

Short Term Forecasting for Combined Wind and Solar Electricity trading 2nd Dii DESERT ENERGY CONFERENCE Cairo 2011

Helmut Klug Regional Manager CEMEA GL Garrad Hassan



GL is a global service provider in the maritime and energy markets

Maritime

- Classification of 6800 ships in service
- Plan approval and new build supervision of 500 ships p.a.
- Maritime Systems & Components
- Maritime Solutions



Oil & Gas (GL Noble Denton)

- Technical Assurance
- Engineering Consulting
- Asset Performance & Maintenance
- Marine Operations & Consulting
- Project Execution
- Software Products

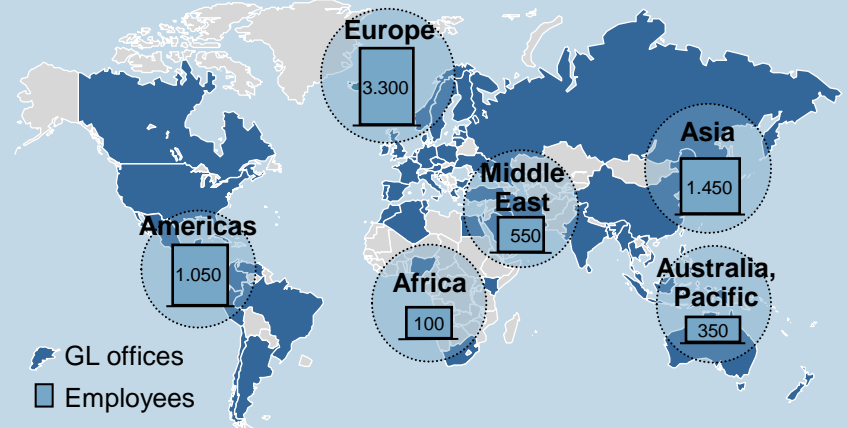


Renewables (GL Garrad Hassan)

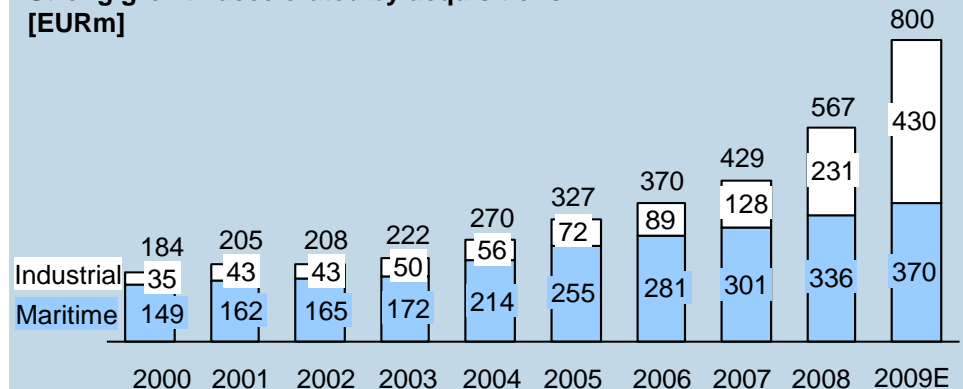
- Certification
- Engineering Consulting
- Marine Operations
- Measurements
- Software Products
- Training



6.800 Employees in 80 Countries



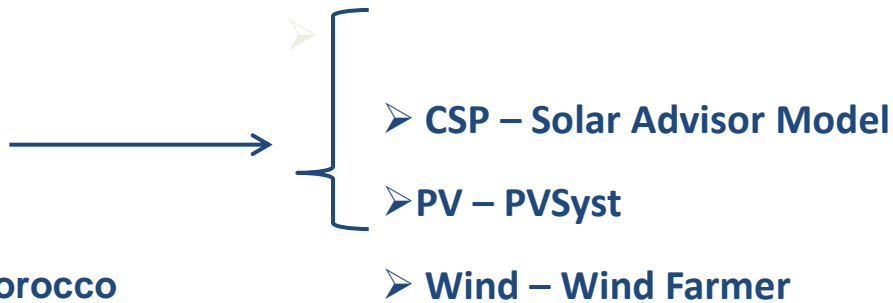
Strong growth accelerated by acquisitions [EURm]



Input data

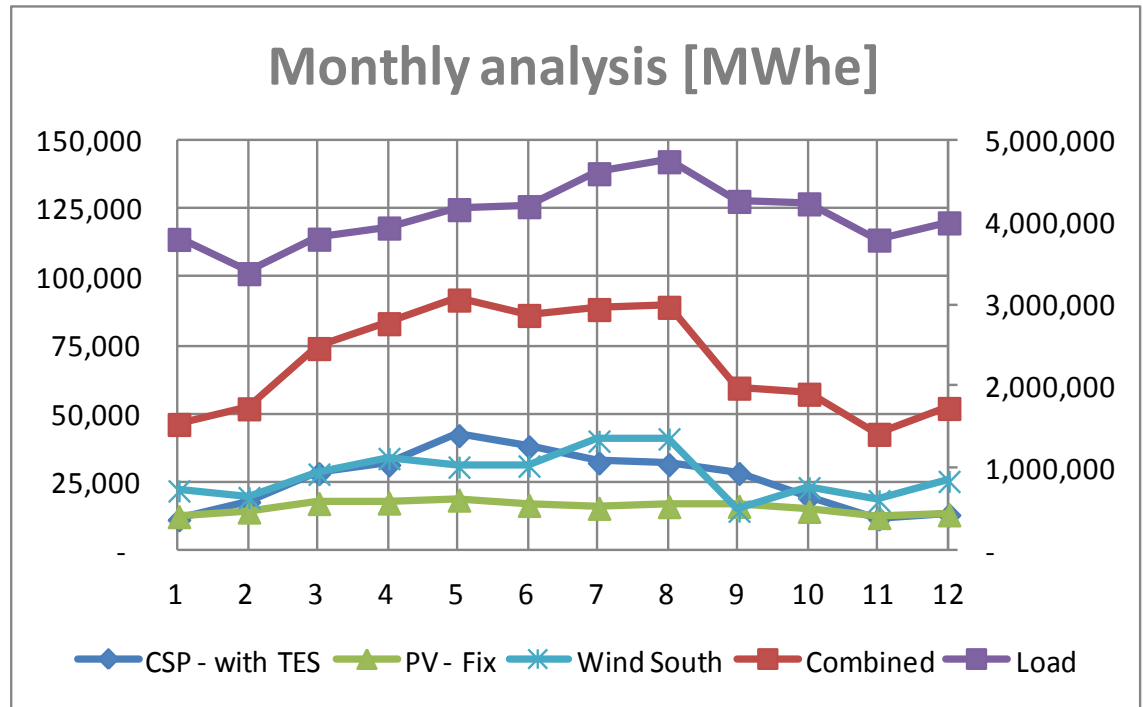
- **CSP Plant**
 - **Parabolic Trough Technology**
 - **100 MW**
 - **With Thermal Storage**
- **PV Plant**
 - **Ground Fix Installation**
 - **100 MW**
- **Wind Farm**
 - **2 MW Wind Turbines**
 - **100 MW**
- **Simulation tools**

Sites: South Region of Morocco



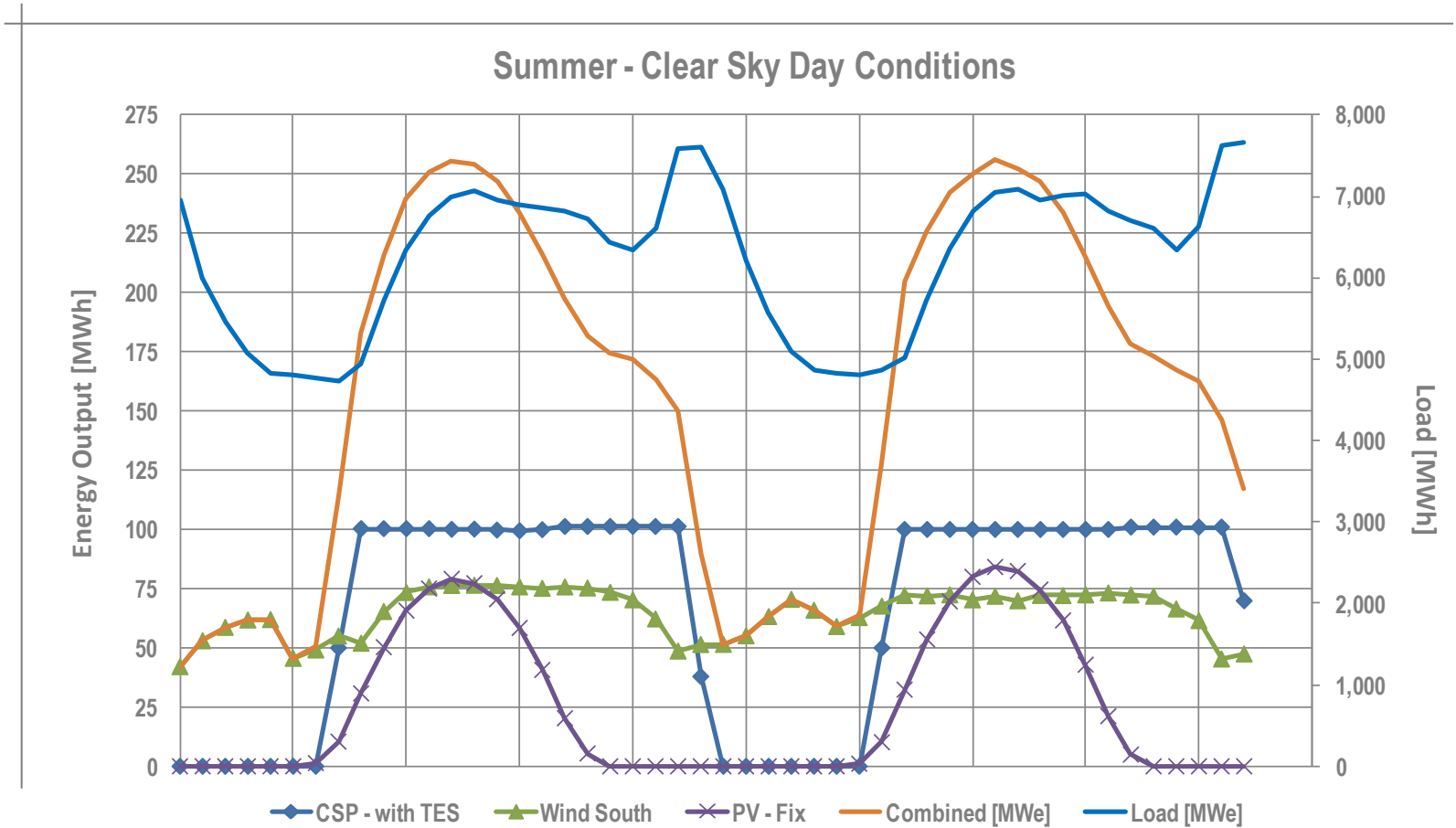
➤ **Electrical load Morocco**

Monthly Analysis



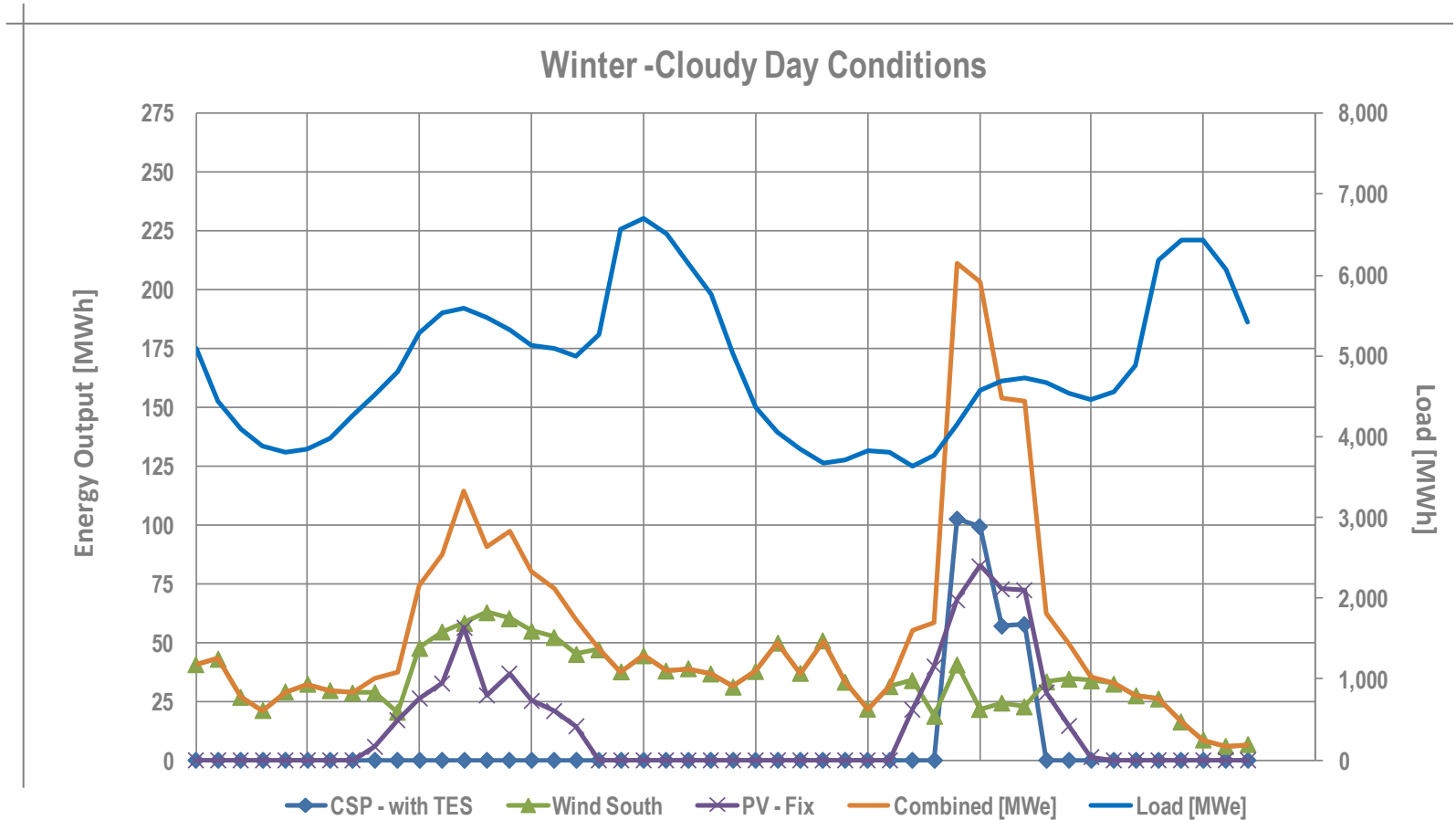
48 hrs Simulation and comparison with electrical load data from Morocco

- Summer - Clear Sky Conditions

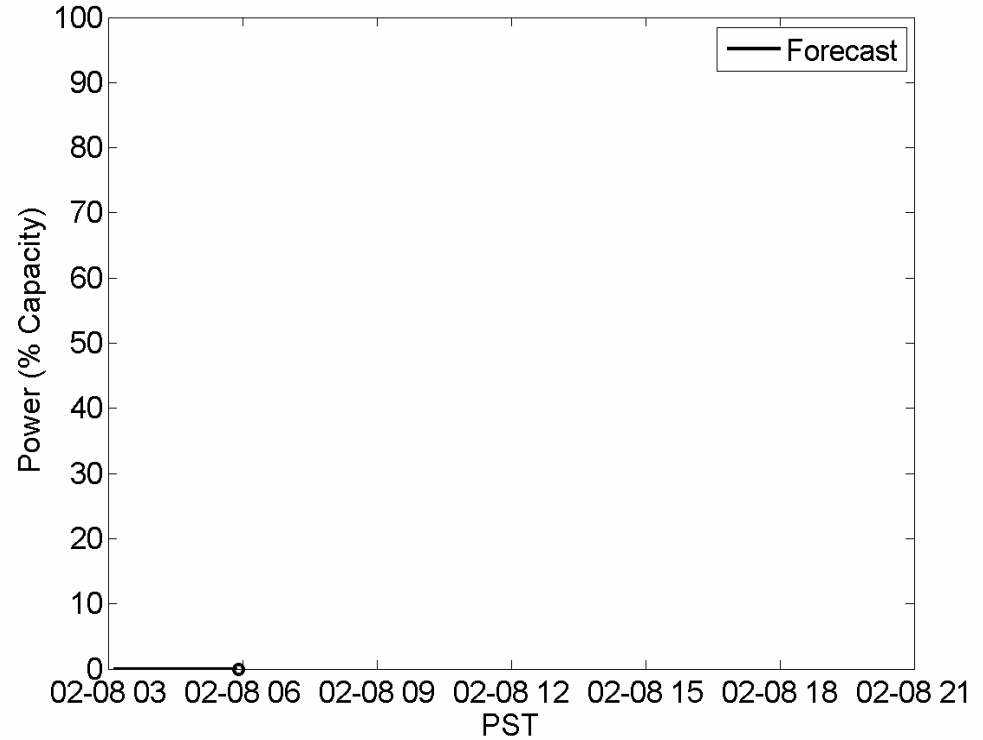
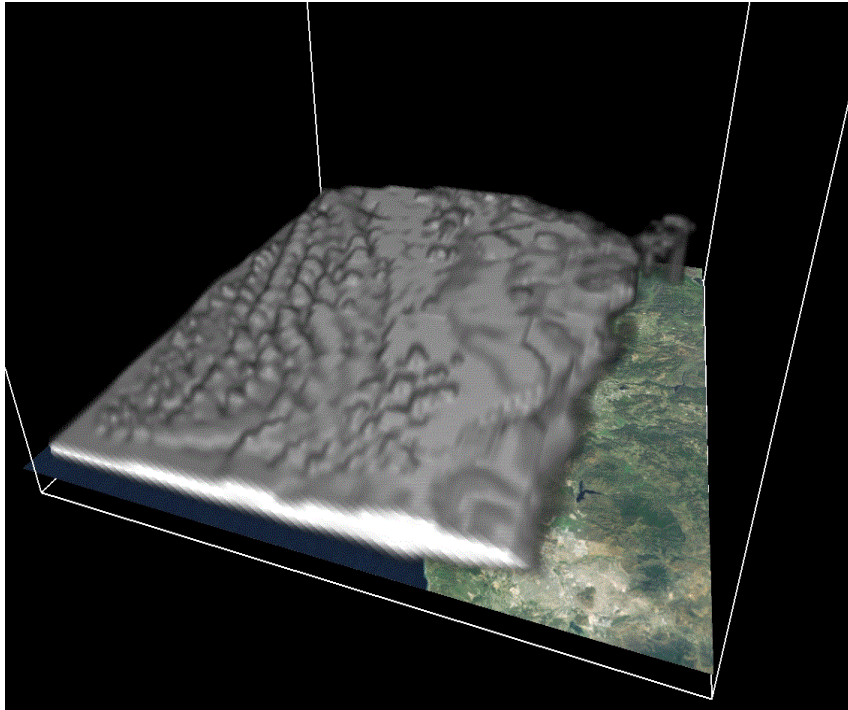


48 hrs Simulation and comparison with electrical load date from Morocco

- Winter - Cloudy Day Conditions



Numerical Weather Prediction (NWP) provides accurate solar energy forecasts

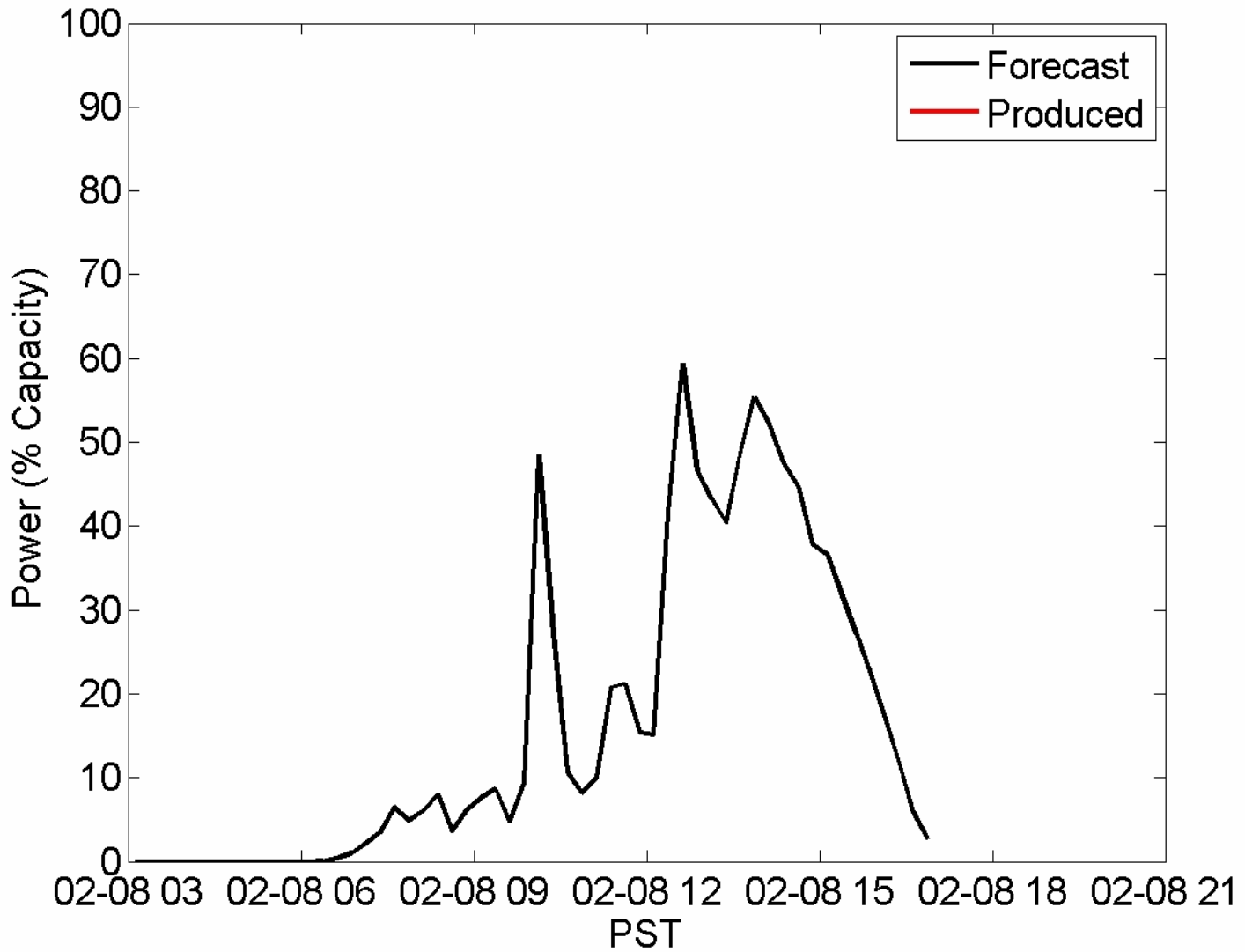


Cloud Forecast



Day-Ahead Energy Forecast

Solar Power Forecast – Comparison with Production

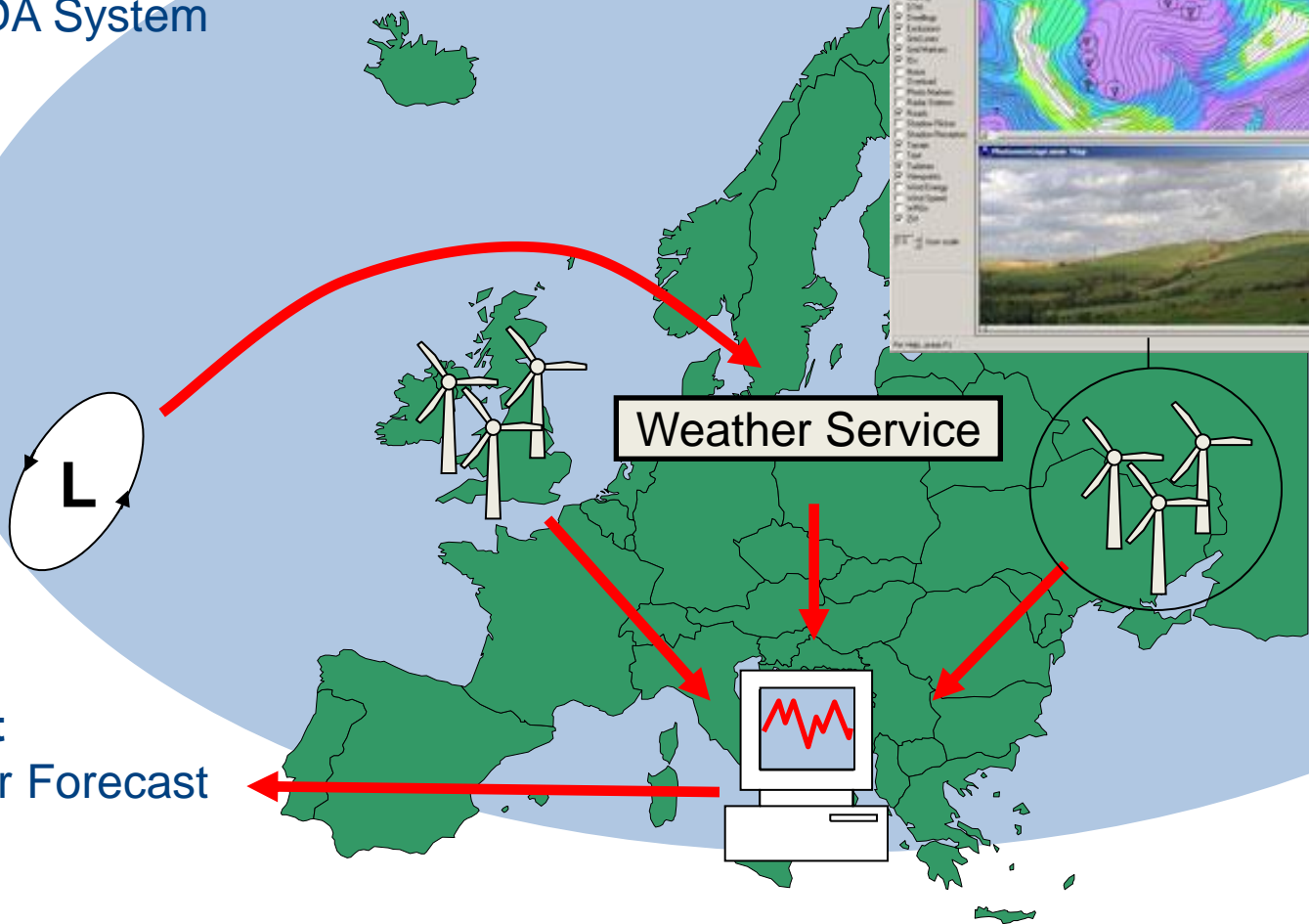
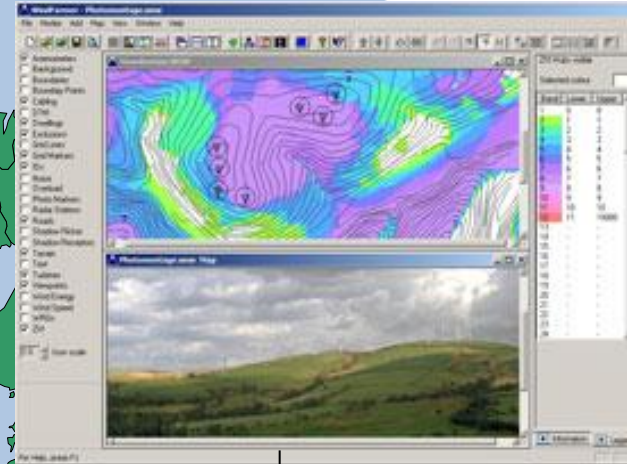


Overview of Forecasting Method

Inputs

- Numerical Weather Prediction (NWP)
- Site Topography
- SCADA System

GH WindFarmer

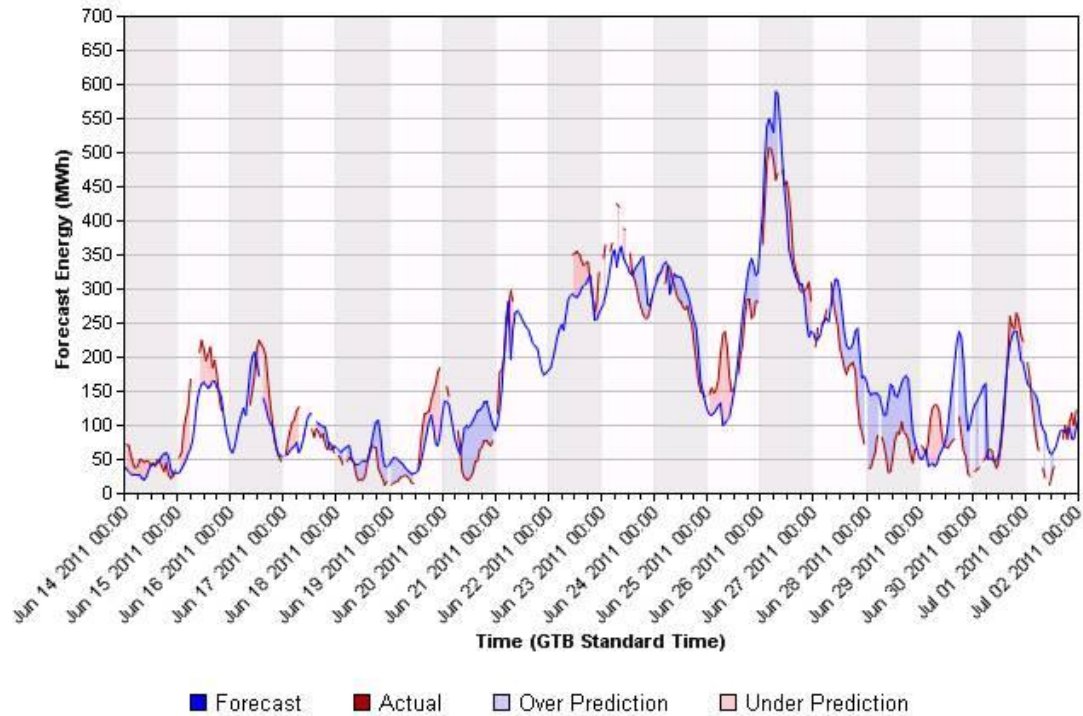


Output

- Power Forecast

Forecasting experience in Greece

Day-Ahead Energy Forecast for Hellenic Transmission System Operator

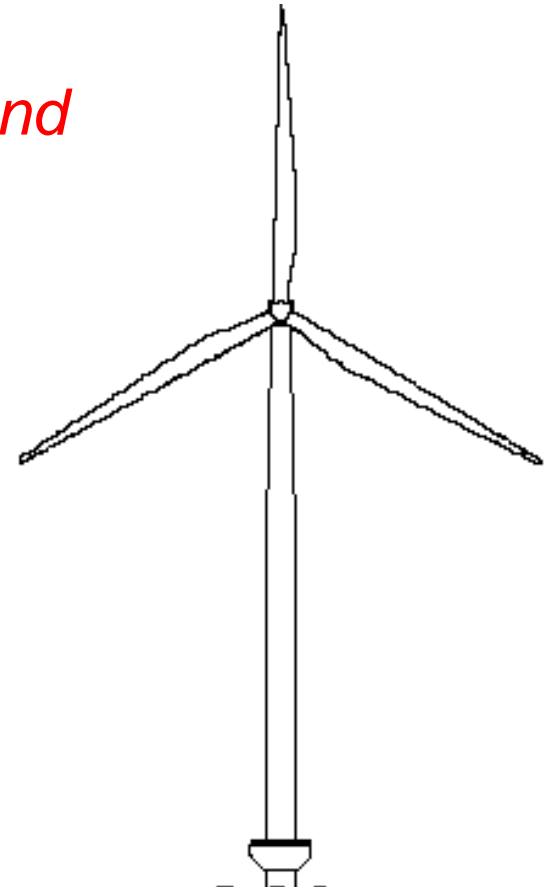
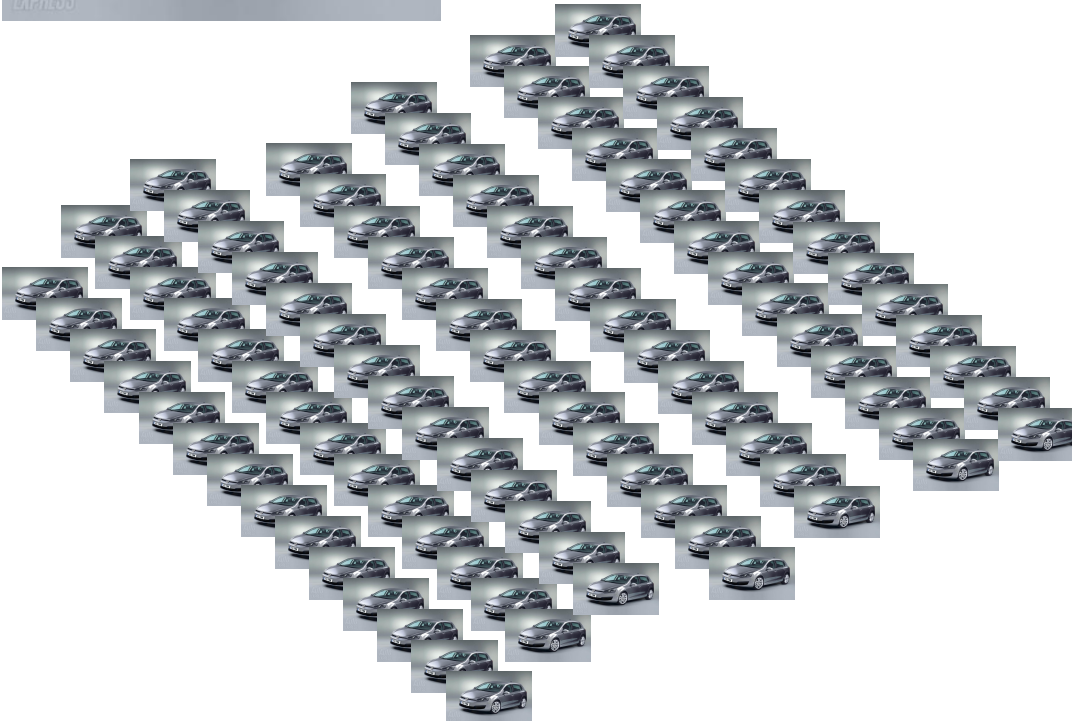


Wind Energy is fluctuating BUT predictable!

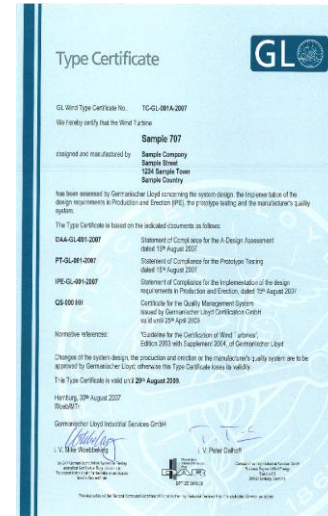
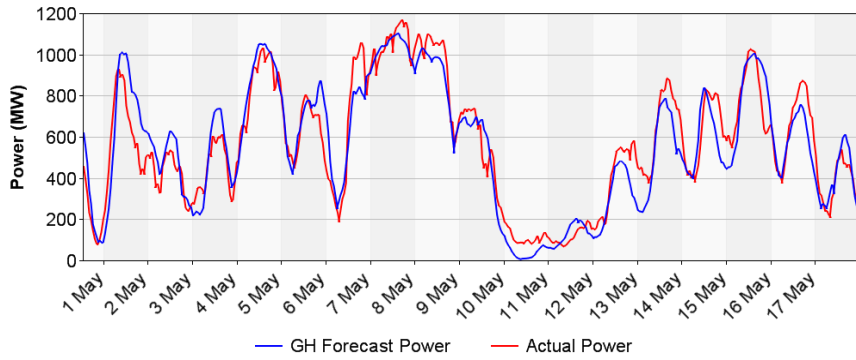
Mass of the air passing the rotor per sec?



100 Golfs per second



110m rotor



Thank You!
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