Spotlight On… Turbines and Energy System Integration

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The concept of Energy System Integration (ESI) has gained ground in energy discussions in Brussels as a way to help achieving climate neutrality. With the publication of the EU's Energy System Integration Strategy in July 2020, the topic enjoys a high priority on the political agenda. In this article, we will cover the concept of ESI and the role of renewable gas power plants in an energy system where the heating, gas and power networks are closely connected.

First things first – what is a truly integrated energy system for us? Understanding the notion is impossible without looking at the concepts of sector coupling (SC) and sector integration (SI). SC refers to the connection of the electricity, gas and heat networks in a way that they interact with each other – becoming more efficient and flexible as a system. The use of turbines in combined heat and power (CHP) applications perfectly illustrates the concept of sector coupling, using gas to provide electricity and heat/cold, and thus bringing together the three networks. SI refers to the connection of the energy sector with other energy-consuming sectors, such as mobility or industry. A well-functioning coupling of the different energy networks is key for turbine technology. It provides power and heat, thus making it important to allow interactions with sectors that have a high demand of electricity and heat.

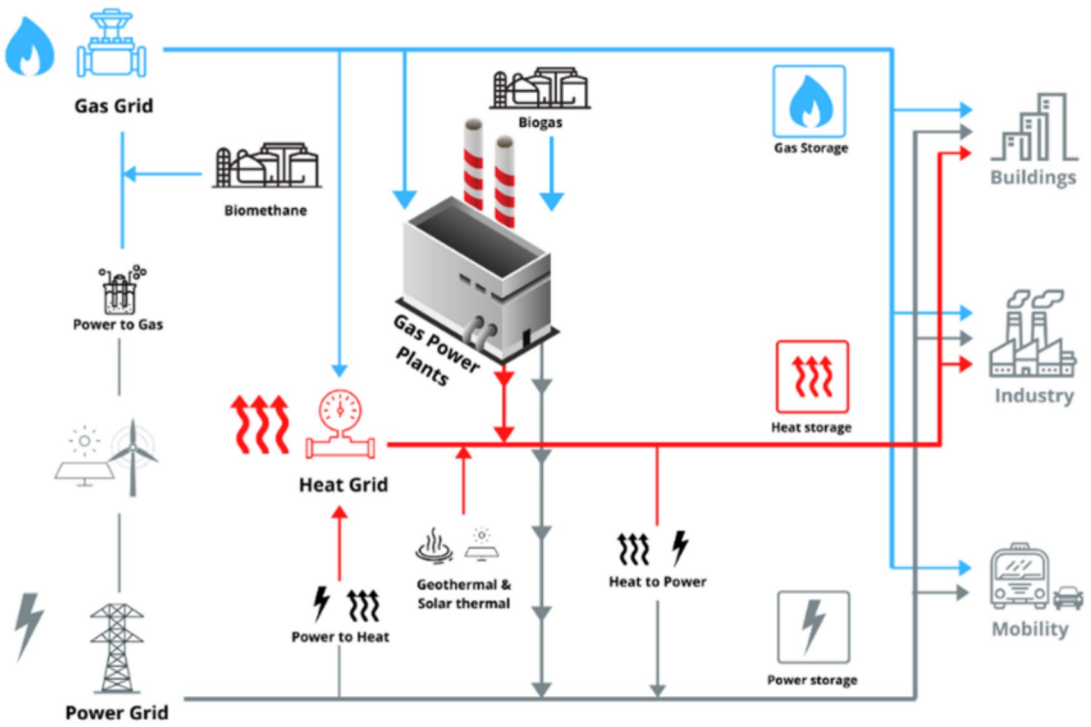
ESI is about combining the strengths of different energy vectors and systems to maximise the production, transport, storage and usage of energy through enhancing connections and interactions within the system to find the best solution for each situation.

Gas power plants with turbine technology: in the centre of ESI

Electrification is often seen as the best available solution for the decarbonisation of the European economy and its industrial sectors. However, a truly integrated energy system becomes possible when **it does not only consider electrons** to be part of it, but also **decarbonised and renewable gases** (and fuels) as well as heat/cold.

The gas sector has an important role to play in the future energy system, but to do so, it needs to decarbonise. Among the decarbonised and renewable gases that will progressively replace natural gas, hydrogen is expected to have the greatest significance. The gas network offers a long-term and seasonal storage solution, which other technologies and options cannot provide – contributing to enhancing the increasingly needed flexibility of the energy system. Therefore, although a prominent field of application for decarbonised and renewable gases – especially hydrogen – are "hard-to-abate" sectors, such as the cement or the long-distance aviation sectors, **their use in power generation should not be overlooked**.

The gas turbine technology is not bound to a fuel and can also operate with decarbonised and renewable gases, be it hydrogen or biomethane, thus being able to **provide sustainable electricity and heat/cold in flexible gas power plants.**



Gas power plants in the centre of ESI

With an ever-increasing share of variable renewables in the electricity system, the use of renewable gases will help the future decarbonised energy system. Renewable energy sources such as wind and sun – dependent on weather conditions – do not deliver constant power when needed, which challenges the stability and reliability of the electricity grid and security of supply. This way, the flexibility challenge in the future energy system, which will continue to grow as more variable renewables are introduced, can be solved thanks to the storage capability of the gas network and the support of flexible gas power plants to deliver power and heat/cold when needed.

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It is important to point out that gas power plants do not only provide electricity but can also produce heat – reaching up to 90% of efficiency. As the provision of heat accounts for half of Europe's energy consumption[1], it is important to have a reliable decarbonisation option. Here is where CHP plants come into play: they have the potential to efficiently produce heat and power while not relying on intermittent renewables. The heat is then fed in the heating network, which can then be used in buildings or industry, enabling enormous energy-saving potentials.

In this regard, **gas power plants play a central role in the future energy system,** creating synergies between energy carriers. They serve as connecting points between two and in some cases three different energy networks, making it possible to fully exploit and benefit from their interactions.

Renewable gas power plants – a future-proof solution!

Gas power plants guarantee that different sectors are connected, while making sure that the grid remains stable and heat is produced. In the future, with the use of decarbonised and renewable gases, the energy system will be able to benefit from the advantages of this solution in a climate-neutral way. Gas turbines in gas power plants are in the centre of this, providing power and heat in a flexible manner and integrating the future energy system.

[1] See here: https://ec.europa.eu/energy/topics/energy-efficiency/heating-and-cooling_en?redir=1