

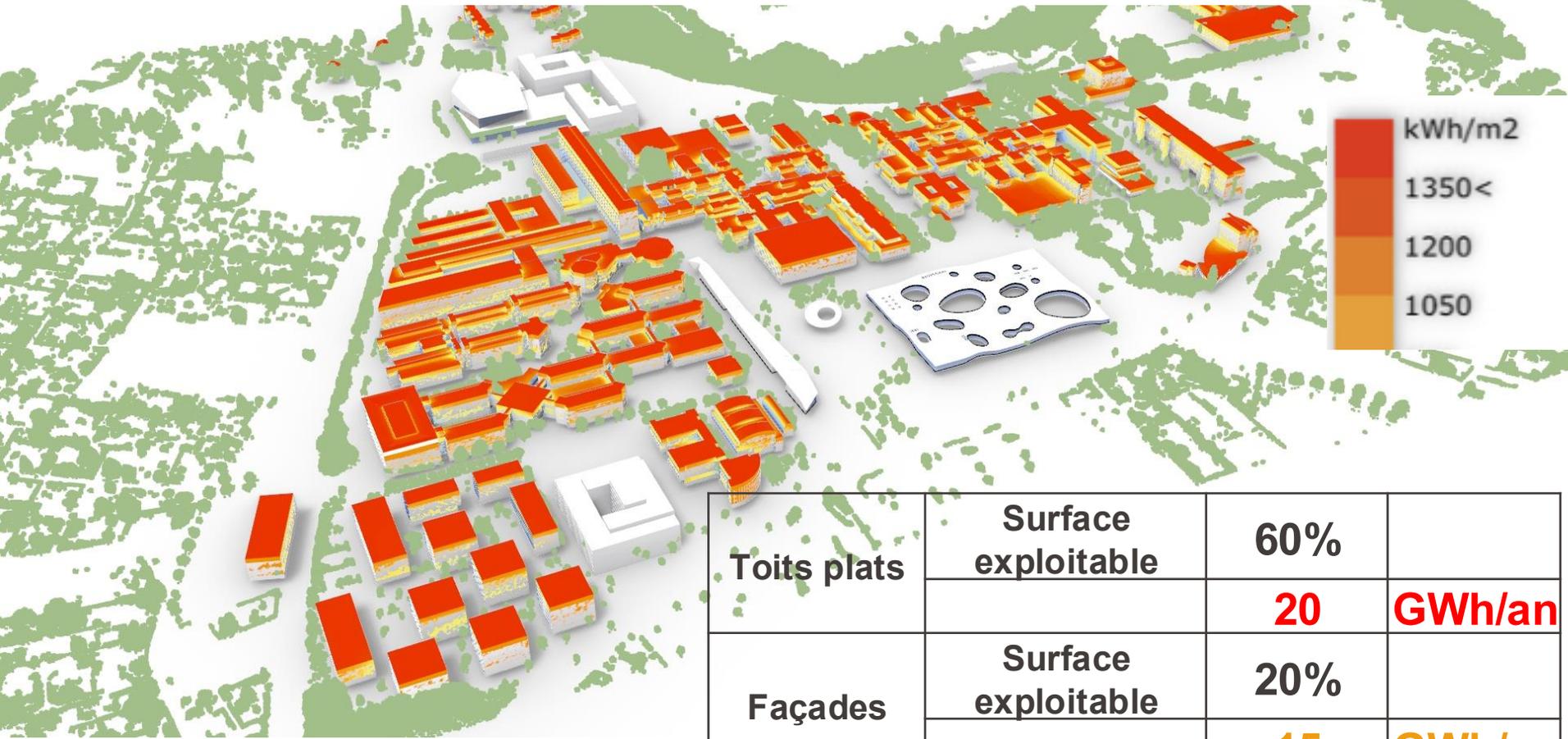
# Decarbonization, toward electricity self-reliance at EPFL campus

## Solutions for Sustainability Initiative (S4S) H2elios NeuroCam

An aerial photograph of the EPFL campus in Lausanne, Switzerland. The image shows a large complex of modern buildings with various architectural styles, surrounded by green spaces and a road. In the background, there is a large body of water (Lake Geneva) and mountains under a blue sky with some clouds.

**Christophe Moser**  
Mario Paolone  
Luisa Lambertini  
Demetri Psaltis

# What if Roofs and facades are covered with PV



Toits plats	Surface exploitable	60%	
		20	GWh/an
Façades	Surface exploitable	20%	
		15	GWh/an

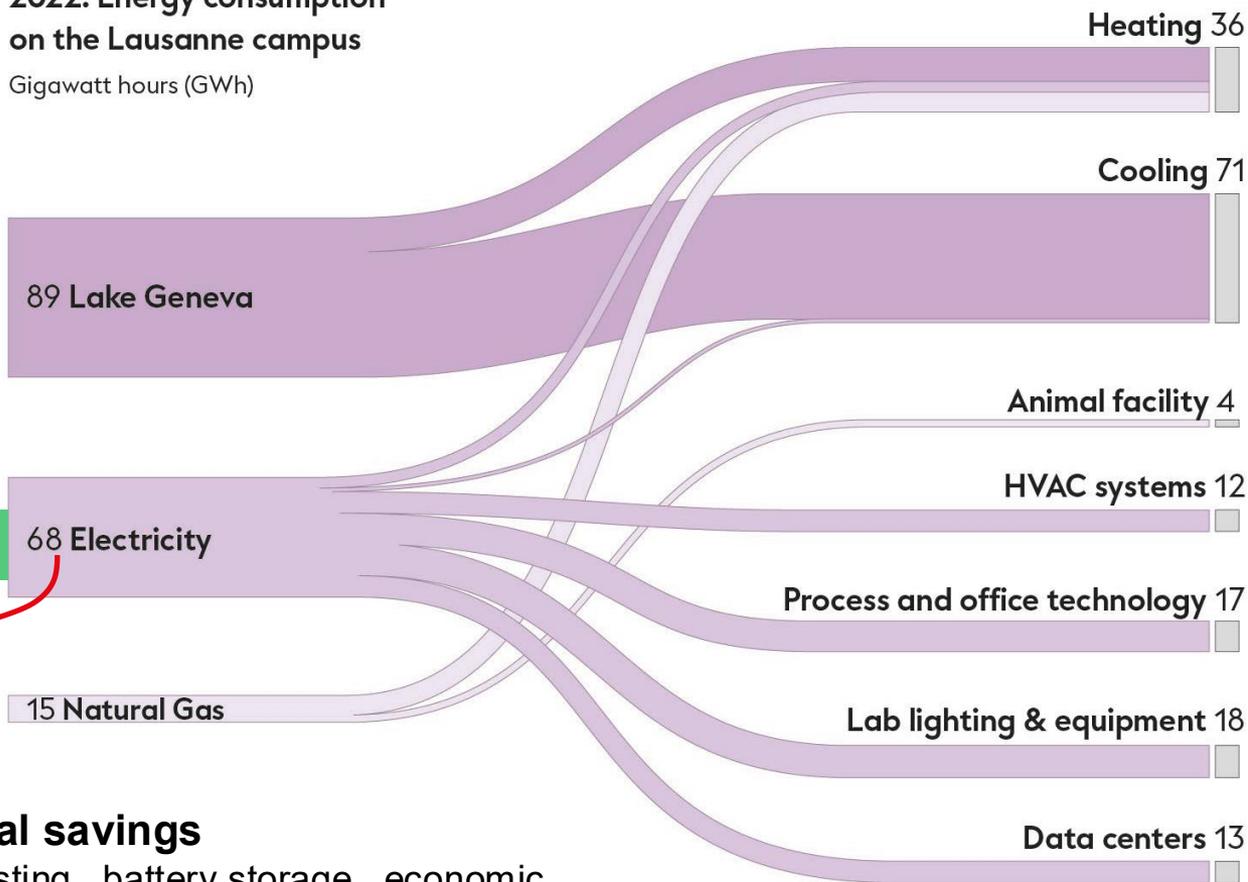


Sedrun Solar  
29 GWh/year

- surpassing Mont-Soleil (11 GWh), and Solarparc Cressier (8.4 GWh).

## 2022: Energy consumption on the Lausanne campus

Gigawatt hours (GWh)



Source:  
<https://www.epfl.ch/about/sustainability/energy-buildings>

PV 35 GWh

68 Electricity

15 Natural Gas

Heating 36

Cooling 71

Animal facility 4

HVAC systems 12

Process and office technology 17

Lab lighting & equipment 18

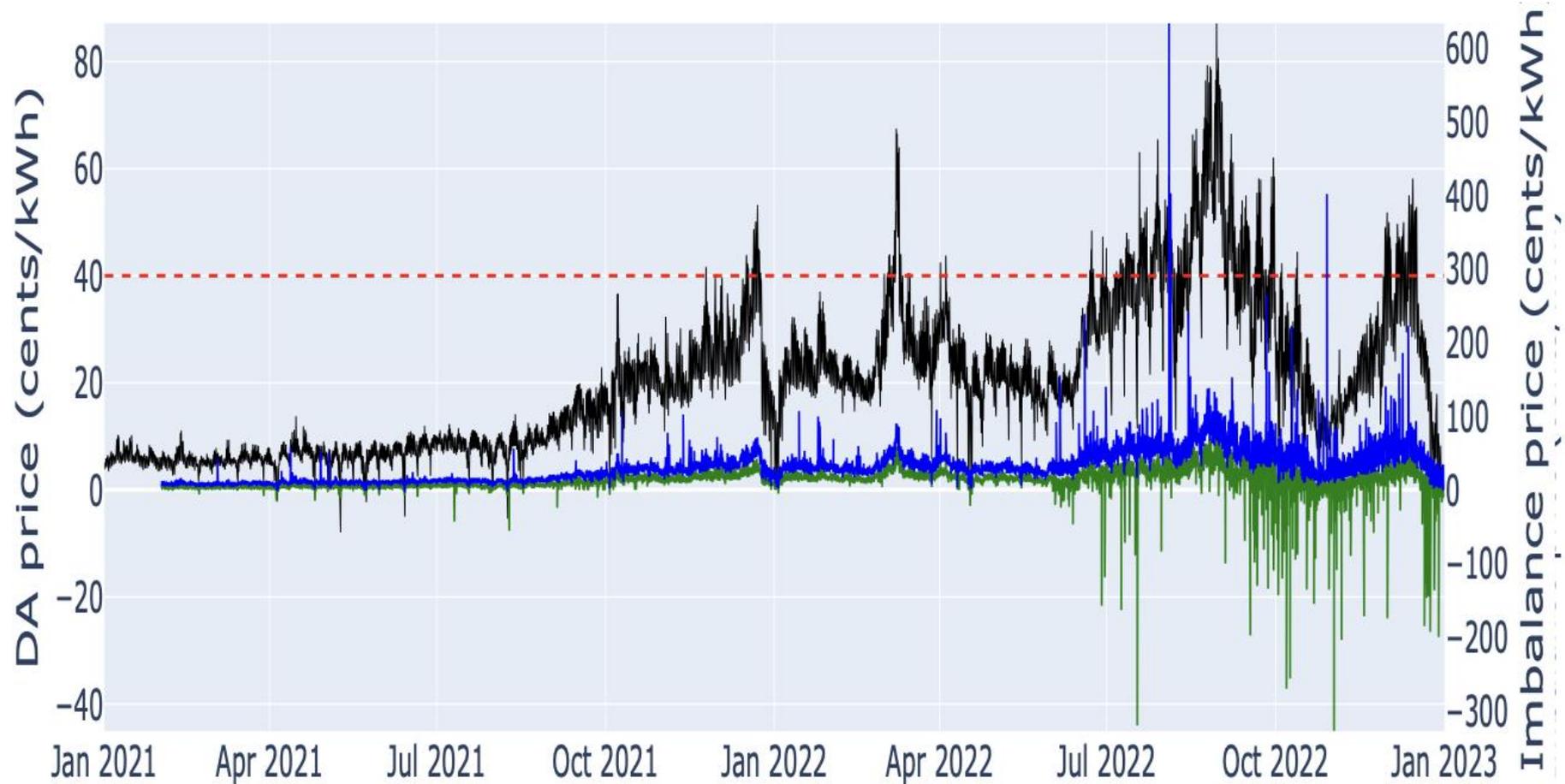
Data centers 13

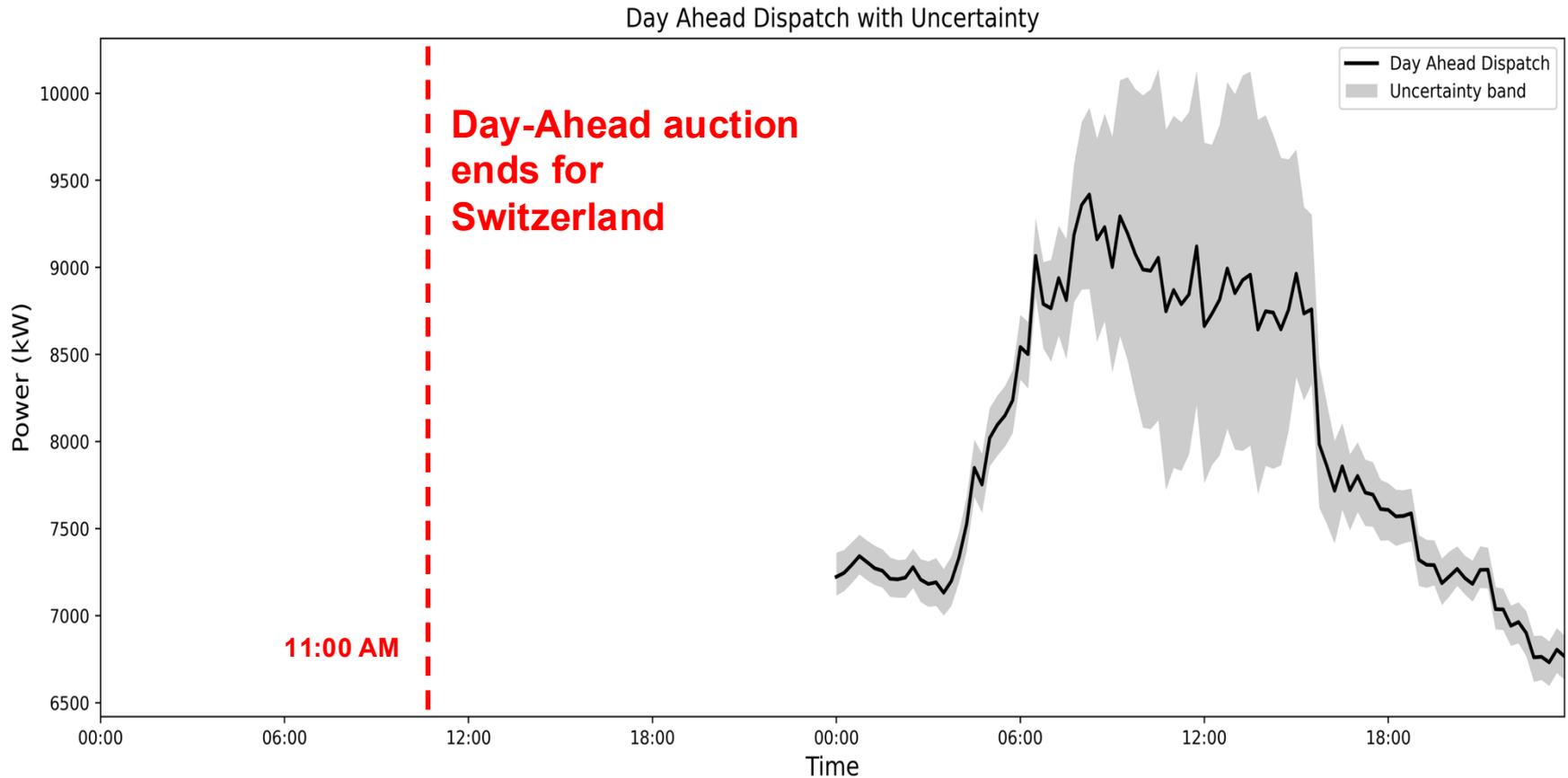
> **CHF 20M annual savings**

through PV forecasting, battery storage, economic model, optimization.

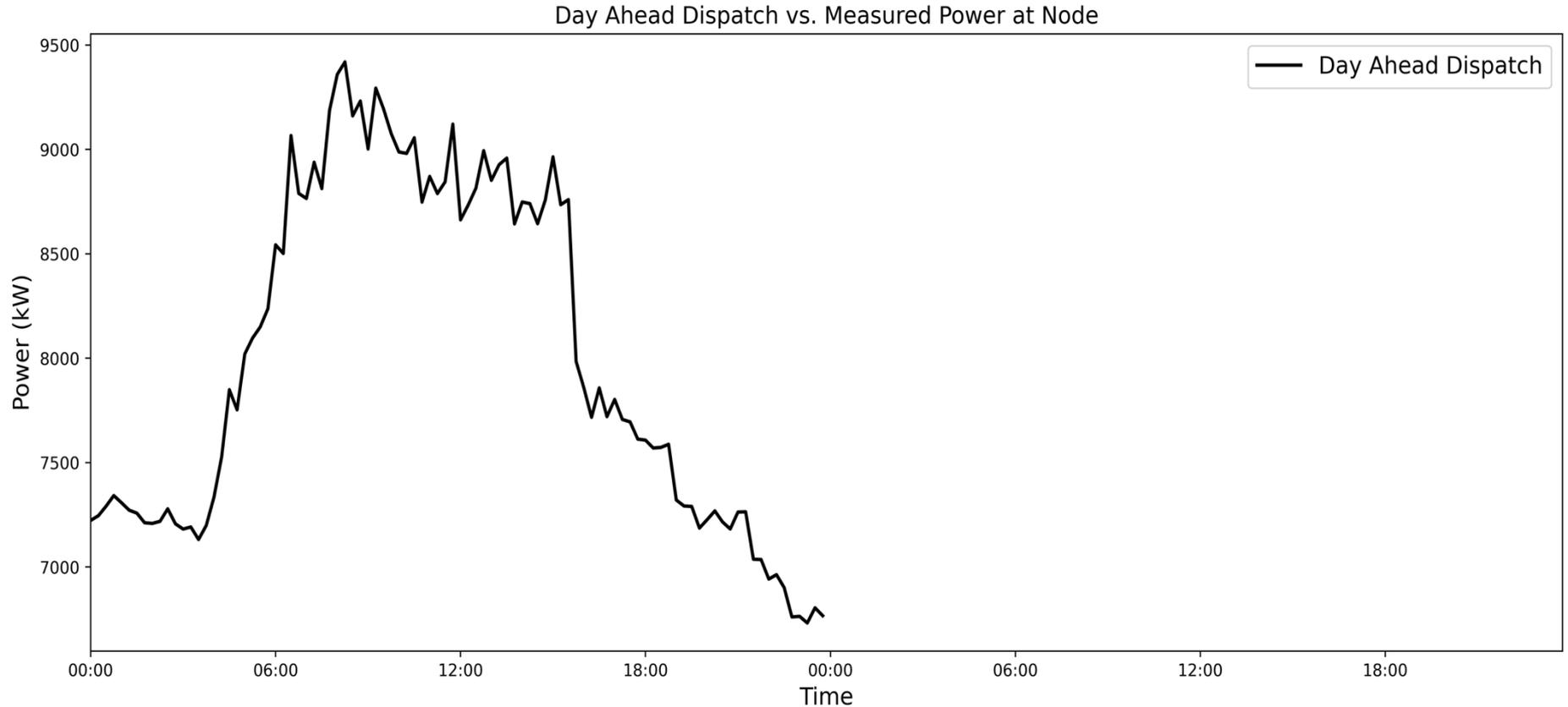
Pioneering sustainable research and education for Swiss universities

# Current Status and Market Access



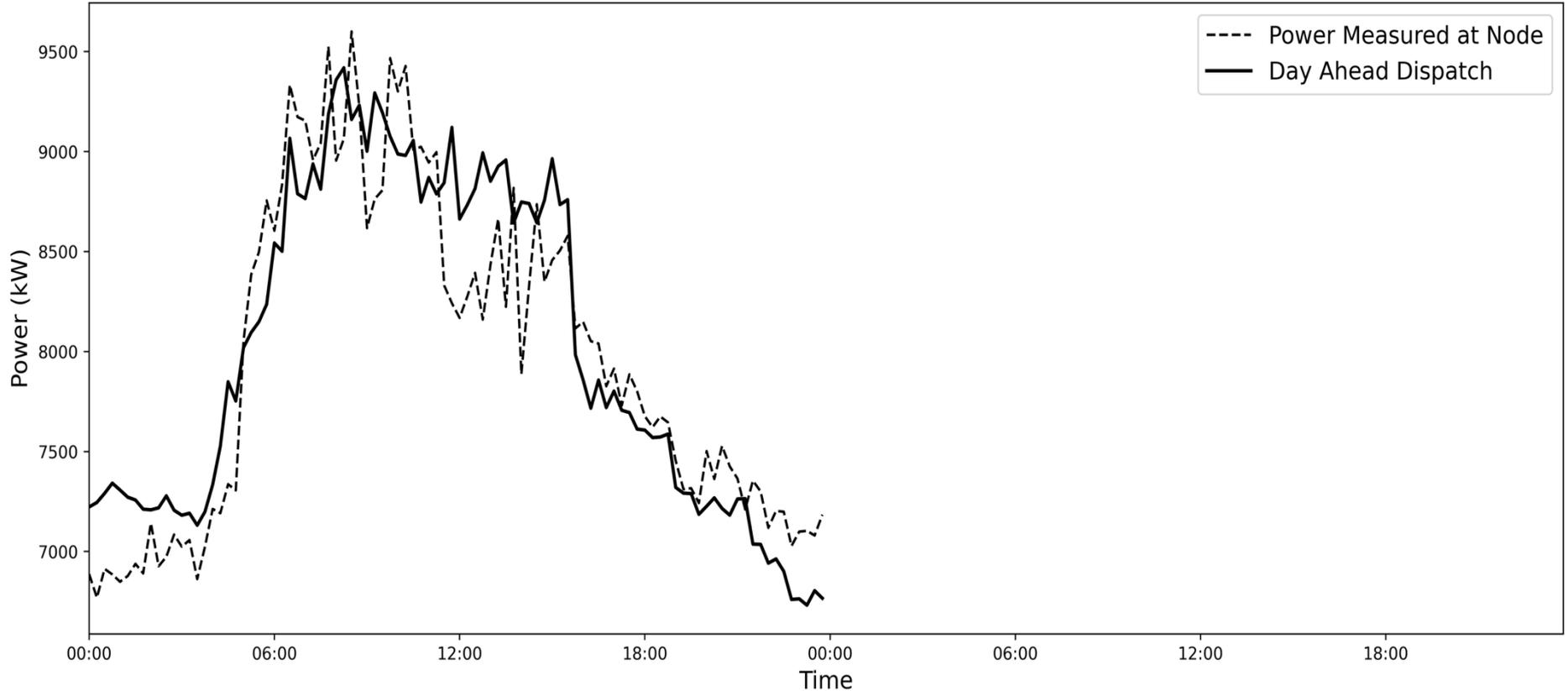


# Going on market : dispatch Concept



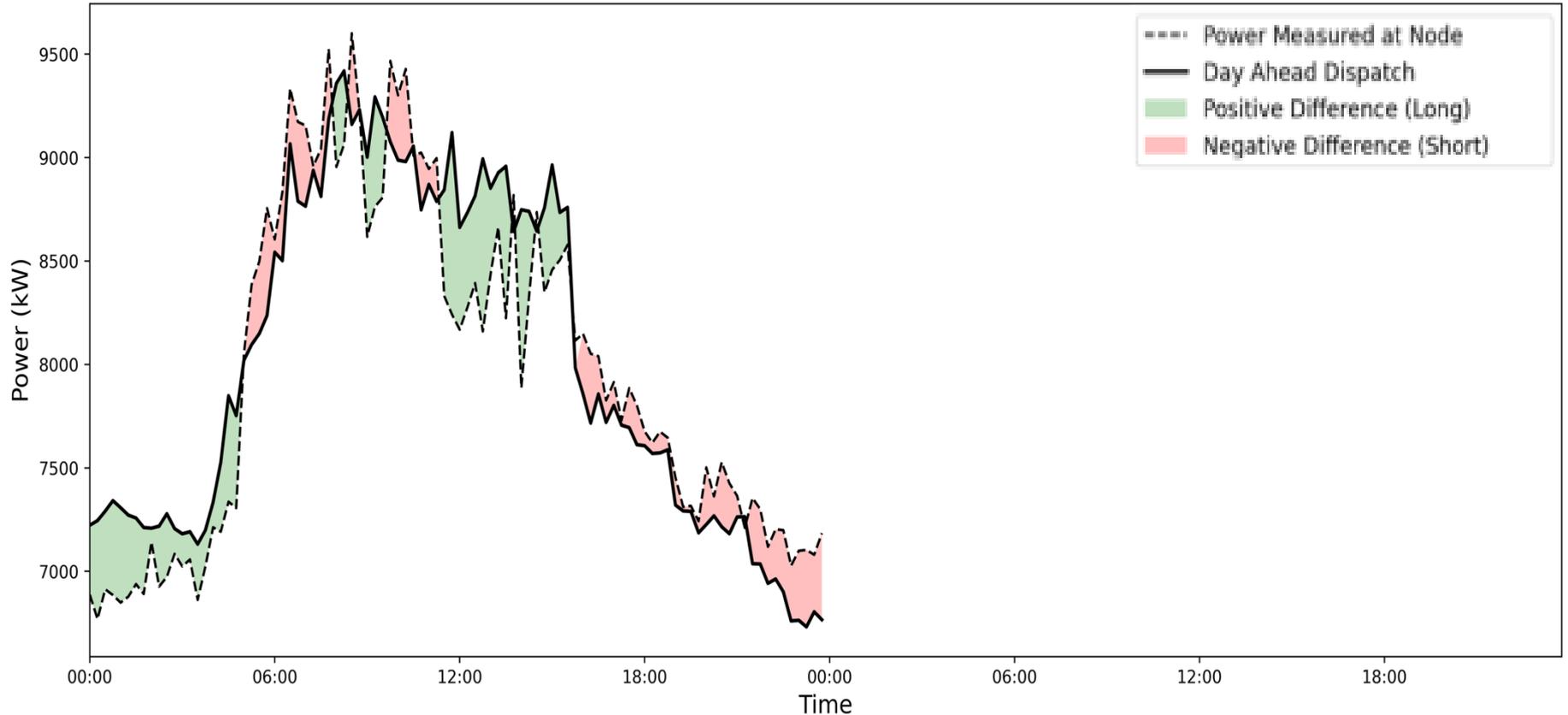
# Going on market : dispatch Concept

Day Ahead Dispatch vs. Measured Power at Node

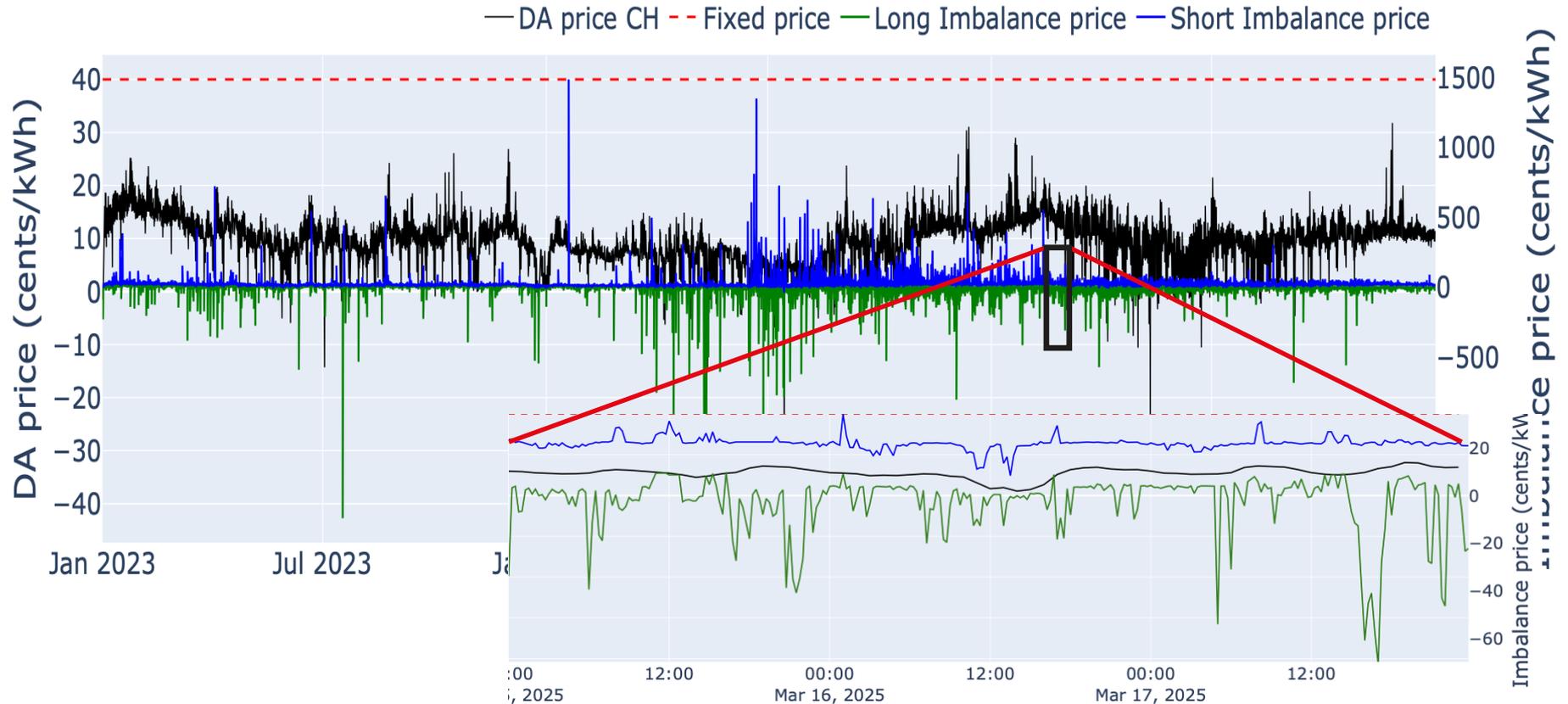


# Going on market : dispatch Concept

Day Ahead Dispatch vs. Measured Power at Node



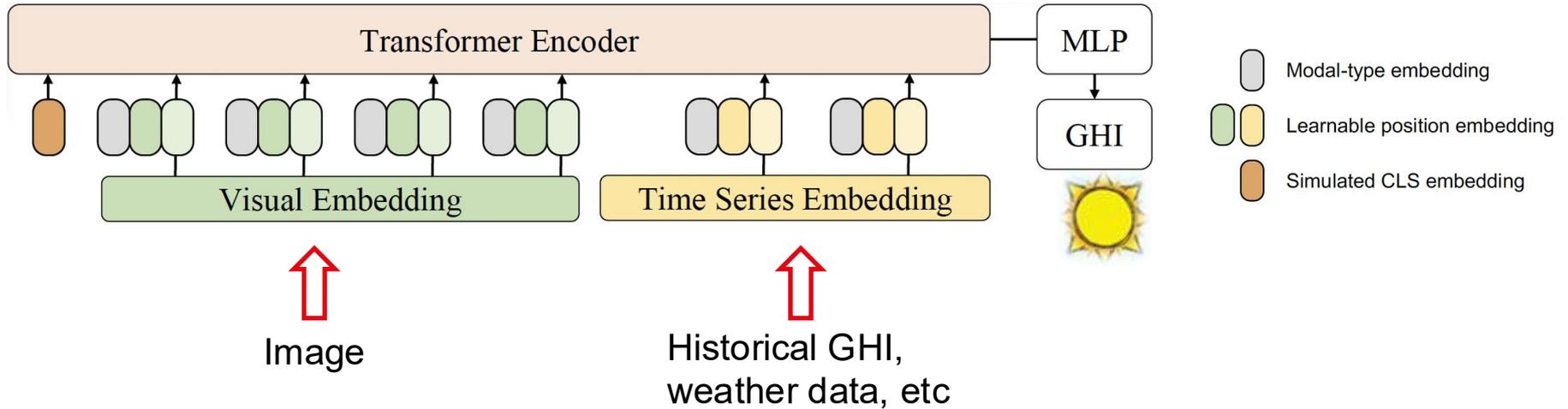
# Imbalance price



- **Forecasting Load and PV Generation**  
crucial, especially as PV penetration increases.
- **Electricity Storage:**
  - reduce imbalance costs
  - self consumption,



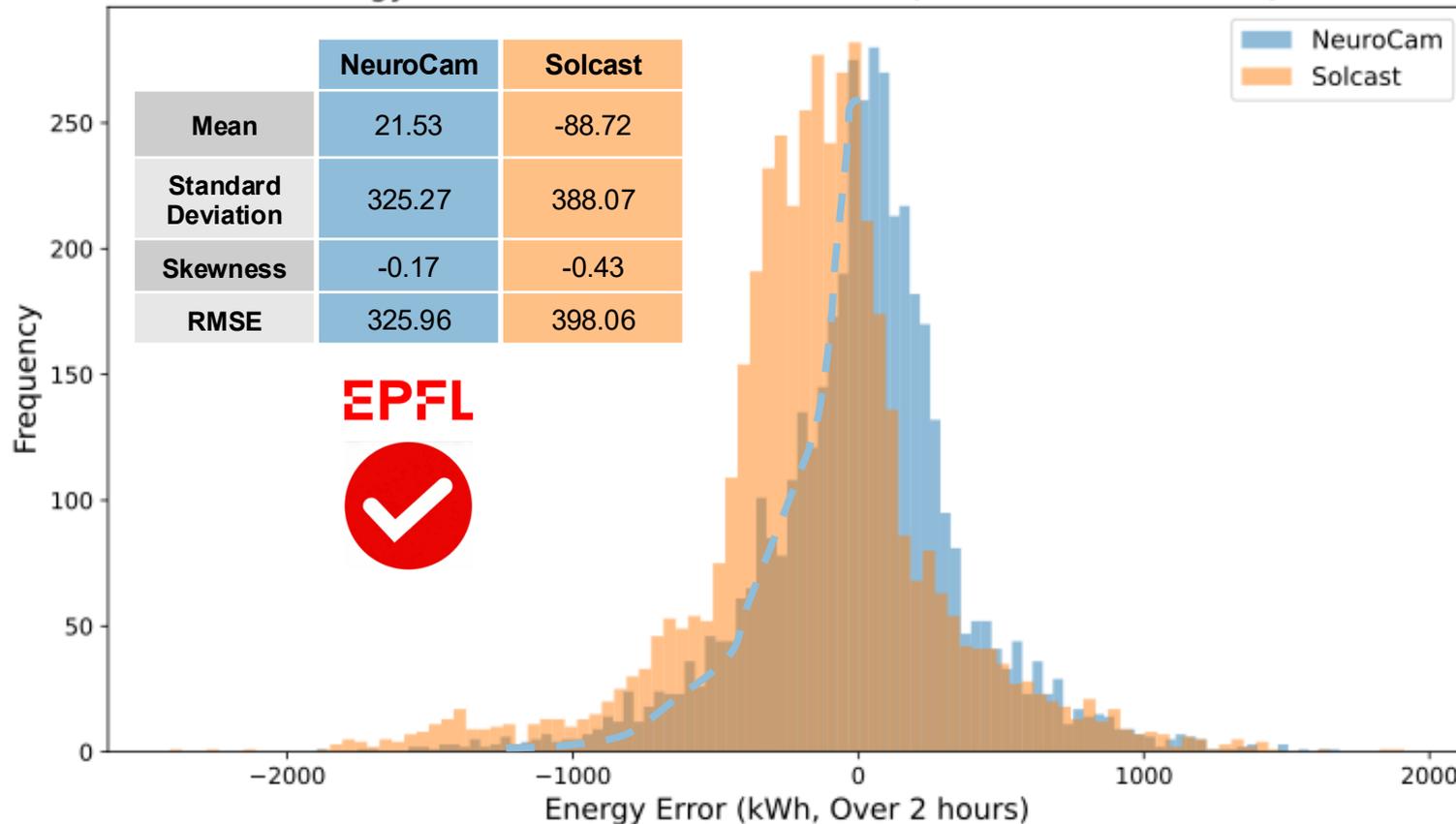
# NeuroCam: Solar Multimodal Transformer (SMT)



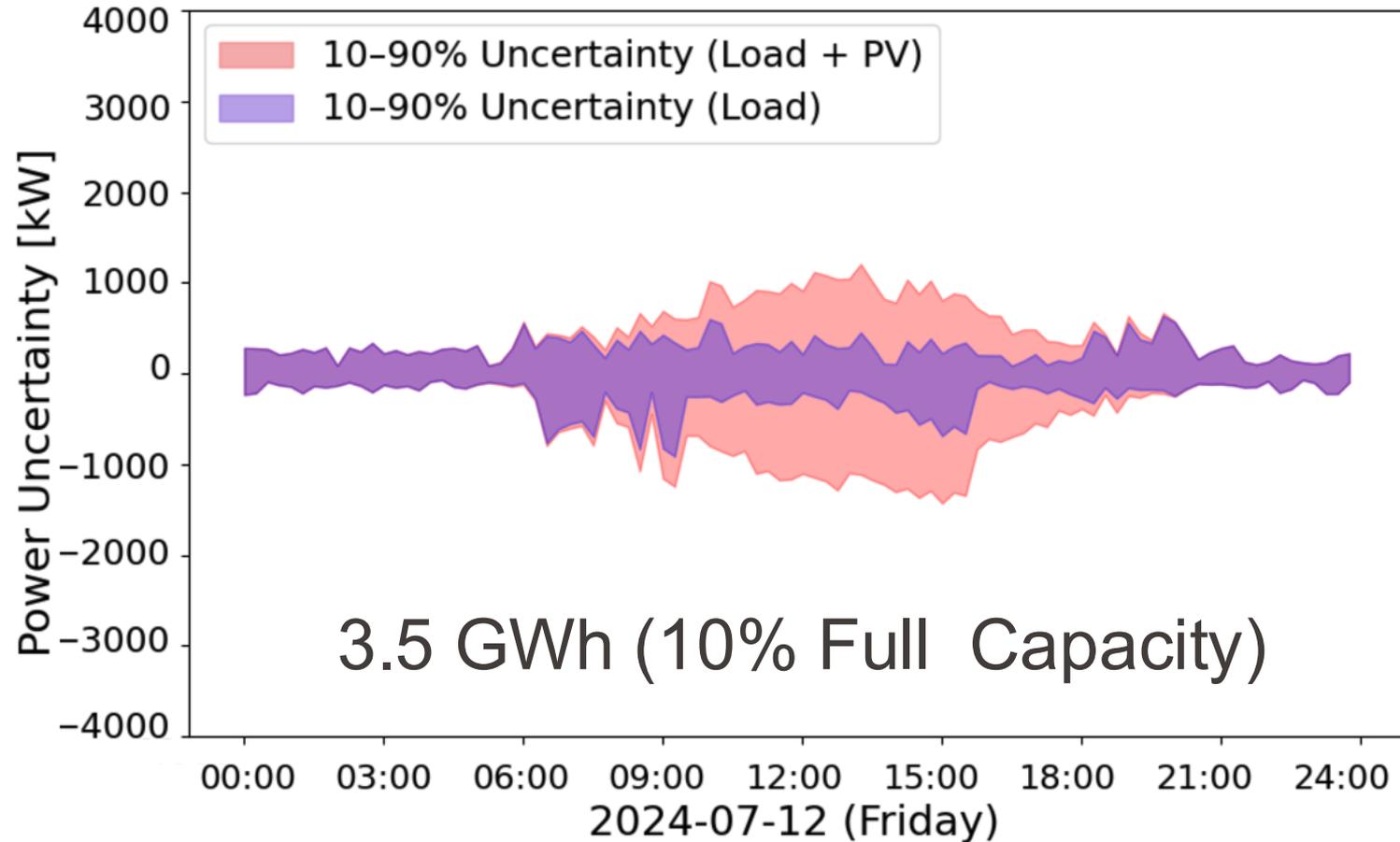
[1] Niu, Y., et al . **Solar Multimodal Transformer: Intraday Solar Irradiance Predictor using Public Cameras and Time Series.** 2025 IEEE/CVF, 2025

[2] Sarkis, et al . **Intraday solar irradiance forecasting using public cameras.** Solar Energy, 2024

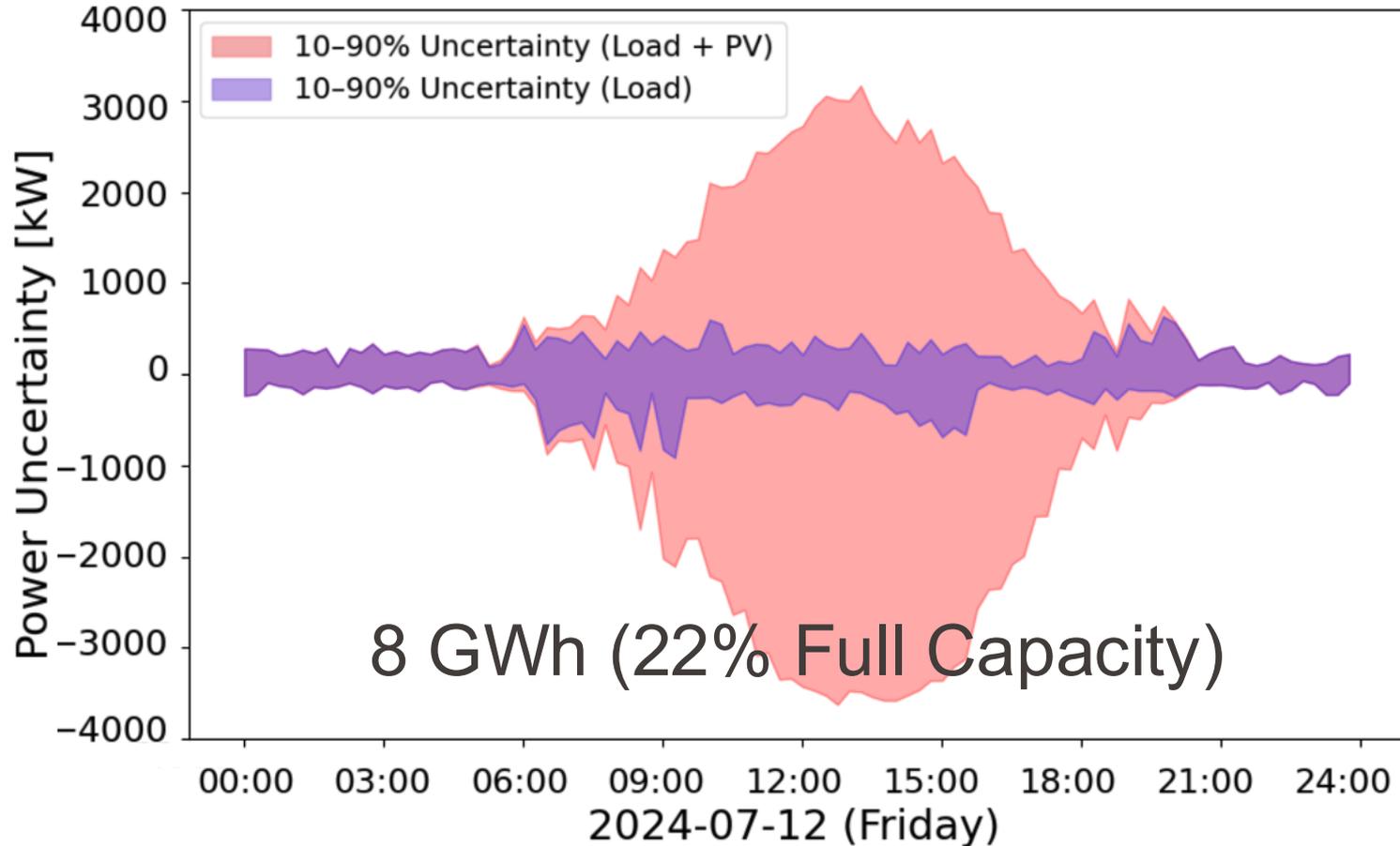
## Energy Prediction Errors Over 1 Year (Relative to Actual PV)



# Load versus PV forecast uncertainty



# Load versus PV forecast uncertainty



## EPFL campus simulation: 1 full year (Nov 2024 – Nov2025)

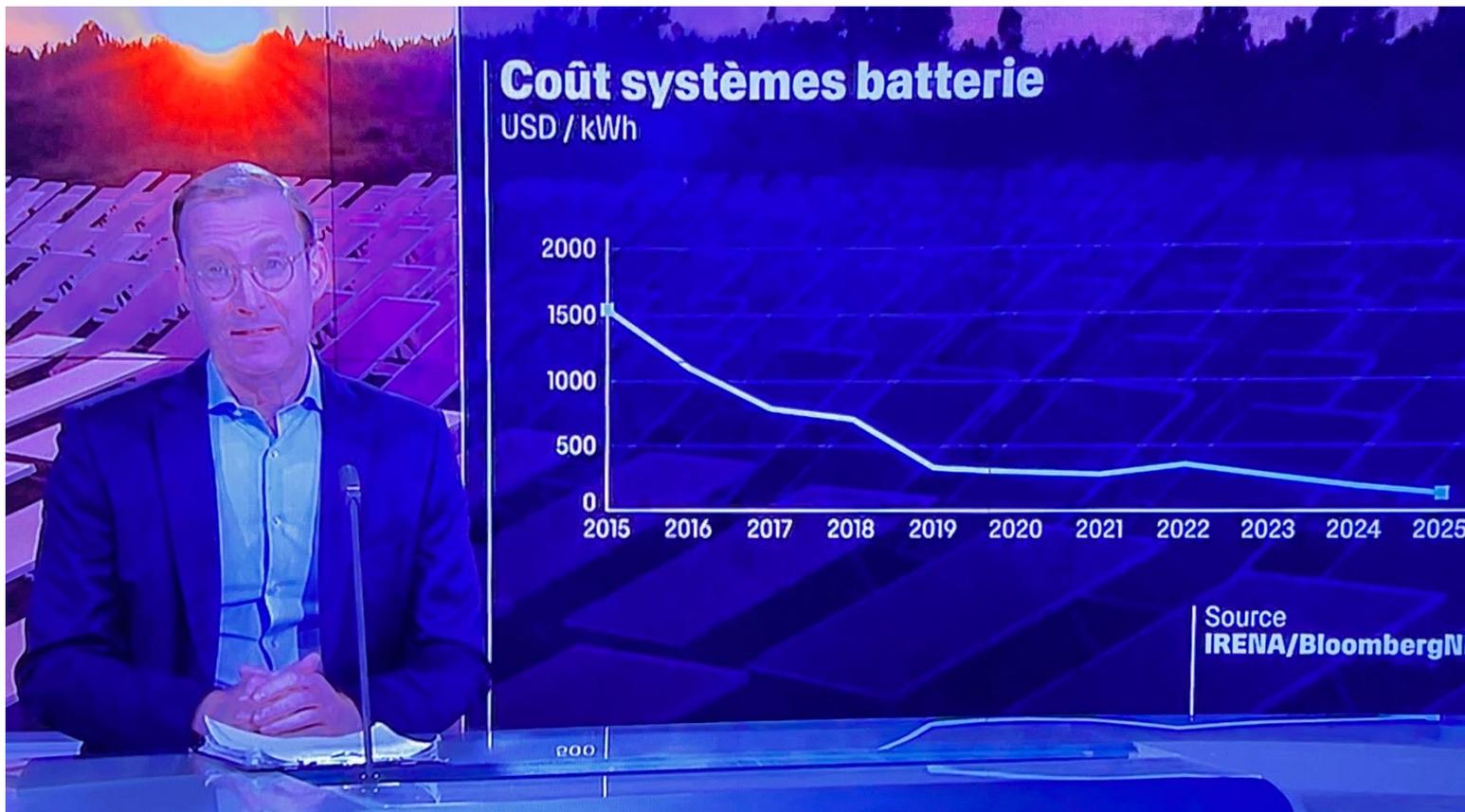
- Full campus load profile is considered
- PV installations (**35 GWh**)
- Battery energy storage system (**30 MWh, 15 MW**)
- Real historical market prices are used
- **Using forecasted imbalance prices**

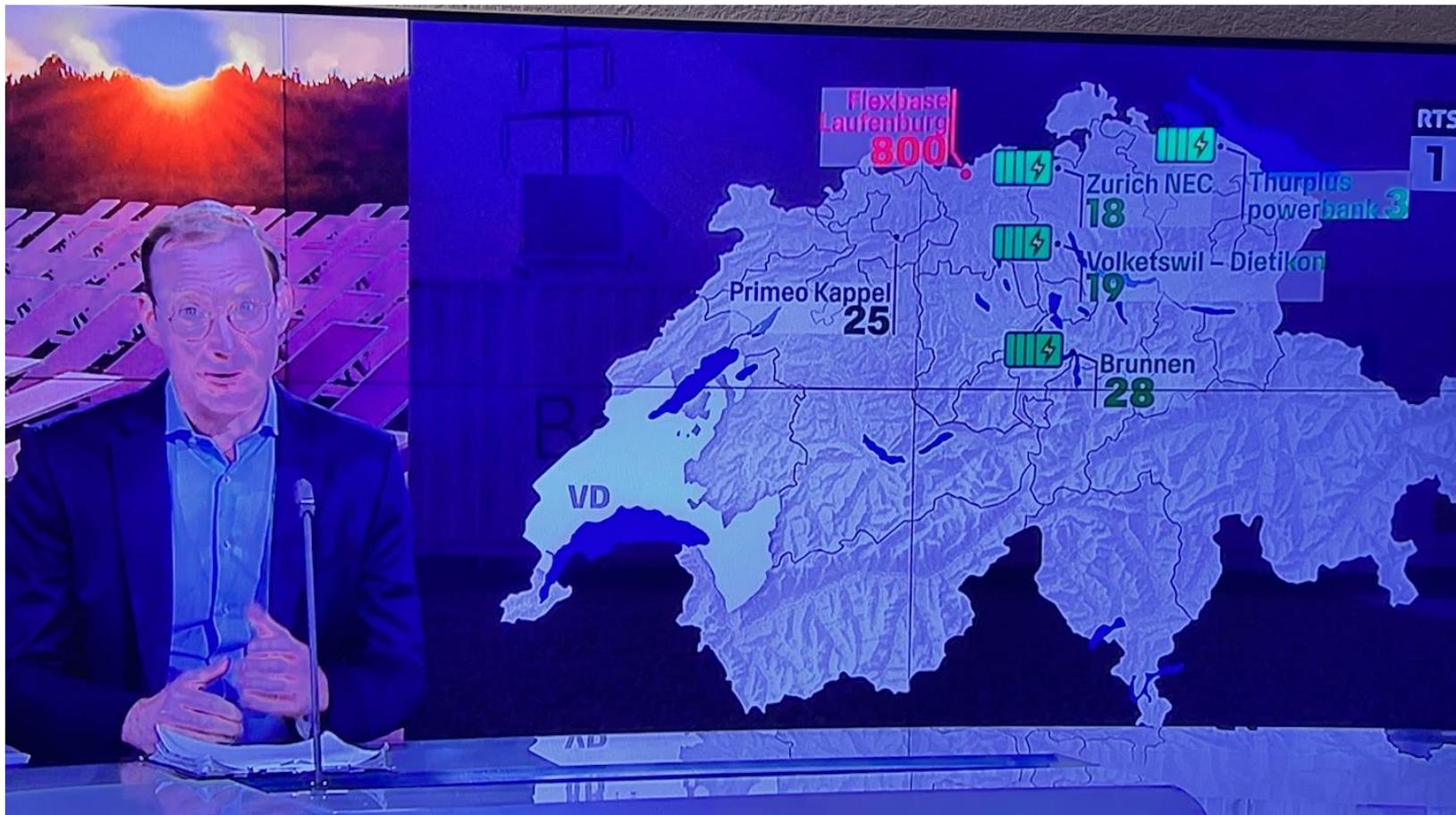
$$\text{Min} \sum_j^N \text{Price}_{imb,j} (P_j^{\text{forecast}} - P_j^{\text{real}})$$

# Simulation – Results (1 Year of Data)

Scenario	Imbalance Cost (Euro)	Cost of Energy (Euro)	Battery Cost (Euro)	PV Cost (Euro)	Total Cost (Euro)
<b>Batteries + Solcast</b>	0.568 M	3.71 M	1.054 M	0.983 M	<b>6.317 M</b>
<b>Batteries + NeuroCam</b>	0.566 M		1.054 M	0.983 M	<b>6.306 M</b>
<b>Fixed price @ 0.3 €/kWh</b>		21.121 M			<b>21.121 M</b>
<b>Fixed price @ 0.4 €/kWh</b>		28.161M			<b>28.161M</b>

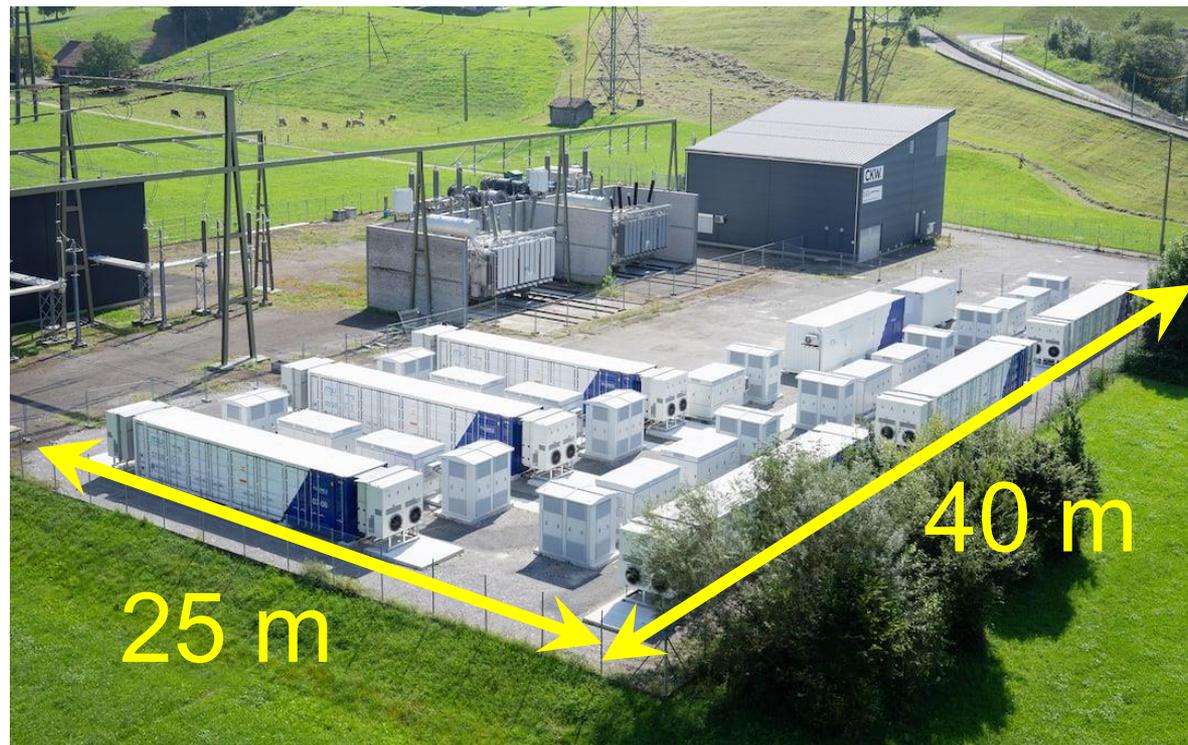
Breakeven price ~ 0.077 €/kWh



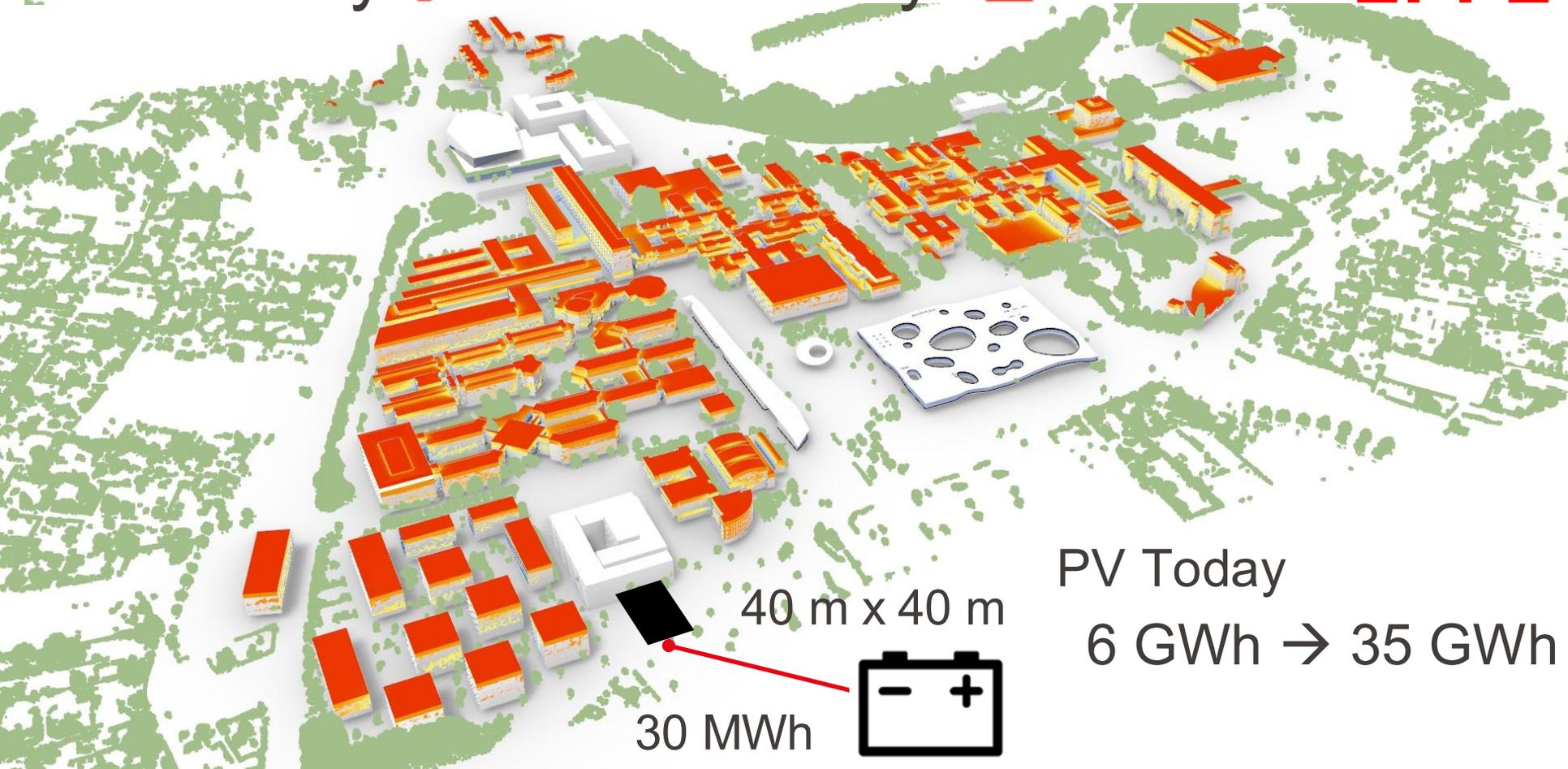


18 MWh  
Li Ion battery  
20 MW

Brunnen



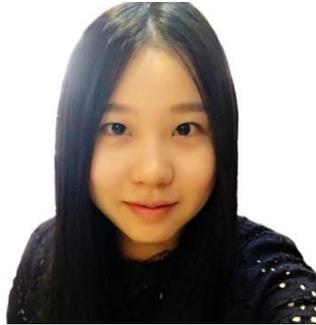
# E Lectricity P owered F ully L ocal EPFL



# Solutions for Sustainability Initiative (S4S)



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