



**POLITECNICO  
MILANO 1863**

DIPARTIMENTO DI ENERGIA



# MG2Lab Experimental Campaign

From 10/09/2023 to 16/09/2023

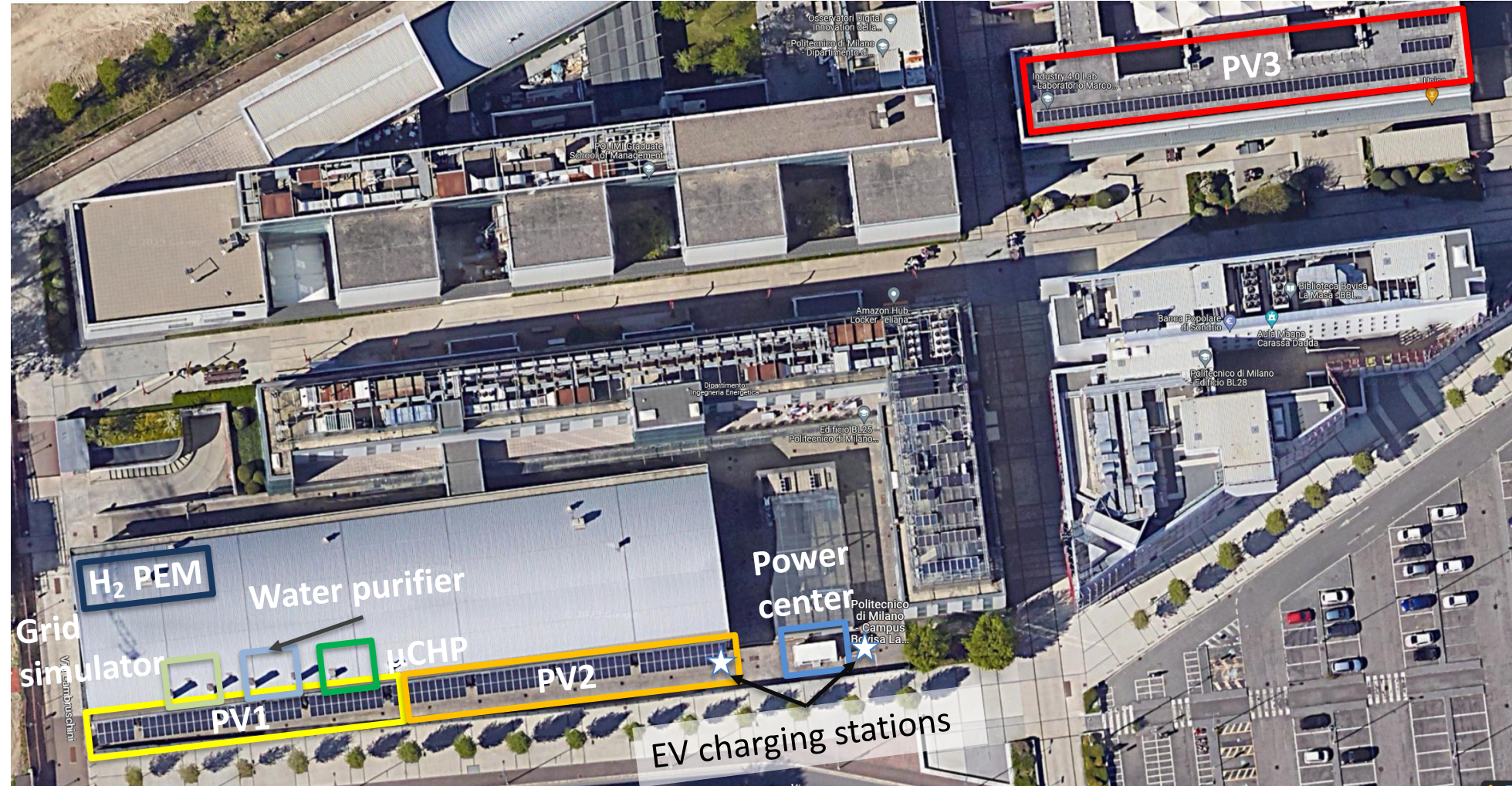
**Centro Nazionale Mobilità Sostenibile  
Spoke 13 – TASK 2.4**

Department of Energy  
Via Lambruschini, 4A  
20156 Milano

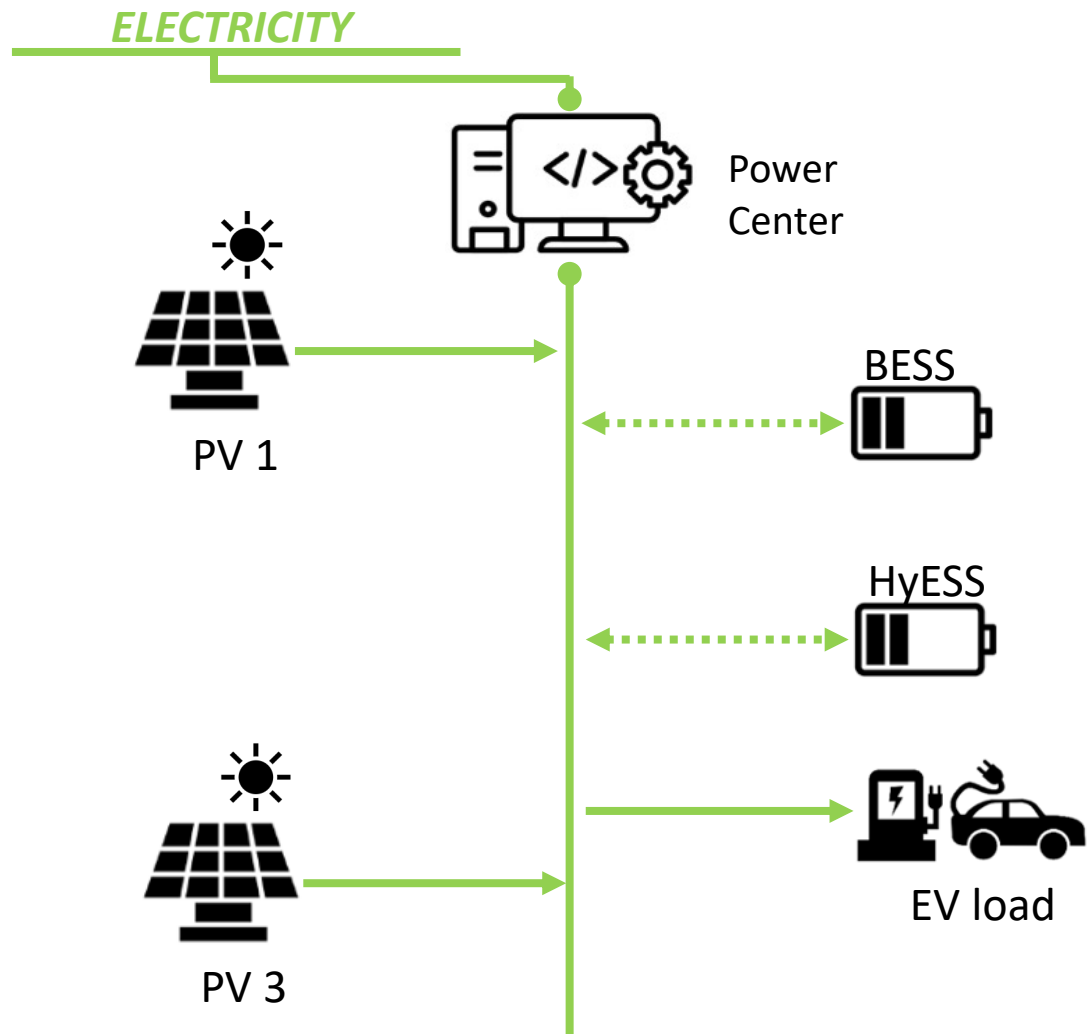
# MG2lab – Multigood microgrid experimental facility

## Configuration

- Electric power generation capacity: 100 kW
- Thermal power generation capacity: 45 kW
- Potable water production: 1 m<sup>3</sup>/h
- PEM electrolyzer 6 Nm<sup>3</sup>/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:  $27\text{kW}_{\text{nom}}$
- PV3:  $25\text{kW}_{\text{nom}}$

### Batteries

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

### EV load

- Data from JPL database

### Grid

- Maximum purchase electricity  $40\text{kW}$

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

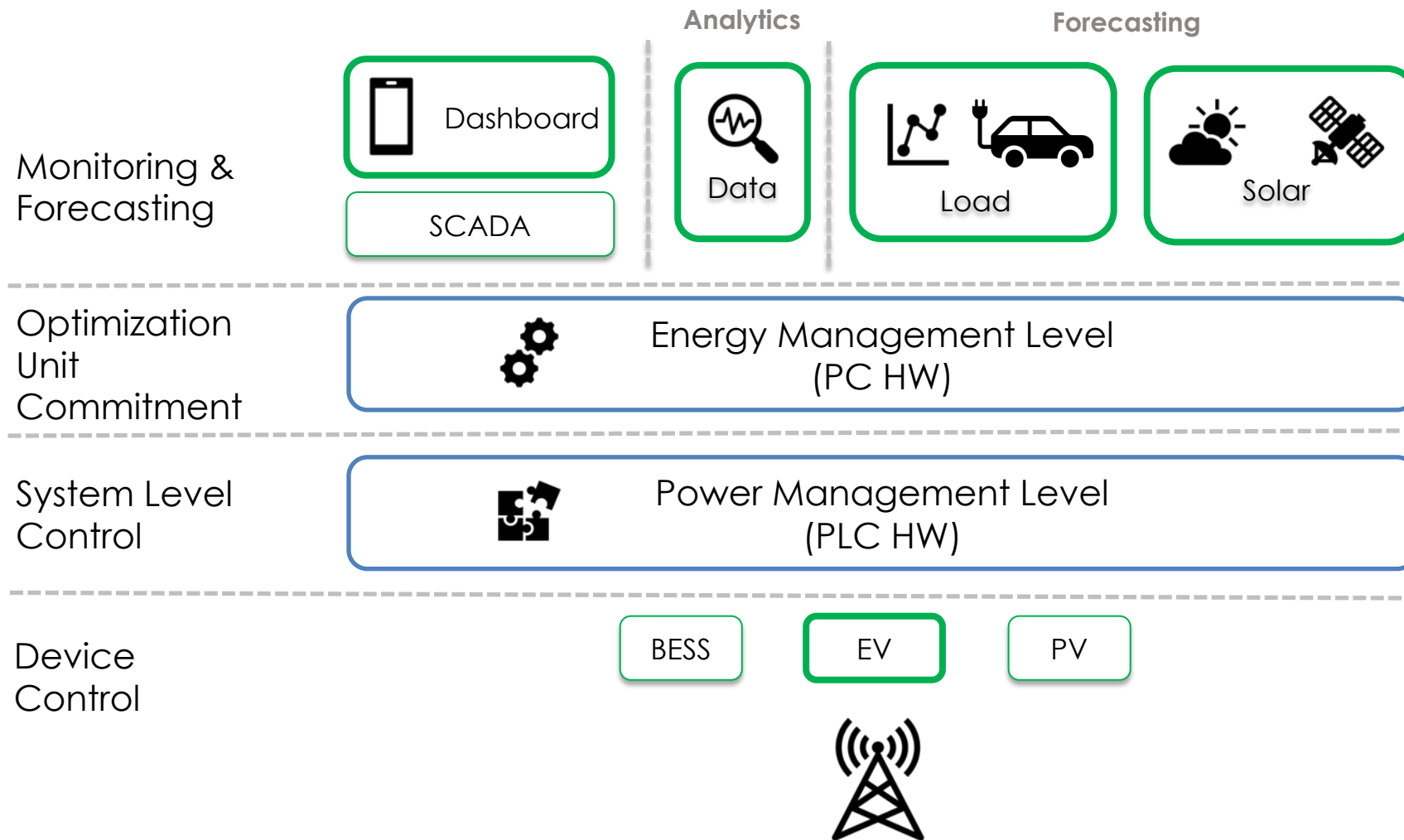
[1] "Robust 24 Hours ahead Forecast in a Microgrid: A Real Case Study" <https://www.mdpi.com/2079-9292/8/12/1434>

[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



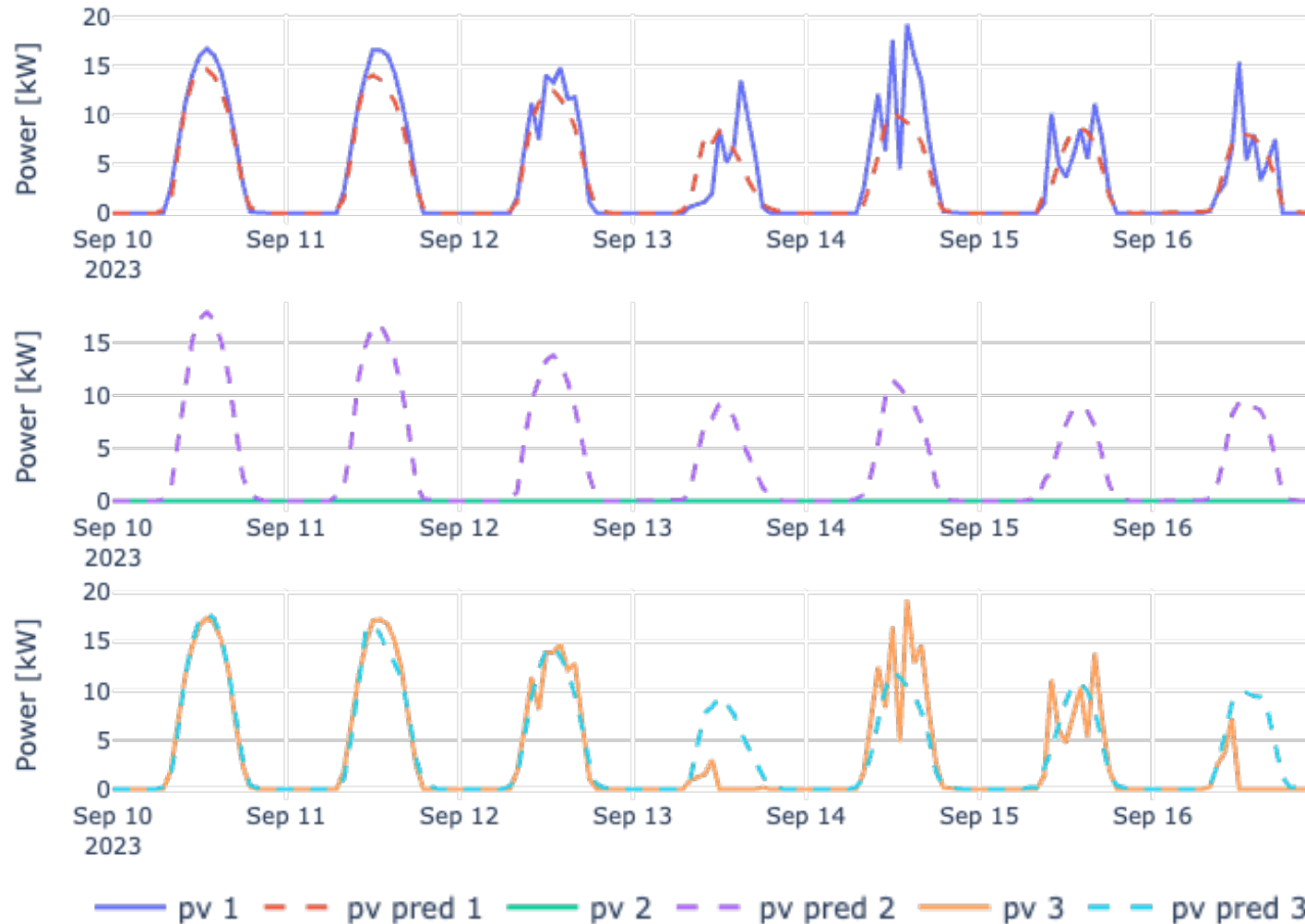
# Case Study – Data Features

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



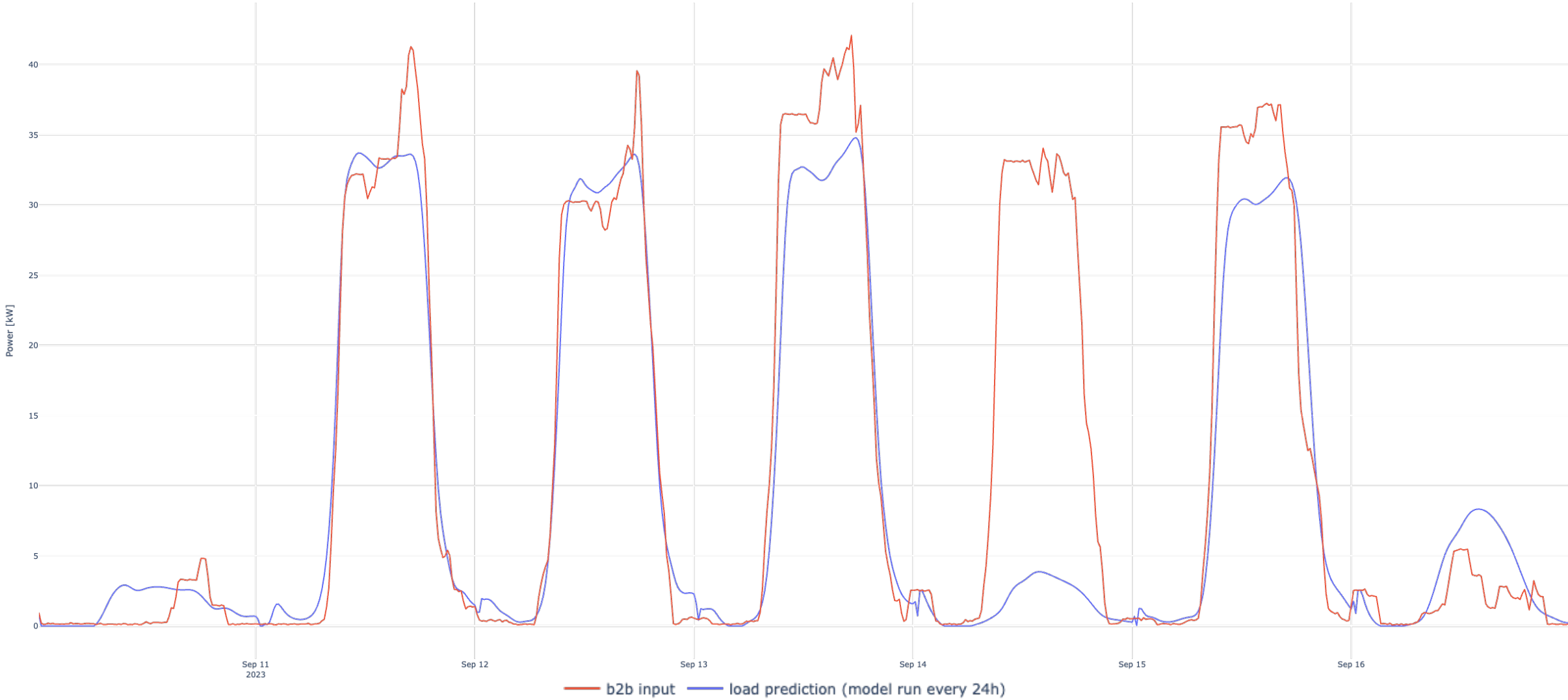
# Simulation Outcomes – PV forecasting performance

Solar PV Actual vs Forecast  
From 2023-9-10 0:00 to 2023-9-16 23:00



# Simulation Outcomes – EV forecasting performance

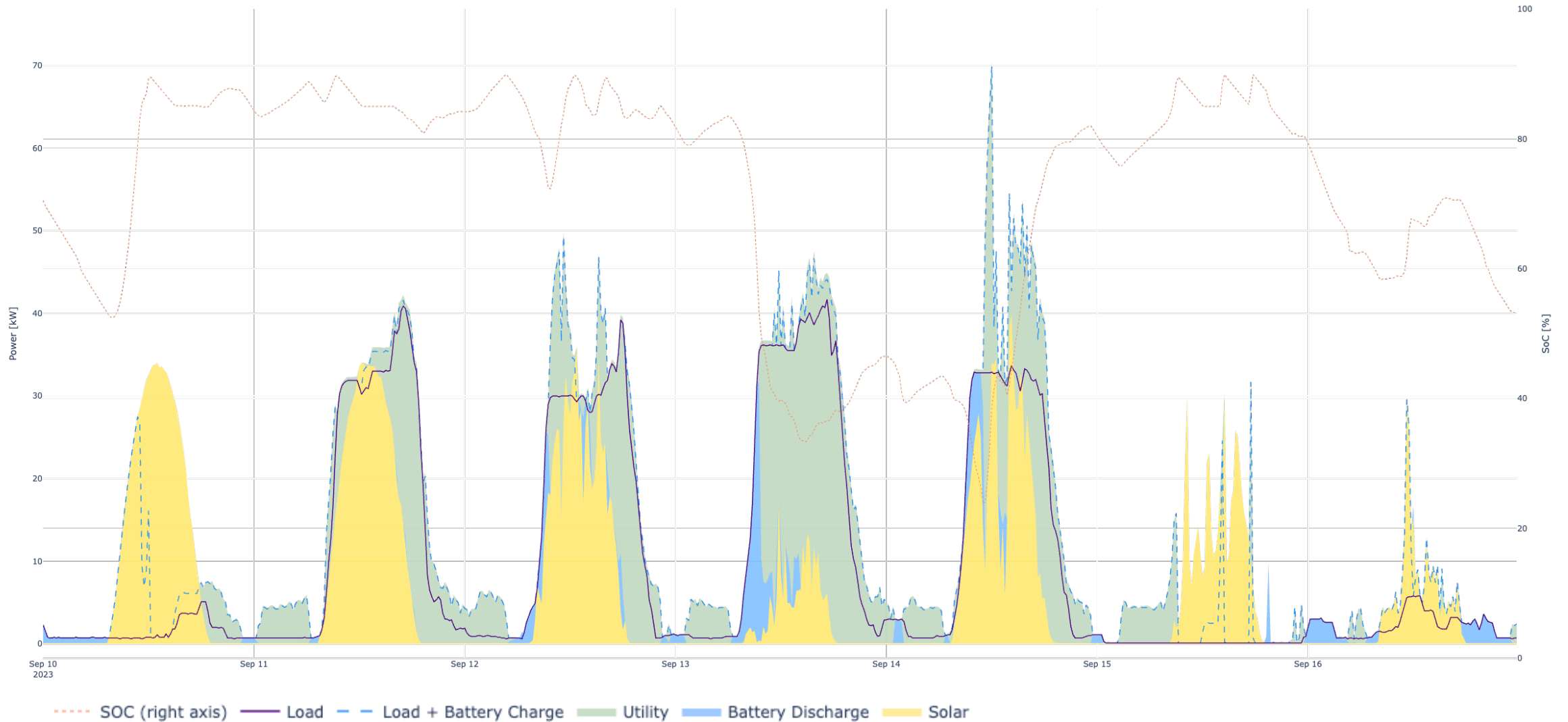
LSTM behaviour  
From 2023-9-10 0:00 to 2023-9-16 23:45





# Simulation Outcomes – EMS Optimization Results – Scheduling

Generation and consumption scheduling  
From 2023-9-10 0:00 to 2023-9-16 23:45



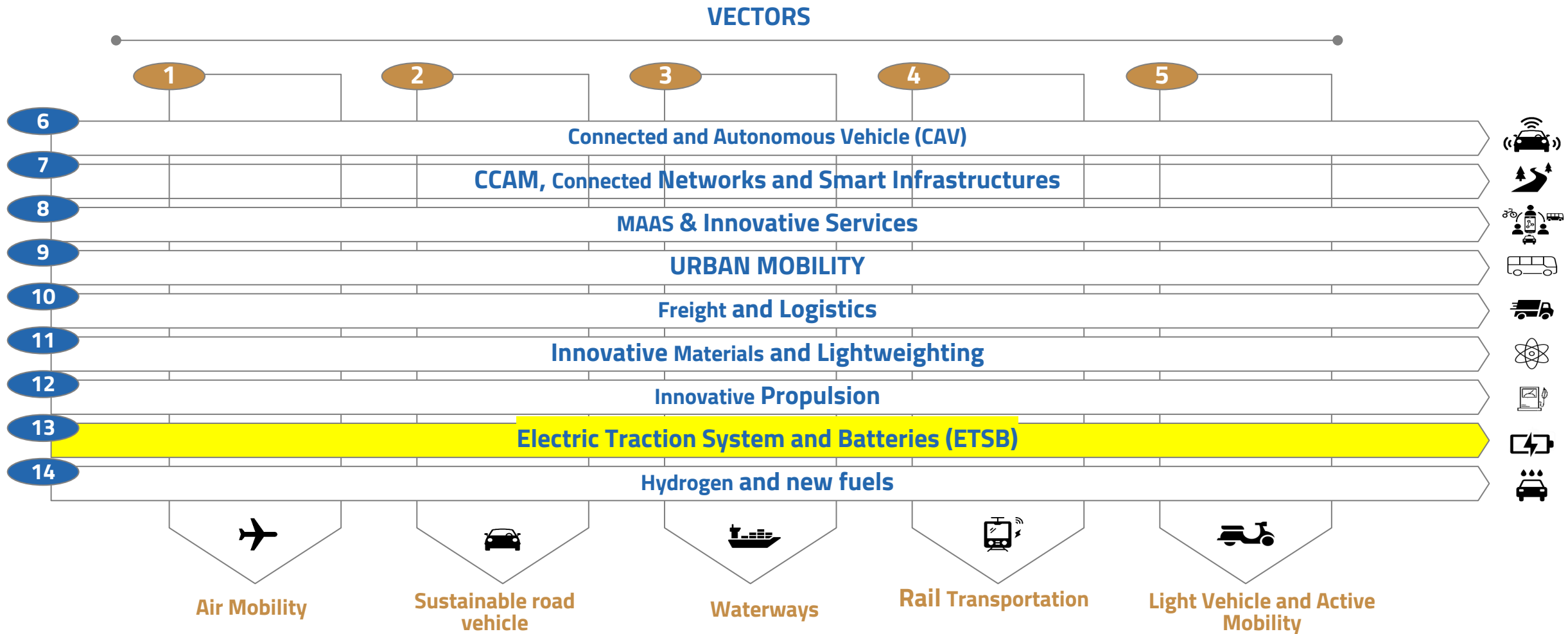
# Highlights

- **B2B** down for 1 day
- **PV Forecaster's** performances are good and quite consistent over the entire week of experiments
- The **EV Forecaster based** on the LSTM+ ran every 24 hours misses the prediction on Thursday, missing the peak
- This discrepancy is reflected in the microgrid behavior: in fact, differently from the other workdays, BESSs do not charge during the night to reduce the import from the grid of the next day
- On weekdays, in particular on sundays, BESSs exploit PV production to charge themselves in order to meet the load of the next workday

[www.MG2lab.polimi.it](http://www.MG2lab.polimi.it)



TECNOLOGIES





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PIANO NAZIONALE  
DI RIPRESA E RESILIENZA

**MOST**  
CENTRO NAZIONALE PER LA MOBILITÀ SOSTENIBILE

## PNRR Total fund: around 200 MEuros

### 25 Universities and Research Centers

Consiglio Nazionale delle Ricerche

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**SPECIAL  
ACKNOWLEDGEMENT**

### 24 Private Entities

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Avio Aero

brembro

eni

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