Energy Forecasting Customers:
Analysing end users’ requirements
Dec 3rd, 2013

Carlos Alberto Castaño, PhD
Head of R&D
carlos.castano@gnarum.com
I. Who we are
II. Customers’ Profiles
III. Improving forecasts for trading
IV. Conclusions
I.

Who we are
• The name **GNARUM** is derived from the Latin word *gnarum* which means “I knew it”.

• **GNARUM** was born out of Gnera Group’s desire to satisfy the IT demands of renewable energy companies operating in the electricity market.

• **GNARUM** is committed to exceptional customer service.

• **GNARUM’s** foundation is formed through Gnera Group’s vast experience. All the knowledge and know-how possessed by Gnera Group has been used and expanded upon for every project developed by **GNARUM**.
I. Who we are

- **Experienced** with multiple renewable technologies
- **Solid know-how** backed by 10 years of experience operating in electricity markets with a high concentration of renewable technologies.
- More than **400 plants** and **1,200 MW** currently managed
- More than **2.5 TWh** forecasted energy in 2012
- **24x7x365** Monitoring Center
II. Customers’ Profiles
**Forecasting Horizon Time Scales:**

- **Nowcasting**
  - Seconds to minutes ahead

- **Short-term prediction**
  - Up to 96-120 hours ahead

- **Medium-long term prediction**
  - Several days ahead up to 2 weeks

**Forecasting Time Resolution:**

- 5 min, 15 min, hourly, daily, monthly
Resource/Generation Analysis Customers:

- Required for **decision making**
- Long-term simulation
- Monthly/Yearly averages
- On-site Data availability: poor
- Predictability higher
- Statistical characterization
- Error tolerance higher
- High computation time consuming

Applications

- Wind farm siting
- Bilateral contracts evaluation
**O&M Customers:**

- **Short-term operation**
- Accuracy is important
- Up to 6-10 hours ahead
- 5 to 10 min time resolution
- Real-Time data availability
- Computation time limited to minutes
- Update cycle: high
- Ramp events forecasts
Market Operations:

- Day-Ahead management
- Revenues and penalties depend on accuracy
- From 6 to 48 hours ahead
- 15-min or Hourly time resolution
- Update cycle: several times/day
- Forecast driven by NWP
- Managing uncertainties
III. Improving forecasts for trading
III. Improving forecasts for trading

Spanish FIT System

GRID OPERATOR AND UTILITIES

GENERATION SIDE

DEMAND SIDE

Energy Flow

Deviation Costs

Pool Costs

Primes

的人

Pool Costs

Deviation Costs

Distribution Fees

MARKET OPERATOR

National Energy Council

Utilities
III. Improving forecasts for trading

Evolution of Wind Installed Capacity (MW)

Evolution of Solar PV Installed Capacity

Evolution of CSP Installed Capacity
Day ahead Market:
Daily session with forecasted energy for the next day.
Intra-day Market:
Several sessions a day to adjust the energy sales
Costs = P x D
P = Imbalancing price
D = Deviation

Average cost 15 €/MWh

Imbalancing penalties are directly proportional to the inaccuracy or deviation.
The Portfolio Effect (EC) is the result of damping. It is the net deviation of a set of renewable plants.

**Cost Asymmetry** only penalizes deviations in one direction, relative to the needs of the electric system.

<table>
<thead>
<tr>
<th>System Need</th>
<th>Deviation</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>2</td>
<td>↑</td>
<td>↓</td>
</tr>
<tr>
<td>3</td>
<td>↓</td>
<td>↑</td>
</tr>
<tr>
<td>4</td>
<td>↓</td>
<td>↓</td>
</tr>
</tbody>
</table>
### April to September 2012:

<table>
<thead>
<tr>
<th></th>
<th>Nameplate Capacity</th>
<th>Costs w/o Forecasting</th>
<th>Costs w/ Forecasting &amp; Portfolio</th>
<th>Costs Managing Uncertainties</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>140 MW</td>
<td>0.86 M€</td>
<td>0.26 M€</td>
<td>0.20 M€</td>
<td>0.66 M€</td>
</tr>
<tr>
<td><strong>PV</strong></td>
<td>513 MW</td>
<td>4.05 M€</td>
<td>0.48 M€</td>
<td>0.40 M€</td>
<td>3.65 M€</td>
</tr>
<tr>
<td><strong>Hydro</strong></td>
<td>125 MW</td>
<td>0.6 M€</td>
<td>0.05 M€</td>
<td>0.04 M€</td>
<td>0.56 M€</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>778 MW</td>
<td>5.51 M€</td>
<td>0.79 M€</td>
<td>0.64 M€</td>
<td>4.87 M€</td>
</tr>
</tbody>
</table>
III. Improving forecasts for trading
IV. Conclusions
IV. Conclusions

• **Forecasting is a valuable source of information**
  • Different applications and problems
  • Different strategies to compute the forecast
  • Different customers for each solution

• **Forecasts adapted to your problem**
  • Extra information can be used to improve the forecasts
  • IT systems are helpful

• **Managing uncertainties, interesting profit for trading**