Indonesia Smart Grid Workshop
European utilities efforts to increase the smartness of their Power System

Filip Carton, Head of the National Control Center, Elia Group, Belgium
Elia Group = At the heart of the energy transition
Elia Group = A European top 5 company

Netzquartier 50Hertz, Berlin
The grid we manage in Belgium - today

- **800** substations
- **22,000** transmission towers
- **8,432 km** of lines and cables
- **12,696 MW** Maximum load – Elia Grid Load
- **13,500 MW** Total load – Belgian Consumption

Elia is the Belgian Transmission System Operator (30 kV - 380 kV) managing over 8,400 km lines and underground cables.
The grid we manage in 2030
Fast-paced trends impacting the electricity sector

Decarbonisation of the energy sector

Decentralised generation & new players

Supranational coordination

Digital transformation
New demands from society require a holistic approach

Generation follows consumption

Demand will follow generation

Smart grids is much more than a story of assets, it’s also (and maybe even more important) about smart market design, methodologies, state of the art forecasting and algorithms, operational procedures supported by digital technologies ….
Forward looking: Internet of energy io.E: 3 building blocks to realise a consumer-centric system

Vitit https://www.ioenergy.eu/ for more information
Rise of the Renewables - Share in total load

Peak production The largest share of total load covered by all renewables combined was: 68% of total load (20/04/2020 14:30)

Installed base

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar (MW)</th>
<th>Offshore (MW)</th>
<th>Onshore (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>3369</td>
<td>1178</td>
<td>1978</td>
</tr>
<tr>
<td>2019</td>
<td>3886</td>
<td>1548</td>
<td>2248</td>
</tr>
<tr>
<td>2020</td>
<td>4787</td>
<td>2254</td>
<td>2416</td>
</tr>
</tbody>
</table>

Callout percentages are “% of total load”
Despite higher RES penetrations we achieve a better system balance thanks to improvements in balancing market design.

**Key Improvements:**
- Reactive balancing possibility
- Single Marginal Pricing
- Continuously improved published Forecasting Data
- Continuously improved transparency data

**System imbalance**

<table>
<thead>
<tr>
<th>Year</th>
<th>St. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>154 MW</td>
</tr>
<tr>
<td>2019</td>
<td>158 MW</td>
</tr>
<tr>
<td>2020</td>
<td>156 MW</td>
</tr>
</tbody>
</table>

**Area control error**

<table>
<thead>
<tr>
<th>Year</th>
<th>St. Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>53 MW</td>
</tr>
<tr>
<td>2019</td>
<td>61 MW</td>
</tr>
<tr>
<td>2020</td>
<td>56 MW</td>
</tr>
</tbody>
</table>

The decrease of the ACE was higher than the decrease of SI.

On top of that, the average ACE and SI were both close to zero (<2MW each).
Anticipating issues with security of supply requires state of the art forecasting tools (total load, generation, …)
Forecasts are published on internet to facilitate markets

Integration of renewable energies
Day-ahead forecast errors

- Installed capacity
- Absolute P99 error (%)
- Relative P99 error (MW)

Rel. error is almost flat, **forecast quality is constant**. Offshore wind has highest relative errors, high grid impact!

### Solar
- Inst. capacity
- Abs (P99)
- Rel (P99)

### Onshore
- Inst. capacity
- Abs (P99)
- Rel (P99)

### Offshore
- Inst. capacity
- Abs (P99)
- Rel (P99)
Line ratings of existing assets can be maximized using dynamic line rating technologies.