PLAN.
INNOVATE.
ENGAGE.

ETIP SNET
EUROPEAN TECHNOLOGY AND INNOVATION PLATFORM
SMART NETWORKS FOR ENERGY TRANSITION

Reliable, economic and efficient smart grid system

INFORPV

Short presentation of the project

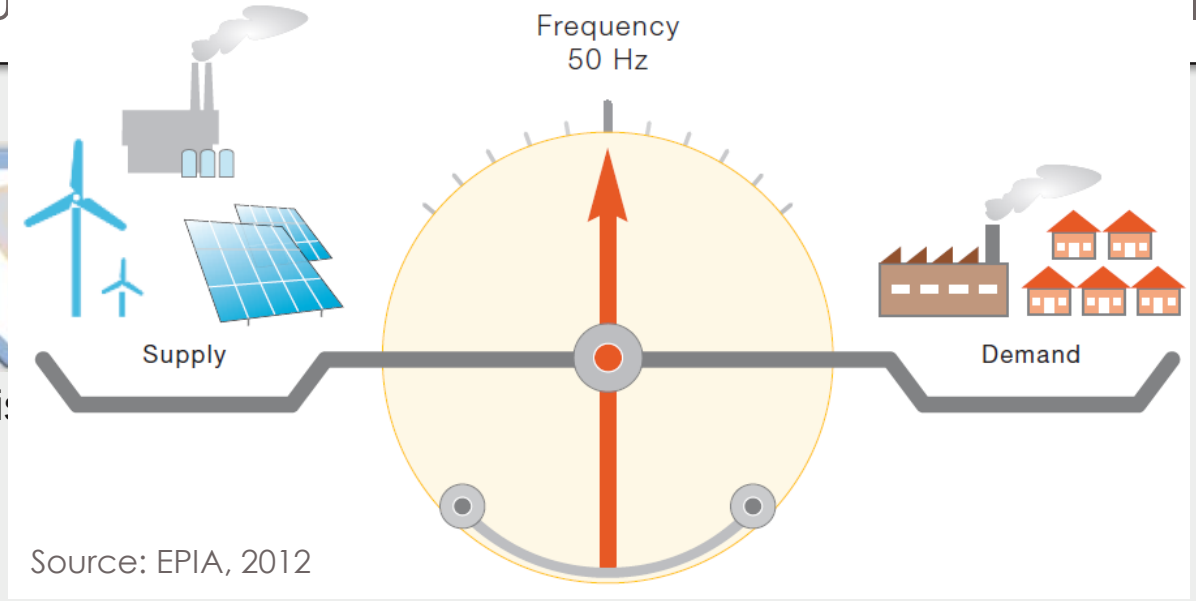
- **I**nnovative **For**ecasting **PV** Energy Yield Solution for Sustainable Large Scale Deployment (**INFORPV**) (Project Budget: €400,000)

Project Challenge

Project Solution

Supply-side Variability and Uncertainty (high solar photovoltaic shares - grid) poses stability problems to grid operators (need to schedule and keep balance)

(solution to convert forecasts into operational intelligence)



Source: EPIA, 2012

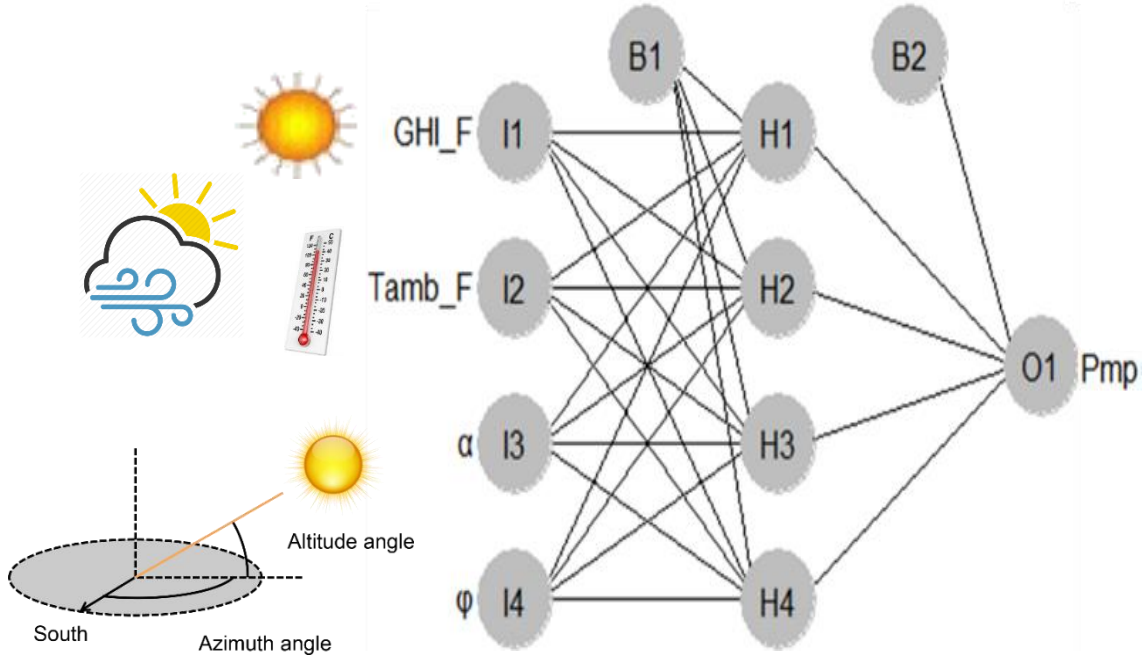
M.G. Lightning Ltd

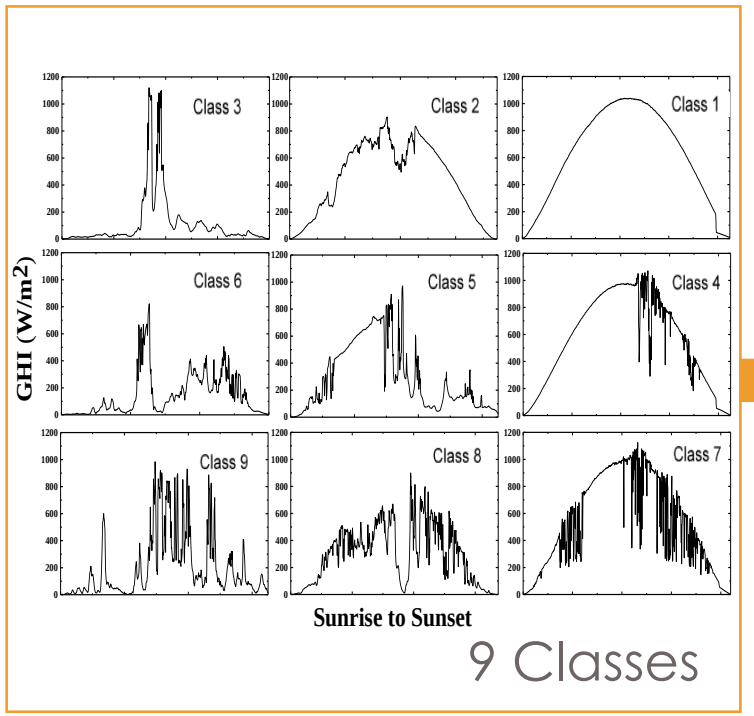
Decis

CYPRUS DEPARTMENT OF METEOROLOGY

Key exploitable results addressing energy system integration

Result 1 – Development of an optimal sensor-less day-ahead PV power production forecasting algorithm (machine learning and decision entity)





9 Classes

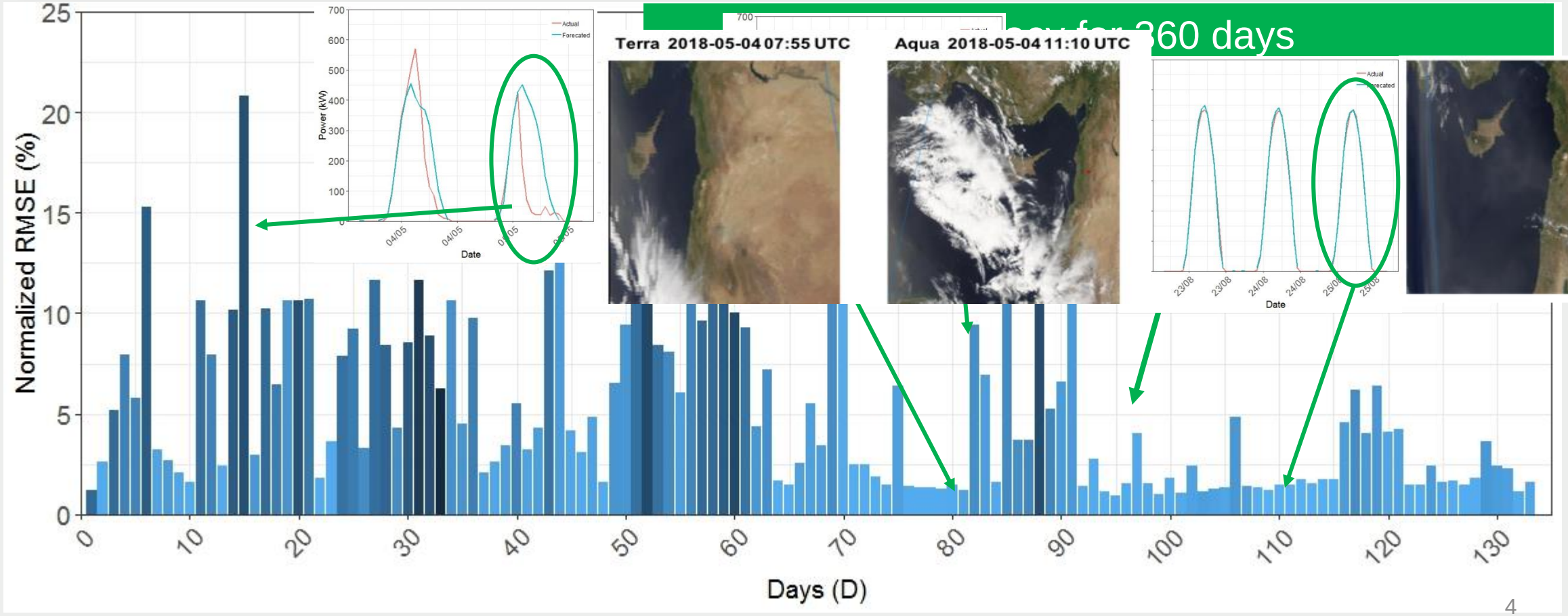
Output

Irradiance daily profiles
(Forecasted Irradiance)

Decision Unit
(Linear Correction Factors)

Key exploitable results addressing energy system integration

Result 2 - ~5% root mean square error (RMSE) relative to the nameplate power (5 single plants)



Key exploitable results addressing energy system integration

Result 3: Advanced Hour-ahead forecasting algorithm - fully data-driven with minimum input features (~3% nRMSE for hour-ahead forecasting)

Quantifiable benefits (financial benefit, decrease of CO2 emissions):

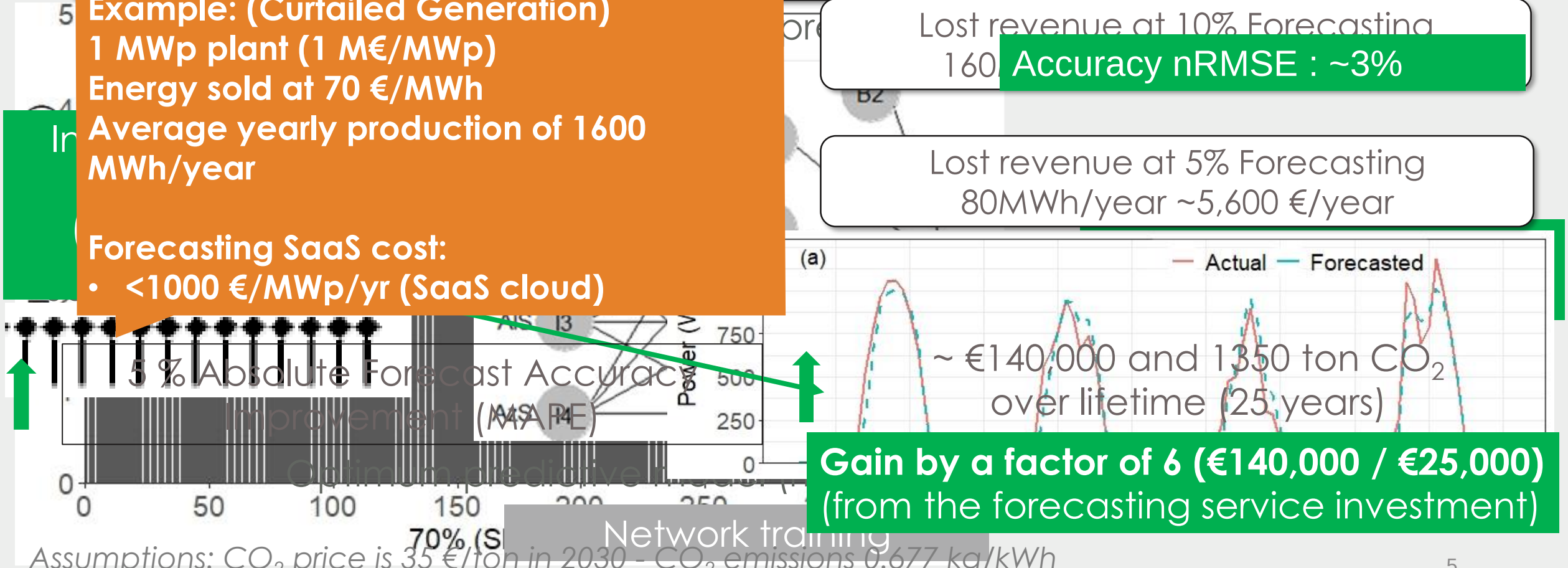
Example: (Curtailed Generation)
1 MWp plant (1 M€/MWp)
Energy sold at 70 €/MWh
Average yearly production of 1600 MWh/year

Forecasting SaaS cost:
- **<1000 €/MWp/yr (SaaS cloud)**

Lost revenue at 10% Forecasting 160

Accuracy nRMSE : ~3%

Lost revenue at 5% Forecasting 80MWh/year ~5,600 €/year



5 % Absolute Forecast Accuracy Improvement (MAPE)

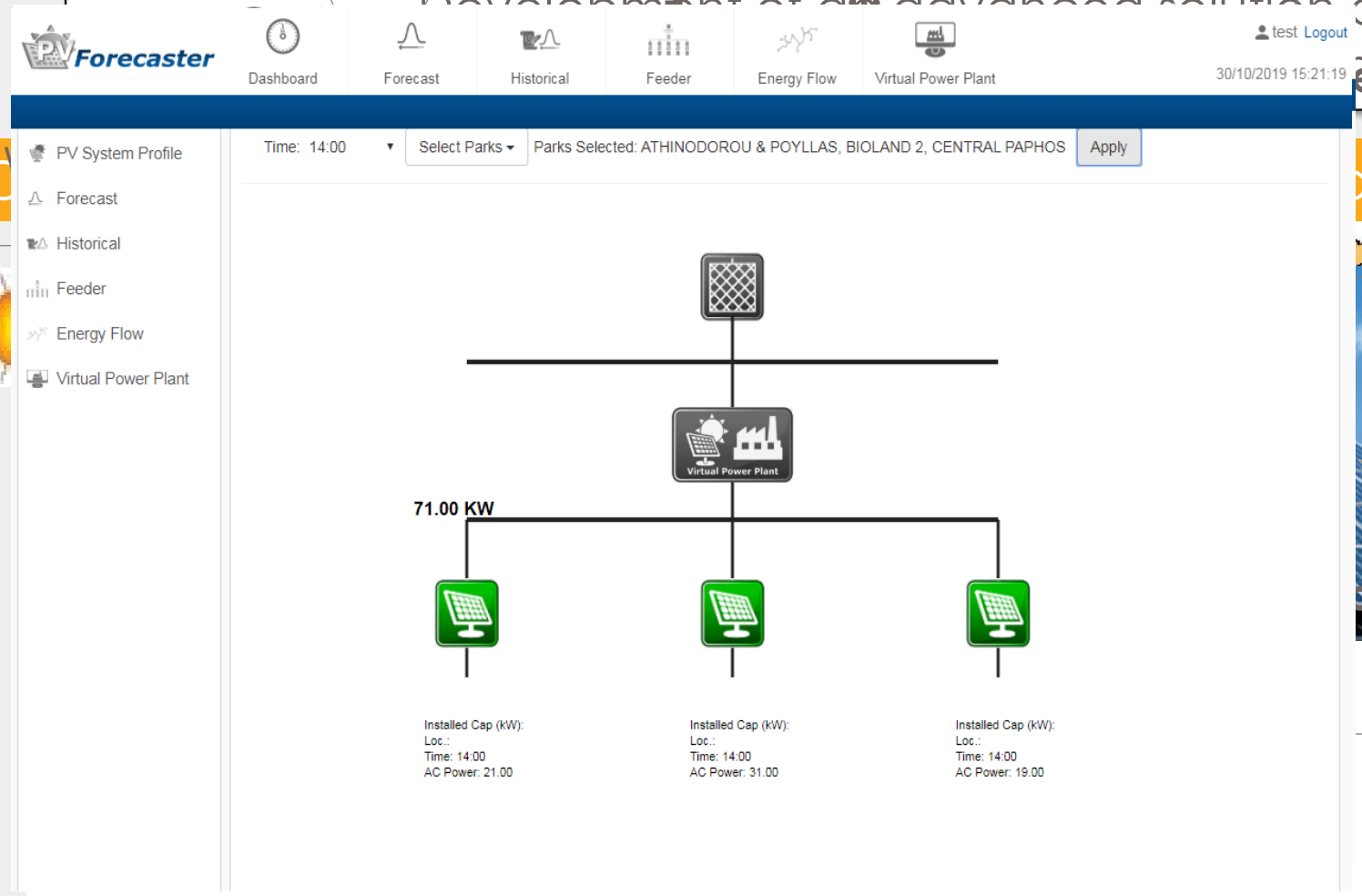
~ €140,000 and 1350 ton CO_2 over lifetime (25 years)

Gain by a factor of 6 (€140,000 / €25,000)
(from the forecasting service investment)

Network training

Assumptions: CO_2 price is 35 €/ton in 2030 - CO_2 emissions 0.677 kg/kWh

Deployment prospects
DSO Forecasting Active Grid Tool



Development of an advanced solution of accurate point

Upscaling

egionalised aggregation

Upscaled aggregated

f-top systems (absence of AMI)

Actual Estimates
Aggregated Power

provides forecasts to:

Day-Ahead Forecasted
Aggregated Power

Lessons learned and barriers to innovation deployment

Lessons learned:

- **Sensor-less** PV power production forecasting method **day-ahead ~5% (train with forecasts)**
- **Hour-ahead** PV power production forecasting model accuracy is **~3% (slide 70% of yearly data)**

Barriers:

- **Quality of data** for training data-driven models and the **deployment of smart meters**.
- **Lack of forecasting standards** causes interoperability problems (vendor dependent)

Further testing:

- Data requirement for roof-top **aggregated sites verification**
- Improve accuracy by including a **irradiance ramping rate parameter as input feature**
- **Automatically select operational control scheme** by operating **optimal power flows**

Thank You For Your Attention

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