WHAT IS THE PLACE OF FOSSIL GAS IN A SUSTAINABLE ENERGY MIX ?

The transition to a sustainable energy system is not just about developing renewable energy sources - mainly solar and wind - and closing down fossil fuels. It also entails devising ways to match electricity production with demand, given that some sustainable energies have variable output. In this respect, there is a role for fossil gas to play in the transition to a fully decarbonized electricity system, though that role is not as crucial as the major players in the gas industry claim. The real value of fossil gas in the transition, far from being less carbon-intensive than coal, is its ability to deliver significant power very quickly, or at peak levels. But while fossil gas provides a means - among others - of intervening punctually and providing flexibility, there is currently no justification for massive investment in new gas-fired power plants.

The climate benefits of fossil gas as part of the transition are often misunderstood. Replacing all coal-fired electricity with gas-fired electricity using the argument that gas is responsible for fewer greenhouse gas emissions for the same electricity production is not a viable solution. Emissions from the entire gas value chain are still too high, and a global gas-based electricity system would be as bad for the climate as one based on coal.[1] But gas can play a complementary role in the development of variable sustainable energies, which will replace current fossil fuel production.

1. THE CURRENT ELECTRICITY SUPPLY PARADIGM

Electricity demand never falls to zero for two reasons: some electricity-consuming processes run continuously (e.g. industrial processes, residential refrigerators), and a network with a large number of users means at any given time electricity is being used (e.g. lights are switching on, cell phones are charging). As a result, a minimum amount of energy is required at all times, which is called the baseload. The additional component that varies over time is described as the "intermediate" or "peak" load.

Historically, electricity demand has been met by fossil fuels,[2] with a clear distinction between:

- **Baseload power plants:**

Typically nuclear and coal-fired power plants, characterized by high capital costs and relatively low variable costs. These plants are designed to deliver constant power over a long period of time in order to amortize their initial costs. However, they are also characterized by low ramp-up capacity, which offers little or no flexibility in output. The intermediate baseload is provided by gas-fired combined-cycle power plants. These are also characterized by high investment costs and low production flexibility.

1. Although burning gas emits around half as much CO2 as burning coal, gas remains a fossil fuel composed mainly of methane. Methane is a greenhouse gas with 83 times the warming power of CO2 over 20 years, and is responsible for around 30% of the rise in global temperatures since the industrial revolution. Unlike coal, gas emits more upstream - in other words, as soon as it is extracted, as well as during transportation. Reclaim Finance, 10 preconceived ideas against climate action, November 2022
2. International Renewable Energy Agency (IRENA), From Baseload to Peak: Renewables provide a reliable solution, 2015

- **Peak load power plants:**

Typically open-cycle gas-fired or oil-fired power plants. These plants are characterized by low capital costs, but high variable costs.[3] They are designed to operate for a limited period, and generally trigger a rise in electricity prices to compensate for their high variable costs.

The key idea behind this approach is that demand is the controlling force and varies freely, while supply must keep up at all times and coincide with demand. However, satisfying baseload does not necessarily require baseload power plants. For example, variable sustainable energy systems assisted by controllable energy systems (in which production can be controlled) can meet the same needs.

2. EVOLUTION TOWARDS A POWER SYSTEM BASED ON VARIABLE SUSTAINABLE SOURCES COMBINED WITH FLEXIBLE SYSTEMS

a. Obsolete baseload power plants

With the increasing penetration on world electricity markets of renewable energies (share of electricity generated from renewable sources), the use of baseload power plants is becoming less and less relevant. Indeed, as variable sustainable energy sources produce electricity at almost zero variable cost, their electricity is supplied first when it is available. The result is a reduced need for baseload generation, making it increasingly difficult to operate this type of power plant and amortize related investment costs.

In short, baseload power plants are becoming obsolete in power grids based on renewable energies, and there is no justification for funding their continued development.

b. The need for flexibility

To compensate for the variability of certain renewable electricity sources, flexible systems are needed. These systems can be characterized by:

- controllable sources of electricity (hydroelectricity, various forms of storage, including batteries, fossil gas energy),
- electricity demand modulation that ensures supply meets demand at all times (more commonly known as demand-side management or demand response).

These systems bridge the gap between demand and supply in the short term, which requires rapid response systems, but also in the long term - for example in the event of a cold winter with little wind and therefore little electricity generated from variable energy sources.

Behind this new approach to demand-side management and the diversification of flexible systems that integrate different sustainable energy sources is one key idea: since both demand and supply vary up to a certain point, they both need to be flexible enough to adapt to each other. In this way, supply is no longer bound to demand.

3. THE PLACE OF GAS IN THE NEW ELECTRICITY SUPPLY PARADIGM

a. Gas-fired power plants to provide short-term flexibility?

Open-cycle gas turbines (OCGTs) can increase electricity output three to four times faster than combined-cycle gas turbines (CCGTs).[4] This enables them to cope with peaks in demand, and to adapt when variable sustainable production is too low to meet demand. In this way, they play a role in

3. In effect, the open cycle of these plants reduces their efficiency: for the same amount of electricity produced, more gas has to be supplied.

4. National Renewable Energy Laboratory (NREL), Ramping up the ramping capability: India's power system transition, September 2020

a network based on variable sustainable energies.

Conversely, since combined-cycle gas turbines cannot modulate output at the same rate, they cannot provide short-term flexibility in a power grid based on variable sustainable energies. As underlined by the German case of the Irsching 4 & 5 CCGT plants built in 2010 and 2011 to compensate for the variability of sustainable energies: "CCGT plants risk losing their commercial viability if they are essentially required to simply serve as backup to cover the intermittency of renewables rather than as baseload providers in their own right."[5]

b. Gas-fired power plants to provide long-term flexibility?

The International Energy Agency (IEA) has studied the needs of power grids with a 70% penetration of variable renewable energies. Several technologies are likely to deliver long-term flexibility by providing long-term storage capacity. The most advanced is pumped-storage hydropower, which provides between a third and a half of seasonal flexibility needs in IEA scenarios. Other innovative solutions are under development, such as compressed-air energy storage and other mechanical or thermal systems.[6]

Older thermal power plants are another option for providing seasonal flexibility. However, according to the IEA's scenarios, existing power plants are already sufficient to meet this need, meaning there is no justification for building new gas-fired power plants. What's more, in this kind of context, thermal power plants are used on average between 500 and 2,000 hours a year - far less than the current world average of 4,000 hours - making new construction uneconomical (as the Irsching cases illustrate).[7]

5. United Nations Economic Commission for Europe (UNECE), How Natural Gas can Support the Uptake of Renewable Energy, 2019
6. Reclaim Finance, Factsheet - Bioenergy, March 2024
7. IEA, Managing Seasonal and Interannual Variability of Renewables, April 2023

RECOMMENDATIONS

Reclaim Finance calls on financial institutions not to present fossil gas as a transitional energy source and to commit to a complete short-term halt to all financial services that support fossil gas expansion across its value chain, including in the power generation sector. This includes an immediate halt to all support for new gas fields and liquefied natural gas (LNG) export terminals, as well as to the companies developing them.

Click here to consult our detailed recommendations for financial institutions.