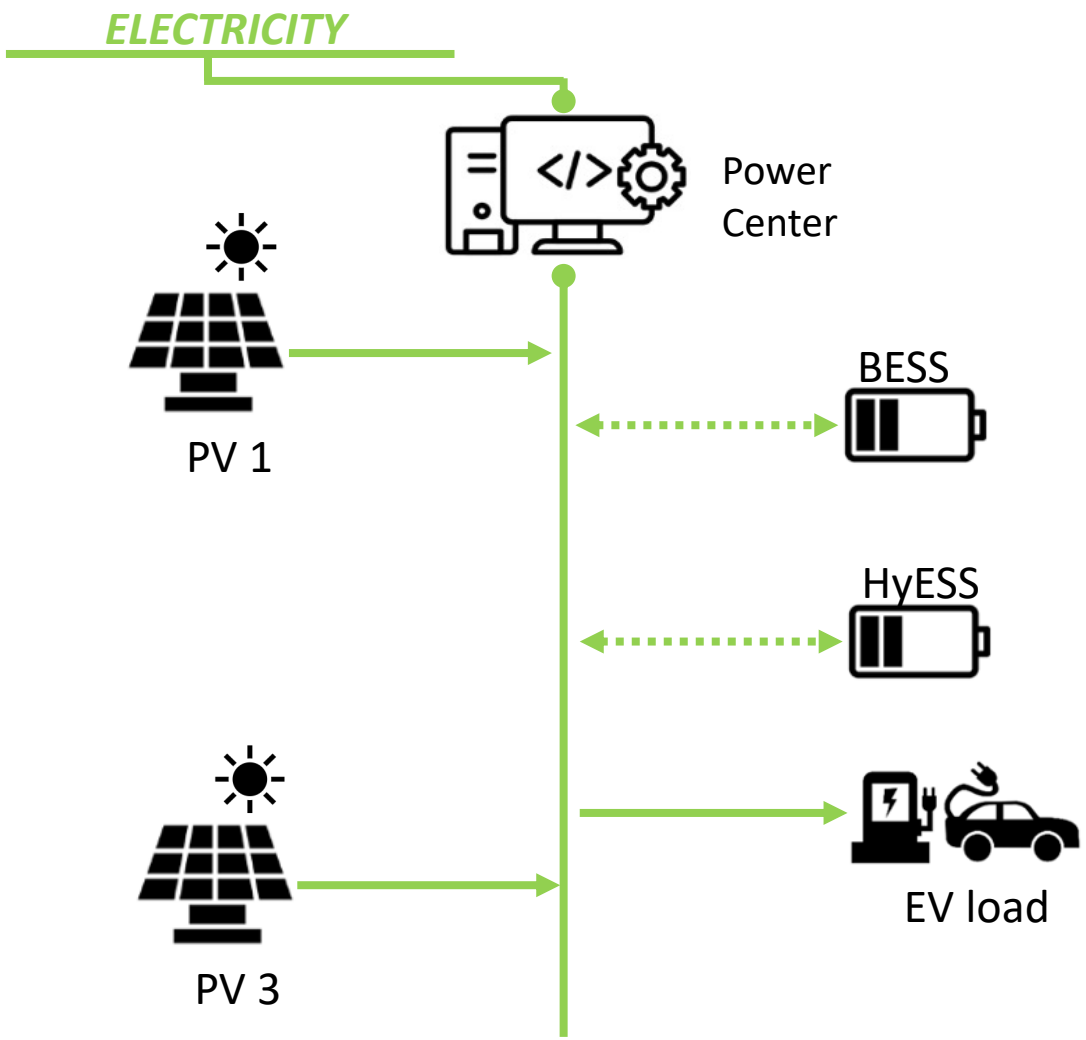
MG2lab – Multigood microgrid experimental facility

Configuration

- Electric power generation capacity: 100 kW
- Thermal power generation capacity: 45 kW
- Potable water production: 1 m^3/h
- PEM electrolyzer 6 Nm^3/h
- Electric storage: 150 kWh
- Hydrogen storage: 30 kWh
- Thermal storage: 50 kWh
- Electric Vehicles (EV): 2
- Electric Bikes: 10



Case study microgrid configuration



Power System (PV + BESS) connected to the National Electricity Grid through a single connection point

Microgrid components

PV fields

- ❑ PV1: 27kW$_{nom}$
- ❑ PV3: 25kW$_{nom}$

Batteries

- ❑ BESS : 70kW$_{peak}$, size 70kWh
- ❑ HyESS: 70kW$_{peak}$, size 70kWh

EV load

- ❑ Data from JPL database

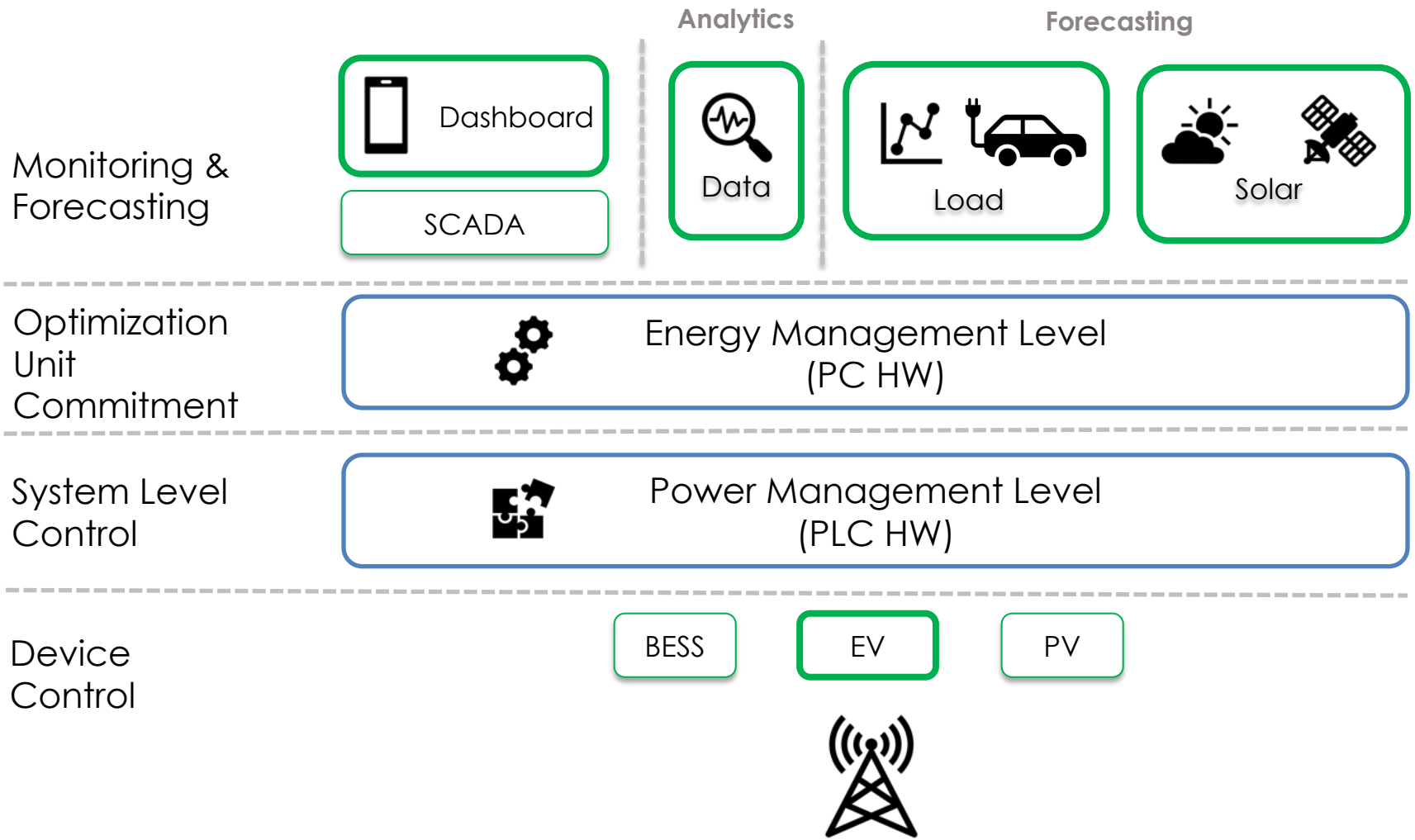
Grid

- ❑ Maximum purchase electricity 40kW

	Module	Technique	Version	Reference
FORECASTER	PV Forecaster	PHANN	v1.0	[1]
	EV Forecaster	LSTM+	v2.1	[2]
OPTIMIZER	1° Layer	Deterministic MILP	v1.0	[3]
	2° Layer	Heuristic Control	V1.2	[4]

[1] *"Robust 24 Hours ahead Forecast in a Microgrid: A Real Case Study"* https://www.mdpi.com/2079-9292/8/12/1434
[2] *"User Behavior Clustering Based Method for EV Charging Forecast"* https://ieeexplore.ieee.org/document/10014991
[3] *"Assessing the impact of a two-layer predictive dispatch algorithm on design and operation of off-grid hybrid microgrids"* https://www.sciencedirect.com/science/article/pii/S0960148119307207?via%3Dihub
[4] *"Numerical and experimental testing of predictive EMS algorithms for PV-BESS residential microgrid"* https://ieeexplore.ieee.org/document/8810548

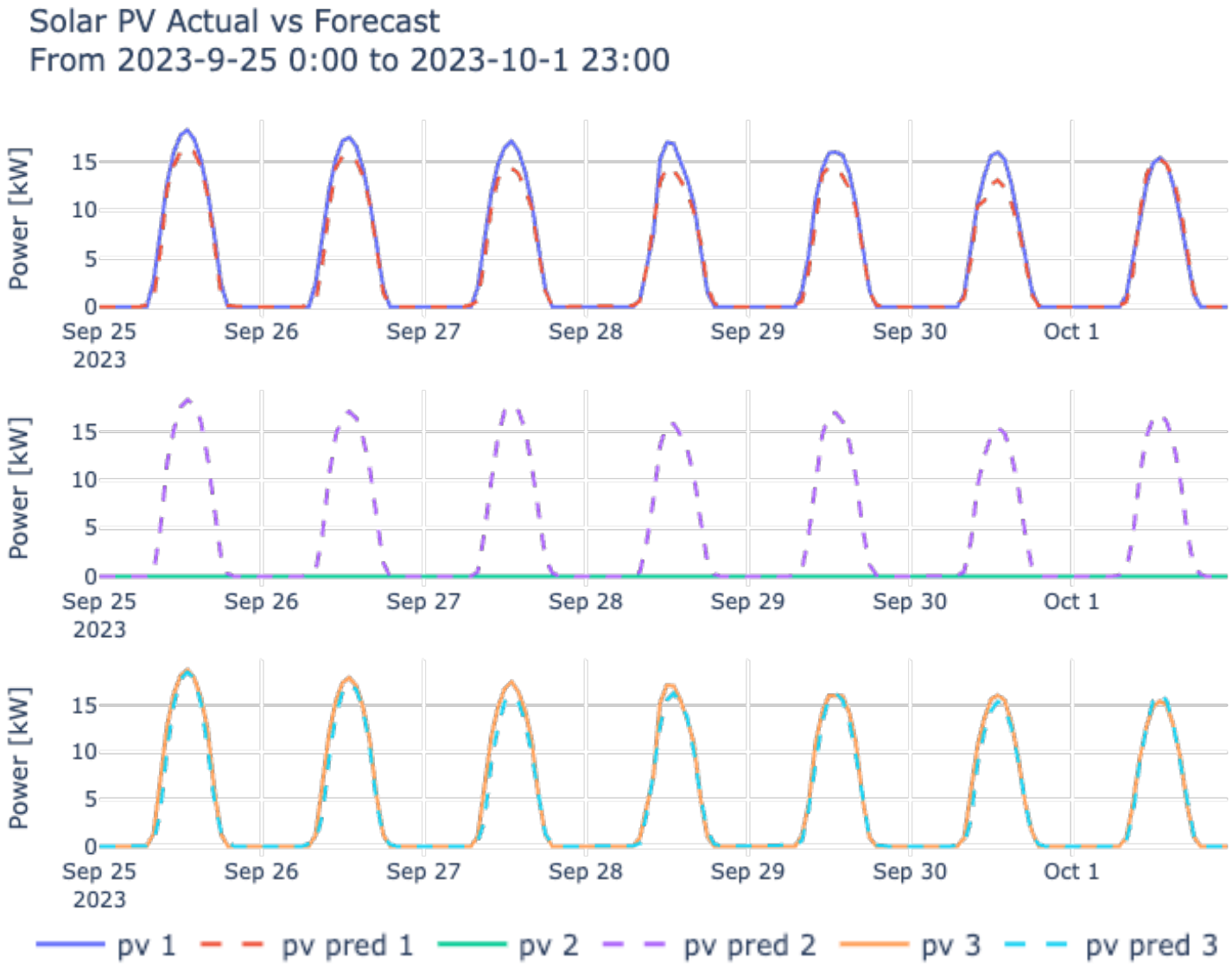
Optimizer focus



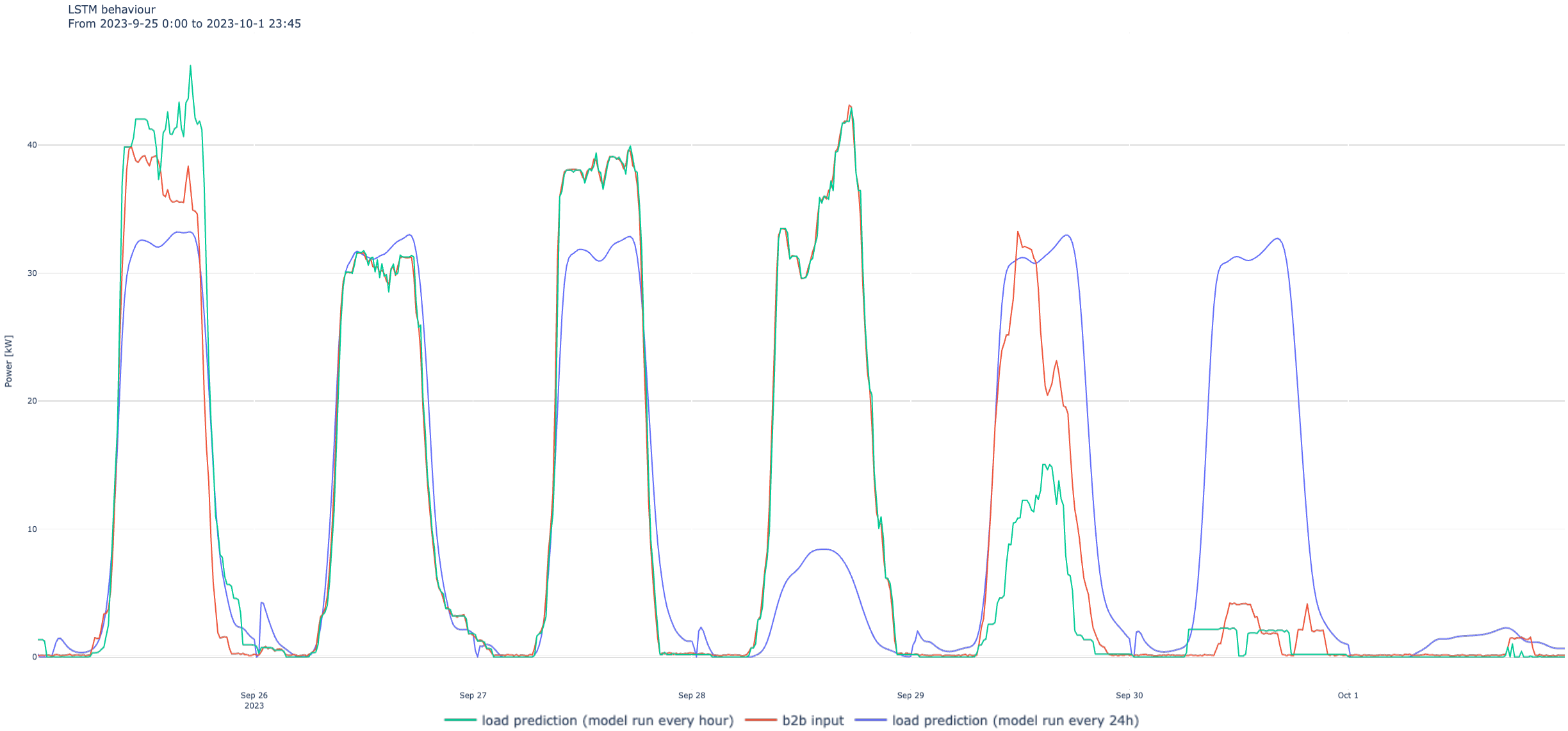
Case Study – Data Features

Data	Components	Reference
PV Data	PV1, PV3	MG2Lab Measurements
EV Data	B2B	JPL Dataset
Simulation Outcomes	/	result's folder

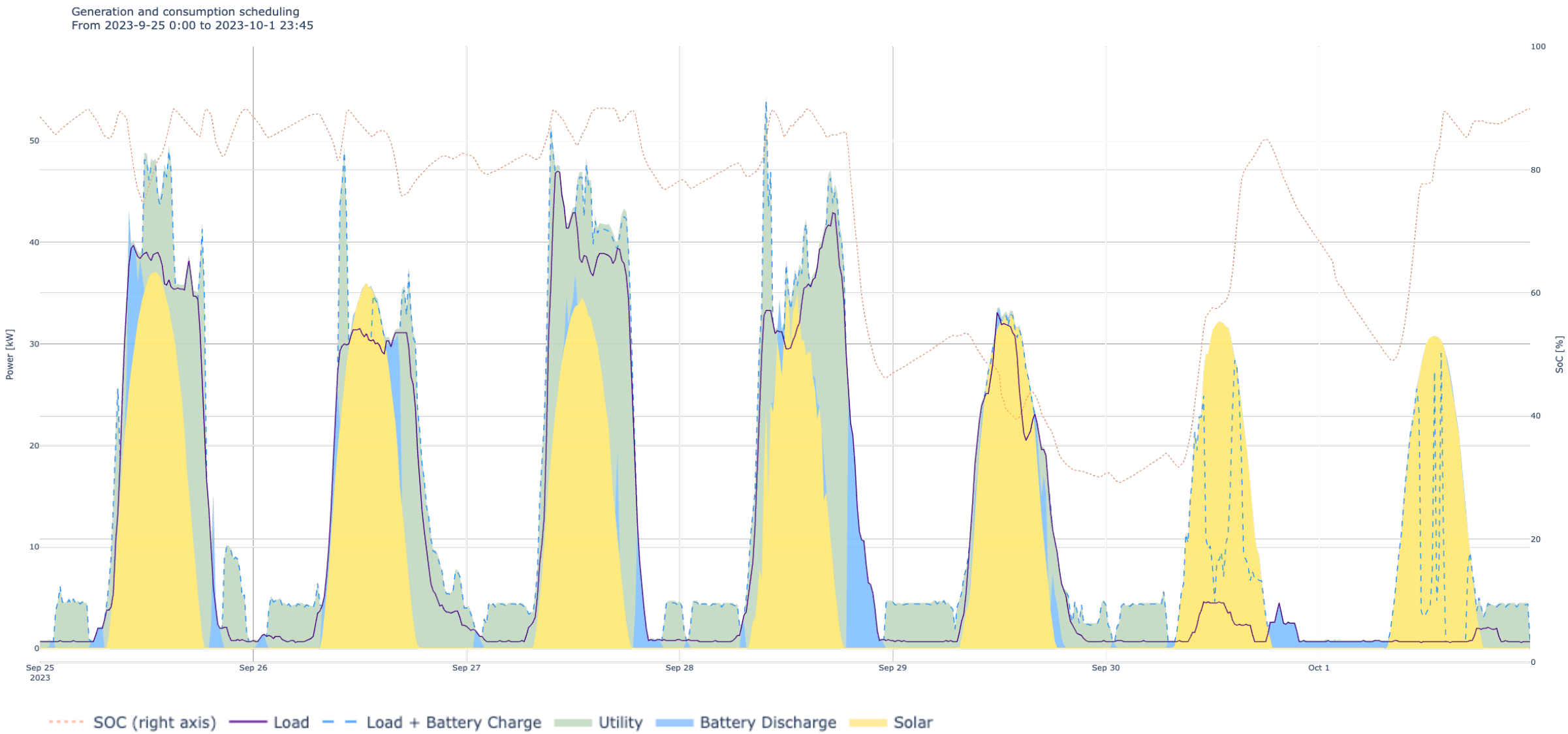
Simulation Outcomes – PV forecasting performance



Simulation Outcomes – EV forecasting performance



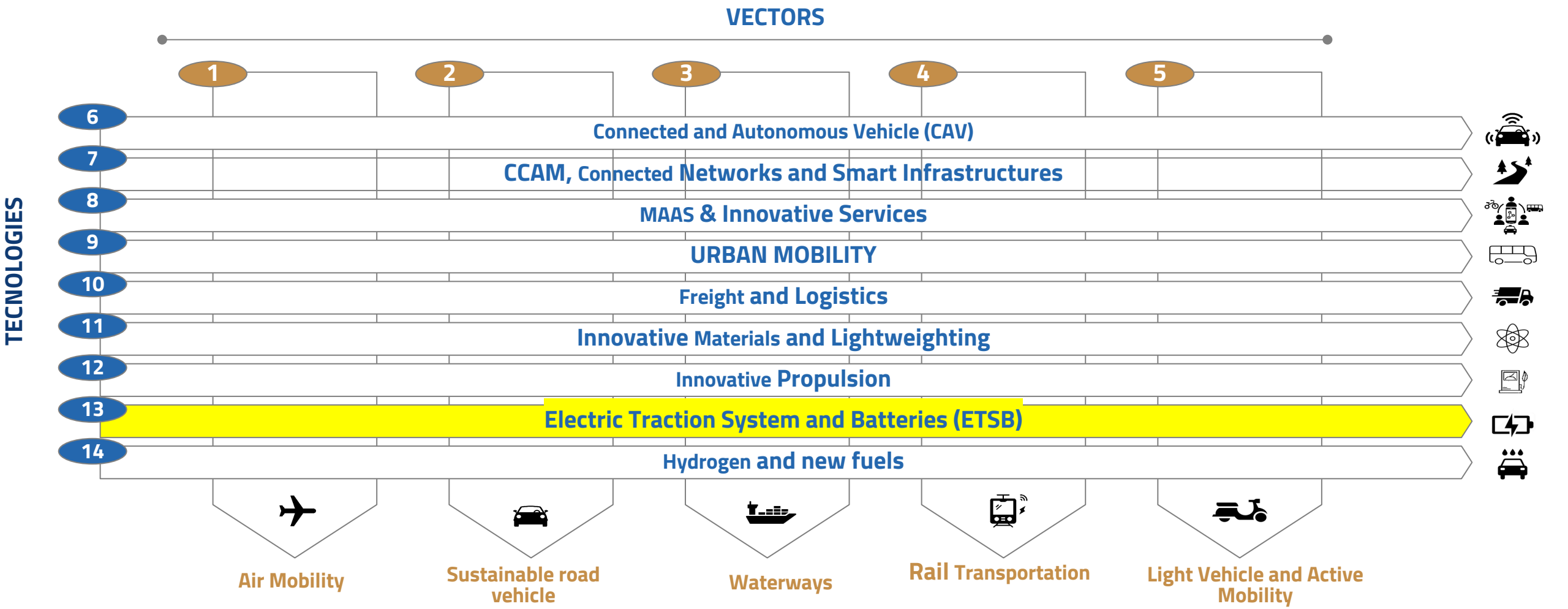
Simulation Outcomes – EMS Optimization Results – Scheduling example



Highlights

- Experimental activity has been performed without any malfunctioning during the entire week
- **PV Forecaster's** performances are very good and consistent over the entire week of experiments
- Two **EV Forecaster based** on the LSTM+ tested: the model ran every 24 hours misses some peaks, showing poorer performances if compared to the model ran every hour
- The EMS exploits the forecast to anticipates the change in the load and minimizes the overall operational costs

www.MG2lab.polimi.it



www.centronazionalemost.it

PNRR Total fund: around 200 MEuros

25 Universities and Research Centers

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SPECIAL AKNOWLEDGEMENT

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