Mid-Term Adequacy Forecast
MAF 2019

European Network of Transmission System Operators for Electricity (ENTSO-E)

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Programme

1. Adequacy at ENTSO-E
2. MAF 2019 methodology and outcomes
3. Future scope – CEP Implementation
4. Q&A
Adequacy at ENTSO-E
Energy transition requires a robust methodology

High temporal volatility

Probabilistic (hourly)

High spatial volatility

Interconnections (Pan European)

Need to reflect accurately the complementarities of the different technologies (generation capacity flexibility, storage, demand response, energy efficiency)
Different risks addressed with different timeframes

- **Long term** (>10 years)
- **Mid-term** (several years)
- **Short term** (several months)

Policy decisions
- Investment decisions
- Operational decisions

Uncertainty increases

TYNDP
- Mid-term
  - Several months
  - 1 week

MAF
- Addressed today

Seasonal
- Week ahead

RSCs'
MAF 2019: Methodology
## MAF 2019 scope and limitations

<table>
<thead>
<tr>
<th>Addressed by MAF 2019</th>
<th>Not yet addressed</th>
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</thead>
<tbody>
<tr>
<td>Identification &amp; quantification of <strong>resource scarcity risk</strong> in day-ahead market in 2021 and 2025</td>
<td>Economic viability assessment</td>
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<tr>
<td><strong>Accelerated low-carbon</strong> stress test for 2025</td>
<td>Suitability of <strong>regulatory framework &amp; market design</strong> (e.g. rightness of Capacity Mechanism)</td>
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<td><strong>Flow-Based</strong> sensitivity for 2021</td>
<td><strong>Internal congestion</strong> within a Bidding Zone (considered as copper plate)</td>
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Resource Adequacy: General Methodology

Available Generation

Network Infrastructure

Demand

Storage

Deterministic Forecast:
- ENTSOs’ Scenarios
- Planned Outages

Uncertainty:
- Wind generation
- Solar generation
- Hydro generation
- Forced outages

Deterministic Forecast:
- ENTSOs’ Scenarios

Uncertainty:
- Temperature
Resource Adequacy: Construction of Sample Years

35 years of interdependent climate data

$N$ random draws for unplanned outages

$35 \times N$ (Monte Carlo) sample years
Improvements compared to previous editions: Focus on input data – Hydro and Demand

**Hydro Modelling: Complete set of climate years with year-specific hydrological conditions**

- Hydropower modelling has a significant impact on the results;
- Harmonized assumptions, common methodology based on re-analysis of historical data and better reflection of the interdependence of hydrological and the rest climate variables (temperature, wind, solar, etc.);

**Demand time-series: advanced tool for an improved model**

- Common tool and methodology to build time-series for all zones;
- Trained on a number of historical demand time-series and their correlation with climate variables based on identification of significance of each variable, e.g., temperature, irradiance, wind speed, etc.;
- Considering contribution of Electric Vehicles and Heat Pumps.
Improvements compared to previous editions: Focus on input data – Thermal Generation

**MAF 2018**

**PEMMDB 2.0**

- **Clustering:**
  - generating units clustered by technology

**MAF 2019**

**PEMMDB 3.0**

- **Individual power plant data:**
  - economic parameters
  - technical details
  - scenario building fundamental assumptions

- **Unit-by-unit granularity of thermal generation data** is a milestone for System Development studies;

- **Detailed modelling** of various properties, e.g., maintenance, derating of generation plants, ramping, expectations of commissioning and decommissioning, economic parameters etc.;

**Hybrid approach for first implementation in MAF 2019**
MAF 2019: Main Outcomes
Base case results: Comparison of year 2021 and 2025

[Maps showing LOLE (hours) for Base-Case 2021 and Base-Case 2025 across Europe.]
Low-Carbon stress test for 2025: 23 GW phased out

*only zones with LOLE > 0.5 hours/year are shown
Future Evolution: Towards the European Resource Adequacy Assessment (ERAA)

CEP Implementation
Pan-European Resource Adequacy Assessment: CEP deliverable methodologies

What does this mean for ENTSO-E and adequacy in Europe?

→ Three main methodology packages (to be delivered by ENTSO-E):

1. Methodology for the European Resource Adequacy Assessment (ERAA)

2. Methodology for:
   - Cost of New Entry (CONE)
   - Reliability Standards
   - Value of Lost Load (VoLL)

3. Methodology for calculating the maximum entry capacity for cross-border participation to Capacity Mechanisms
Pan-European Adequacy Assessment: Impact of CEP Implementation and New Challenges

What are the differences with current methodologies?

<table>
<thead>
<tr>
<th>Current Approach (MAF 2019)</th>
<th>Target Approach</th>
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<tbody>
<tr>
<td>• Probabilistic market modelling</td>
<td>✔ Probabilistic market modelling</td>
</tr>
<tr>
<td>• 7 years ahead - 2 simulated years</td>
<td>❏ 10 years ahead - annual granularity</td>
</tr>
<tr>
<td>• Bottom-up approach and expectations of commissioning / decommissioning</td>
<td>❏ Economic viability of generation assets, integrated in the model</td>
</tr>
<tr>
<td>• No explicit CM considerations</td>
<td>❏ Integrated consideration of CM</td>
</tr>
<tr>
<td>• NTC approach, flow-based only tested</td>
<td>❏ Compliance with FBMC when available</td>
</tr>
<tr>
<td>• No sectoral integration</td>
<td>❏ Sectorial integration (P2X consideration)</td>
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Time for questions/answers
European Resource Adequacy methodologies: stay tuned and have your say!

5 December 2019 - Public consultation on all methodologies opens for 8 weeks

16 December – Stakeholder workshop on the Resource adequacy methodologies
THANK YOU FOR YOUR ATTENTION!