**Market conditions, general trends**

**P. Jansohn**

Comments from the PB meeting

P. Jansohn:

* keep the structure
* mention the three Ds in the text: Decentralisation, Decarbonisation, Digitalisation.

A. Sayma:

* adapt the title to *Market conditions & policy framework*, as *political* would refer more to politics than policy.

A. Sayma:

* The power range of micro gas turbines must be defined.

U. Simeoni:

* The range defined in the MGT Technology Summary could be used.

### Operating conditions of gas turbine based power plants

G. Terzer:

* mention *operational flexibility* in this section.

M. Ruggiero:

* a differentiation should also be made between *centralized* and *decentralized* power generation
* add a sentence on *hybridization*.

### Decentralised electricity production

O. Bernstrauch:

* mention the *2050 ETIP SNET vision*, or even refer to it.

Energy systems are undergoing major changes in many countries across the world. Decentralized energy generation, intelligent power grids, unconventional sources and of course, renewable energy sources (RES) are at the top of the energy agenda.

Despite the renewable boom, it is foreseen by the International Energy Agency (IEA) that conventional gas-fired power generation will still be needed to provide a reliable and cost effective, dispatchable power source to respond to peaks in demand and when intermittent renewable sources are not available for many decades to come.

This chapter outlines topics which have a strong influence on gas turbine technology development, gas turbine sales and gas turbine deployment and use.

## Economic environment for oil & gas business

Following four years of stability, oil prices fell abruptly in the second half of 2014. In June 2014, the price of Brent crude was around $115 per barrel and as of January 2015, it had fallen by more than half, down to $49 a barrel. The low oil and gas price, the shale gas boom (USA), the rise in oil and gas supply, the diversification of the energy mix and the decline in consumption have now changed the global energy landscape worldwide. The unfavourable conditions of the European gas turbine market and a potentially prolonged period of low oil and gas prices create immense pressure on production cost. Most likely this will have significant implications on the gas turbine industry, hence cost reduction measures are of paramount importance.

**Climate change**

The Paris Agreement reached at the United Nations Framework Convention on Climate Change (UNFCCC) COP21 conference in December 2015 is expected to give new strength to policies on climate change and the low-carbon energy transition. However, according to the International Energy Agency (IEA) projections for Organisation for Economic Cooperation and Development (OECD) economies, the average CO2 intensity of electricity needs to fall from 411 grams per kilowatt hour (g/kWh) in 2015 to 15 g/kWh by 2050 to achieve the goal of limiting the global increase in temperatures to 2°C. While many studies conclude that this is both technically and economically feasible, reaching this goal calls for new power market designs.

The roles of Carbon Capture and Storage (CCS) and low CO2 emission technologies need to be considered in order to achieve CO2 mitigation goals. However, for the moment, there is no market pull for the reduction of CO2 emissions in Europe as the EU Emission Trading System (ETS) does not yet incentivise the investments needed in the sector.

EU countries have also agreed on a new 2030 Framework for climate and energy, including EU-wide targets and policy objectives for the period between 2020 and 2030.

* At least 40% emissions reduction from 1990 levels by 2030;
* At least 27% energy efficiency increase by 2030;
* At least 27% renewable energy share by 2030;
* 15% increased energy interconnections between member states by 2030.

These targets aim to help the EU achieve a more competitive, secure and sustainable energy system and to meet its long-term 2050 greenhouse gas (GHG) reductions target (long-term goal of reducing GHG emissions by 80-95% when compared to 1990 levels).

**Operating conditions of gas turbine based power plants**

Gas turbines are a viable and secure option both economically and environmentally for power and heat generation. In future energy scenarios renewable energy resources (wind, solar) will play a much more significant role than in the past. As these resources do exhibit a weather dependent fluctuating non-controllable energy source (for electricity production), it is indispensable to have additionally controllable electricity production technologies available which can compensate the variable electricity production from wind & solar, in order to keep the electricity network stable i.e. to maintain the balance between production and consumption of electricity. Even with large electric storage systems hopefully becoming available in the future as well, flexible controllable electric power generation technologies, like gas turbine power plants, will be still required to provide sufficient generation capacity necessary to maintain grid stability and security of supply for electricity.

**Integration of Renewable Energy Sources (RES)**

The increasing share of intermittent Renewable Energy Sources (RES) is changing the pattern of energy generation. In the short term, GTs and Micro Gas Turbines (MGT) can help the integration of RES into the energy system by absorbing the fluctuations of the RES in the grid as well as by using low or CO2 neutral fuels like natural gas, biogas, industry waste gas or landfill gas. In the long term, hybrid GT and MGT applications that can assure high utilisation of RES and ensure security of energy supply due to the fuel flexibility if needed. This will provide significant contributions to a decarbonisation of the energy system and to the full deployment of RES in the grid.

Rapid improvements in low-carbon, demand-response and storage technologies can lead to a smarter, more efficient and more secure system, but achieving their full potential requires new approaches to policy and regulation. “Power-to-gas“ technology could also provide significant amounts of hydro- gen (H2) and/or synthetic natural gas (SNG) making it necessary to adapt gas turbines for the future use.

**Decentralised electricity production**

We are currently moving from a highly-centralized to a more decentralized energy system relying on more distributed generation, energy storage and a more active involvement of consumers through demand response. If regulatory regimes, market design and system operation end up lagging behind technology deployment, the result may undermine electricity security and, ultimately, the low-carbon transition itself.

In this context, small scale power plants and MGT with micro-CHP can play a substantial role in supporting renewables and meeting the challenges of the modern electricity grid. MGT technology is able to support renewables at the system level in Europe and can realise multiple benefits as a form of demand response. They can operate as a stand-alone unit in off-grid operations or grouped in farm arrangement generating higher output and providing electrical power support to a local microgrid. They offer flexibility in operations, fuels and connection methods, modularity, stable and reliable operations and lower emissions than alternative generation systems.

