Can Europe wean itself off gas?
TTF still high but at more manageable levels on Russian supply loss

We are bullish against the TTF near curve on permanent loss of Russian gas supply.

Source: CME, Argus Media Group, Bloomberg, ECB, system operators, Energy Aspects

Gazprom’s pipeline exports to Europe will be around 155 bcm below 2019 in 2023.
Decarbonisation is an imperative and EU ETS sectors will be first

EU ETS cap under FF55, y/y

Europe’s default policy is to completely decarbonise power and industry by the end of the next decade. Post-2030 LRF will be debated over this year.

Source: EU, Energy Aspects

<table>
<thead>
<tr>
<th>REPowerEU: key points</th>
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<tbody>
<tr>
<td>Gt</td>
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Greater focus on rooftop solar

<table>
<thead>
<tr>
<th>Solar (GW)</th>
<th>Wind (GW)</th>
<th>Others (GW)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>FF55</td>
<td>RePowerEU</td>
<td>Budget (€ bn)</td>
<td>Spending</td>
</tr>
<tr>
<td>420</td>
<td>600</td>
<td>86</td>
<td>Renewable energy</td>
</tr>
<tr>
<td>480</td>
<td>480</td>
<td>29</td>
<td>Power grid</td>
</tr>
<tr>
<td>167</td>
<td>156</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Biomethane (bcm)</th>
<th>Heat pumps (mn)</th>
<th>Renewable H2 (Mt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>30</td>
<td>5.6</td>
</tr>
<tr>
<td>35</td>
<td>10 by 2025</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>56</td>
<td>27</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,067</td>
</tr>
<tr>
<td>1,236</td>
</tr>
</tbody>
</table>

€225 billion REPEU budget. €20 billion will be funded by frontloading EUA sales from MSR.

European policy response to the energy (gas) crisis is REPEU, which looks to do FF55, but faster. Aimed at ending EU reliance on Russian gas by 2027.
Decarbonisation pathways replacing gas largely involve power or CCS

**STEEL PRODUCTION**

- **Existing technology**
  - Blast furnaces
  - BOF

- **New technology**
  - Electric Arc Furnace / DRI
    - Produces solid metallic iron
    - Produces molten steel

**CEMENT PRODUCTION**

- **Electricity efficiency**
- **Novel cements**
- **Thermal energy efficiency**
- **Alternative fuels**
- **Clinker substitution**
- **CCS**

**Space heating**

- **Natural gas combination boilers**
- **Heat pumps / Direct electric heating**
  - Heat pumps
  - Direct electric boilers
  - Electric power
  - Environmental energy

*Source: CEMBUREAU, IEA, Energy Aspects*
Electricity costs remain biggest barrier to reducing green hydrogen costs

LCOH of green hydrogen via PEM electrolysis

$/kg

Hydrogen electrolyser installed capacity

GW

The EU aims to install 37 GW of electrolyser capacity by 2030, with an interim target of 6 GW by 2024. Efficiencies will improve and capital costs will decline by end-decade.

Source: Mayyas et al, NREL 2019–08, Energy Aspects
CCS will have some use in the EU

Carbon break even costs for CCS

Break-even prices rely on the concentration of the effluent stream, if infrastructure can be shared, type of storage.

Source: IOGP Europe, Energy Aspects

Some 72 CCUS projects (5 in Germany) in various stages of development that could deliver 80 Mtpa of emissions reductions by 2030. 7 are operational.
Losing gas (and oil) means European power demand will increase

European power demand
TWh

European power supply, y/y
TWh

Transition means power demand is going to increase as decarbonisation pathways rely on decarbonisation

We assume average annual 70 GW of additional renewables between 2020 and 2030

Source: EU, Energy Aspects
European gas demand to fall but could still hang around in power

European gas demand will fall by 400 bcm (73%) by 2050.

Source: Irena, various member states, Energy Aspects

Increase in low-carbon generation to replace reductions in coal and added demand from EVs, hydrogen production and other electrification (industry and residential).
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