



**The Pathway Forward for Gas Turbines
in a Decarbonized Europe**

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- Only association of European gas and steam turbine manufacturers



- Advocates a competitive economic and legislative environment for the sector
- Promotes the role of turbine-based power generation
- For further information see <http://www.euturbines.eu/>

The background of the slide is a close-up, high-angle photograph of a gas turbine compressor section. The image is dominated by a complex, repeating pattern of dark blue and black rectangular vanes, which are part of the compressor's stator and rotor stages. The lighting is dramatic, with strong highlights and deep shadows, creating a sense of depth and mechanical complexity. A semi-transparent white rectangular box is overlaid on the lower half of the image, containing the title text.

The Pathway Forward for Gas Turbines in a Decarbonized Europe

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- Changes in energy policy in Europe
- Challenges in operating gas-fired power plants profitably
- Best suitable types of gas-fired power plants to cover the transition period
- Carbon lock-in discussion
- Power-to-gas-to-power-approach

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Europe's Energy Landscape

- Massive change in the generation landscape
- Strong political pressure on all types of fossil fuel power generation
- Growing understanding for the need of an increasing amount of flexibility solutions

Gas-Fired Power Generation

- Seen as best available flexibility technology for a transition period
- Views diverging regarding length of the transition period
- Discussion about best suitable types of gas-fired power plants to cover this transition period
 - Big efforts by industry in developing even more efficient combined-cycle power plants
 - Growing number of voices suggest to invest in simple-cycle plants only

Gas Fired Power Generation



" You're perfect for our transition team since you're easily replaceable. "

CartoonStock.com

Operational Changes

- Backup plants with only a few hundred operating hours per year
- Trend to smaller and more decentralized plants
- Limited transition period
 - > investment costs and flexibility weigh more than efficiency
- Growing competition from gas engines

Long-Term Perspective for GT's

- Convincing answer needed to the “carbon lock-in discussion”,
i.e. decarbonising the operation of gas-fired power plants

- Two options
 - burning gases that do not emit greenhouse gases
 - capturing the emitted green house gases

A solid red horizontal bar.


Option «Capturing GHGs»

- Even in times of base load operating plants, carbon capture & storage (CCS) or carbon capture & utilisation (CCU) were too expensive

- With less running hours and smaller decentral plants the cost pressure even increases

Option «Power-to-Gas»

- Approach of power-to-gas-to-power seems the better option
- Con:
 - Economic challenges caused by the low efficiency
- Pro:
 - Growing availability of “green excess energy”
 - possibility to use the existing gas grid as large and seasonal energy storage option
 - Supports need for flexibility
 - **Allows re-electrification, also**

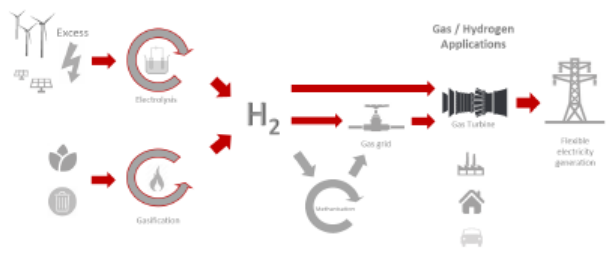


Power-to-Gas & turbines – a perfect combination in the future
R&I priorities for gas turbines

Power-to-Gas will play an important role in the future as part of an energy system that includes an increasing share of intermittent renewable energy sources, such as wind turbines and photovoltaics. Allowing excess energy generated – be it from thermal power plants, or from renewable energy sources – be stored as green fuel to use when needed will contribute to the flexibility that the future energy mix requires.

Gas turbines are very flexible and, in general, can be readily adapted to operate on hydrogen or synthetically derived (syngas) fuels containing hydrogen. Generally, syngas fuel streams can be used with different derivatives of existing combustion systems, based on the characteristics of the different fuels and operating requirements. There are, however, a number of areas that need to be improved and optimized, in order for gas turbines be prepared for this solution in the future.

EUTurbines hereby highlights the flexibility of the gas turbine, identifies where the technology requires further development and outlines how the gas turbine could be used in more novel concepts.



The diagram illustrates the Power-to-Gas process. On the left, 'Excess' energy from wind turbines and photovoltaics is used for 'Electrolysis' to produce H₂. Simultaneously, 'Gasification' of biomass is shown. The H₂ is then transported via a 'Gas grid' to 'Gas turbine' applications. These applications include 'Flexible electricity generation' (represented by a power line tower), industrial processes (represented by a factory), and residential use (represented by a house and a car). A circular arrow labeled 'Hydrogenation' is also shown, indicating a feedback loop or process integration.

So, is there a future for GT's in Europe?

