Austrian Day-Ahead Power prices – 01.07.2023 – 02.07.2023

- Lowest possible price (due to SDAC rules)
- Auction was redone – order books were opened again and additionally offers were allowed
- Despite the second auction around, the price remained at -500 EUR/MWh
Electricity System Austria – 02.07.2023

**Generation**

- Biomass
- Gas
- Hydro Run-of-River
- Hydro Water Reservoir
- Solar
- Waste
- Wind Onshore

**Load**

- Load Total (excl. Pump storage)
- Load Hydro Pumped Storage

**Graph Details**

- MW values for Generation and Load
- Time range from 00:00 to 21:00
Demand side flexibility – P2H

Christoph Zehetner

27.09.2023
Industrial process heat and P2H

- In 2020, **22% of the total energy demand** in Germany was used for **industrial process heat** (*numbers for Austria not available*) – the majority of this heat was being provided by gas boilers or combined heat and power plants (CHP).

- **Power-2-Heat (P2H)** is a potential substitution for gas boilers for providing industrial process heat. P2H is a form of **direct electrification** of industrial processes, and therefore also helps decarbonising industries. P2H plants are available with a capacity of up to 60 MW.

- P2H is characterised by comparably **low investment cost** (150k-200k EUR/MWh), an **efficiency rate close to 100%** and a very **high degree of flexibility** (30 sec from 0 to max load).
### Steam cost comparison 2024 – Baseload

<table>
<thead>
<tr>
<th></th>
<th><strong>Power2Heat</strong></th>
<th></th>
<th><strong>Gas boiler</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy cost</strong></td>
<td>131,40 EUR/MWh</td>
<td><strong>Energy cost</strong></td>
<td>50,40 EUR/MWh</td>
</tr>
<tr>
<td><strong>Grid and taxes</strong></td>
<td>11,50 EUR/MWh</td>
<td><strong>Grid and taxes</strong></td>
<td>5,10 EUR/MWh</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>142,90 EUR/MWh</td>
<td><strong>Total</strong></td>
<td>72,00 EUR/MWh</td>
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<tr>
<td><strong>CO2</strong></td>
<td></td>
<td><strong>CO2</strong></td>
<td>16,50 EUR/MWh</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>Total</strong></td>
<td>85,70 EUR/MWh</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>99%</td>
<td><strong>Efficiency</strong></td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td>144,40 EUR/MWh</td>
<td></td>
<td>85,70 EUR/MWh</td>
</tr>
</tbody>
</table>
Advantage of P2H based on hourly basis (2020 – 2023)
Advantage of P2H based on an hourly basis (December 2020)
Monthly cost benefit of P2H since 2020
Usage of P2H until 2050 – Based on „ICIS‘ long term fundamental model“

- Annual benefit of P2H per MW
- % of hours with P2H advantage (RHS)
Major hurdles for the implementation of P2H

 Capacity based grid cost
  – Upper Austria, voltage level 3 (Netzebene 3): 19.800 EUR/MW/a
  – Does the current grid tariff structure, which has been developed for a power system based on conventional baseload power plants still make sense in a power system with an ever growing share of volatile renewables? – *Need for regulators & politics to change the framework for grid cost!*

 Physically, available grid capacity
  – Grid capacity is already now a bottleneck for the deployment of renewables – large scale electrification would intensify that bottleneck and would need significant lead time and coordination with the respective DSOs
The high degree of flexibility makes P2H the perfect asset for balancing energy markets, especially for negative „automatic Frequency Restoration Reserve“ (aFRR)

This market shows exceptionally high revenue potential in the last months
- The average remuneration per MW (including avoided gas and CO2 cost) was around 350,000-400,000/a

This offers the opportunity to swiftly amortize this asset – to address opportunities of the future spot market whilst simultaneously decarbonizing industrial production.
Thank you for your attention. Happy for all questions and remarks!

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