The Pathway Forward for Gas and Steam Turbines in a World of Increasing Renewable Sources

Dr.-Ing. Michael Ladwig, GE Power – President of EUTurbines
Who is EUTurbines?
EUTurbines in a Nutshell

Energy & Climate Policy

Research Policy

Industry Policy

Environmental Policy
The 2050 Vision of Europe’s Energy System
The 2050 Vision of Europe’s Energy System

www.etip-snet.eu/etip-snet-vision-2050
Why is the vision document important?

- **ETIP SNET Vision 2050**: 27 June 2018
- **ETIP SNET 10-Year Roadmaps (RD&I needs)**: End 2019
- **ETIP SNET Implementation Plan (Priorities for RD&I activities during the next 3 years)**: Beginning 2020
- **EC Horizon Europe Work Programme**: End 2020
The 2050 Vision of Europe’s Energy System

Energy system (almost) fully decarbonised

- A system of systems (combining gas, heat & electricity grids)
- Power conversion and flexible energy storage
- Seasonal storage in the form of gas, liquids or other non-battery massive storage
- Low-cost, efficient balance of thermal energy supply and demand
In 2050

Thermal Power generation

- is mainly running with renewable energy sources
- provides flexibility and ensures electricity and heat supply during times with limited or less renewable energy supply
Europe’s Energy Landscape
The route to 2050

**Today**

- Coal share ~20%
- PV, offshore wind price competitive
- Low flexibility needs – capacity reserves with old coal plants
- Batteries for short-term storage start to be used
- Gas = natural gas, CCS too expensive
- Lack of incentives to invest in flexible gen
- Electrification trends

**2030**

- Most coal-plants retired
- Growing amount of excess energy from vRES
- No gen overcapacities → flexibility solutions needed
- Short-term flexibility provided by batteries
- „blue“ hydrogen (incl. CCS) as interim step
- Peak prices / capacity payments set incentives for new gas plants
- Considerable amount of electro-mobility

**2050**

- Coal phase-out
- Full decarbonisation of power generation (more vRES)
- Greater need for flexibility solutions
- Long-term flexibility provided by (renewable) gas storage
- Gas grid switched to very high share of renewable gas

RES share: ~30%
GHG reduction: min -40%
RES target: 32% (or higher)
GHG reduction: min -80%
RES share: 80%?
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How to make investments in new gas plants (few operating hours) attractive?

- Allow real scarcity pricing – make the market work
- Pay for providing capacity (capacity mechanisms)
- Higher costs on carbon emissions
Gas Turbines in Europe
Where are we today?

With that in mind, the purpose was to highlight the importance of a rational and progressive decommissioning of fossil fuel capacity in the EU electricity sector, and certainly not to forecast.

3 BIG MYTHS ABOUT NATURAL GAS AND OUR CLIMATE

Fossil fuels (all of them!) are the energy of the past. With new technologies like wind, solar, and advanced batteries in our hands, we can power today and tomorrow with clean, reliable energy that doesn’t harm our health and destroy our planet.

Five Reasons Fossil Gas Cannot Form a Bridge to a Safe Climate.
No Room for New Fossil Gas (Even to Replace Coal)

GE shares slump as CEO warns on gas-fired turbine demand

Siemens in March cut its 2018 forecast for the large market by 10 percent to 100 units from its previous forecast of 110 units, while board member Lisa Davis said in May she saw no signs of a medium-term recovery.

Our (European) customers don’t buy

We develop fantastic products
Flexible Backup … the new role?

**Will Gas Plants really be the Flexible Backup?**

- Yes – when coal (and partly nuclear) is phased out …
- ... but not for short-term flexibility
- ... mainly seasonal („Dunkelflaute“)

**What are the political requirements?**

- The cleaner, the better
- Use only when really needed
- No carbon lock-in – minimise investments in fossil technology
- Flexibility more important than efficiency

**Consequences?**

- „Stranded assets“ discussion
- Reduce CAPEX → OCGTs vs CCGTs
- Smaller, more decentral units
- Solutions making CHP more flexible
- Higher fuel flexibility

Target: full decarbonisation as soon as possible
Transitional… or here to stay?

**EU Decarbonisation Target:**
- 80-95% until 2050
- = 100% for power generation

**Lifetime of our equipment:**
- 20 - 30 years

To enable investments in our technology past 2020, we very quickly
- need to make our technology "renewable fuel ready"
- need to get rid of the "fossil" image

… or we will remain a transitional technology.
Our Commitments

The gas turbine industry's commitments to drive the transition to renewable-gas power generation

Gas Turbines: Powering a Carbon Neutral Energy System

Power generation is experiencing a fundamental transformation in Europe; the energy mix will no longer rely on fossil fuels but move increasingly towards renewable energy sources. Energy market players across the value chain are taking the lead and driving the transition to a decarbonised energy mix in line with the EU’s 2050 goal of a climate-neutral economy.

Today, gas turbines, which mainly run on natural gas, are core components of Europe’s energy systems. Like turbines play an important role in the energy mix as they deliver dispatchable, reliable and efficient power and heat, independent of weather conditions. This technology will be of utmost value in a carbon-neutral energy system based on variable renewables, which will need constant available power.

The gas turbine sector supports the decarbonisation of the EU energy system by offering solutions which will harness a large variety of renewable energy fuels and progressively replace natural gas. In this document, we outline our commitments to drive the sustainable energy transition.

**Our Commitments**

1. Providing gas turbines operating with renewable gasses generated from carbon-neutral sources/ synthetic fuels, such as synthetic methane.
2. Providing turbines that can operate with a mix of natural gas and 3-5% hydrogen, while ensuring safety and compliance with emission standards.
3. Delivering in Europe only gas turbines that are capable of running with renewable gas for power generation purposes.
4. Providing customers with gas turbines that can handle a share of 26% hydrogen.
5. Providing retrofits solutions for existing power plants to make them fit for renewable gasses.
6. Meeting customer demand for gas turbines operating with 100% hydrogen.

**Investing for the Future**

By providing the technologies that will drive the transition to fast-acting, cost-efficient and renewable-based power generation, we ensure that investments in gas turbines will neither become stranded assets nor contribute to a carbon lock-in.

**OUR CALL TO ACTION**

The gas turbine industry calls upon policymakers to support the transition to a reliable, cost-efficient, decarbonised and renewable-based energy system by:

- Recognising the value of reliable and efficient power and heat generation for Europe’s society and economy;
- Accelerating the transition to a renewable-gas grid;
- Adopting a technology-neutral approach when selecting power generation technologies;
- Encouraging and rewarding flexible dispatchable generation in electricity markets; and
- Supporting the transformation of the energy system via adequate R&I funding for the turbine industry.

About EUTurbines

EUTurbines is the only association of European gas and steam turbine manufacturers. Its members are Ansaldo Energia, Doosan Skoda Power, GE Power, MAN Energy Solutions, Mitsubishi Hitachi Power Systems, Siemens and Solar Turbines.

EUTurbines advocates an economic and legislative environment for European turbine manufacturers to develop and grow R&I and manufacturing in Europe.

For further information,

EUTurbines Brussels Office
Tel: +32 2 706 8231 | info@eurturbines.eu

www.powertheweu.eu

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EUTurbines promotes the role of turbine-based power generation in a sustainable, decarbonised European and global energy mix and contributes to the political and regulatory discussions through continuous dialogue with the European institutions and other relevant stakeholders.
Our Commitments

Gas Turbines: Powering a Carbon Neutral Energy System

The gas turbine industry will deliver technologies that can operate with high shares of renewable gas, such as hydrogen. We have already started our journey and are committed to contribute to the decarbonisation of the EU energy mix by:

1. Providing gas turbines operating with renewable gases generated from carbon-neutral sources/synthetic fuels, such as synthetic methane.
2. Providing turbines that can operate with a mix of natural gas and 3-5% hydrogen, while ensuring safety and compliance with emission standards.
3. Delivering in Europe only gas turbines that are capable of running with renewable gas for power generation purposes.
4. Providing customers with gas turbines that can handle a share of 20% hydrogen.
5. Providing retrofit solutions for existing power plants to make them fit for renewable gases.
6. Meeting customer demand for gas turbines operating with 100% hydrogen.
Further information

www.powertheeu.eu
Summary: the gas-plant in 2050

- Operating on renewable gases
- Fast-adapting to variable gas qualities
- Few central large peaking plants - OCGTs, optimised for low operating hours and low CAPEX
- Smaller decentral cogeneration units (mostly aeroderivatives/recips)
- Very low NOx emissions
- Batteries integrated to allow fast start
- Thermal or hydrogen storage integrated for optimised operation

Source: GE

Proceedings of 13th European Conference on Turbomachinery Fluid dynamics & Thermodynamics
ETC13, April 8-12, 2018; Lausanne, Switzerland
Summary:

Gas and steam turbines in 2050

gas and steam turbines are needed in a decarbonized energy system

- they will ensure low cost stability of the grid
- they will ensure power and heat supply when other renewable sources cannot deliver
- they will provide these services environmentally friendly with there high power density
- they will run at least CO2 neutral with gas or steam produced from renewable fuels increasing the security of supply

Gas and steam turbine are renewable energy systems
We need only to decarbonize the fuel!