The myth of gas as a bridge fuel

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Key findings

- **Most new fossil gas plants are not suitable for providing the flexibility within a day, week, and between weeks that is required** in modern power systems.
- The most developed type of gas plants run **combined cycle gas turbines (CCGTs)** and are **designed for baseload purposes**.
- Using CCGTs for peakload purposes **reduces lifespan, risks profitability, and increases CO_2 emissions and atmospheric pollution**.
- **Open cycle gas turbines (OCGTs)** are designed for peakload but **have high emissions and are expensive to run**.
- The economic viability of gas plants is ensured through **costly financial mechanisms** supported by consumers and taxpayers that increase the risk of fossil fuel lock-in and slow decarbonization of the power sector.
- Current **gas turbine shortages** threaten the development of new gas plants and will severely delay expansion projects.
- **Sustainable and cheaper solutions already provide efficient flexibility to renewables-based power systems** (storage systems, demand side management, improved interconnections, and grid-enhancing technologies).
- **Supporting the development of storage capacities, power grids, and sustainable power (solar, wind) instead of fossil gas plants** is key to limiting global warming and air pollution.

Executive summary

The current surge of renewables take-up means important technical changes are needed across modern power systems. The variability of wind and solar at times of peak electricity demand calls for new solutions to power production and consumption balancing. Gas is often presented as a turnkey and efficient answer, and pushed as an obvious resource by the fossil gas industry.

Despite this presentation as a “must-have” for power system flexibility, gas plants are limited in the support they can offer to the daily or weekly variability of renewables. Former open cycle gas turbines (OCGTs) have given way to combined cycle gas turbines (CCGTs) with improved efficiency, reduced greenhouse gas (GHG) emissions, higher profitability, and lower levels of pollutants. But CCGTs are designed to provide secure and stable baseload generation[1] and are less responsive than OCGTs that are better suited to peakload.

Nevertheless, the advance in renewables means CCGT gas plants are increasingly engaged as peaking power plants[2] regardless of their inefficiency for peak demand and the resulting increase in maintenance costs, lower lifespan, profitability risks, and rise in emissions.

Along with this, governments and plant operators have resorted to costly financial mechanisms to secure the profitability and take-up of CCGT gas plants as a variability solution, with these costs being supported by households, companies, and states.

An additional issue is that gas turbine producers are struggling to supply turbine orders, with a large number of new gas plants being postponed for several years. The current state of the supply chain undermines plant development and further questions the future role of fossil gas in the power system.

Meanwhile, existing technologies have already proven their ability to provide sustainable, less expensive, and more efficient flexibility to the grid compared to gas. These include battery storage, hydro-pump storage, improved interconnections, and grid-enhancing technologies. To mitigate climate change and limit global warming to 1.5°C, and to improve air quality and protect billpayers, these solutions must be deployed quickly and at large scale.

It is the role of financial institutions to grasp this crucial issue for the decarbonization of the power system and redirect support from fossil gas plants to sustainable, flexible technologies.

[1] Baseload is the amount of power made available by an energy producer (such as a power plant) to meet fundamental demands by consumers. It provides coverage for steady power consumption without significant variations.

[2] Peakload is the amount of power expected to be provided at a significantly higher than average supply level over a sustained period. Peak demand fluctuations may occur on daily, weekly, monthly, seasonal, and yearly cycles.

Introduction

The role of fossil gas plants in the power system is frequently debated. The significant increase in deployment of renewables is changing the balance of technologies in electricity production, requiring greater flexibility. While coal and nuclear power plants provide very low flexibility, gas power is portrayed by its proponents as necessary to support the integration of renewables and ensure grid flexibility. The gas industry is using the argument of gas power "flexibility" to justify the development of new plants and the promotion of fossil gas as a "bridge fuel" for the energy transition.[3]

This paper examines the potential of gas plants to support a renewables-based power system and the consequences of such a strategy in terms of durability and cost.

1. Flexibility needs

The flexibility of a power system is defined by its ability to respond to changes in demand and supply. Electricity demand inherently fluctuates with the power needs of households, businesses, and industry. It usually follows general patterns across days, weeks, seasons, and years, but is not totally predictable because of the influence of the climate and weather conditions. At the same time, electricity production is also highly dependent on climate and weather conditions due to the increasing use of renewable sources of energy. Ensuring grid stability by consistently matching demand and supply is one of the main challenges related to the surge in grid-connected renewables.

Flexibility needs for the power system are divided into different categories:

- Within a day: variations between the hours of a single day. Solar photovoltaic (PV) generation in particular leads to significant fluctuations in residual consumption between day and night.
- Within a week: variations between the days of a single week. Total consumption – and thus residual consumption – varies greatly between weekdays and weekends. In particular, wind power generation can exhibit sudden changes from one day to the next.
- Weekly: variations between the weeks of a single season (summer or winter). These variations are mainly due to weather conditions (sunlight, wind).
- Seasonal: variations between seasons. Main variations occur between summer and winter.
- Annual: variations from one year to the next. These variations depend in particular on meteorological conditions (temperature levels compared to averages, wind power generation levels, etc.).

While the use of fossil fuel, nuclear, and hydro energy provides (to some extent) dispatchable power generation, the introduction of additional renewable energy sources – intermittent and

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[3] Total Energies, [CCGTs, flexible installations that complement renewables to contribute to the stability of the electricity grid](), March 2025
ENGIE, [La nouvelle centrale turbine gaz-vapeur de Flémalle](), October 2025

non-monitored – increases the need for flexibility within a day, a week, and between weeks.[4] Gas plants are often presented as the ideal solution to fill the flexibility gap. However, looking further into the details of different gas turbine technologies and the characteristics of gas plants reveals the significant limitations of fossil gas as a bridge fuel.

2. Gas plant technologies

With the share of coal in the global electricity mix decreasing over the past ten years – from 38.7% in 2015 to 34.1% in 2024[5] – fossil gas has been presented by its proponents as a necessary fuel in the energy transition and the bridge between coal decline and renewables take-up. A significant number of new gas plants are planned or currently under development, totaling more than 1000 GW of additional capacity in 2026 worldwide.[6] As a result, the share of fossil gas in the global electricity mix remains steady – around 22% – despite the ramping up of sustainable sources of energy, mainly solar and wind, which together increased from 3.5% of the global electricity mix to 15% between 2015 and 2024.[7]

Two main gas plant technologies are currently in use or being developed:
- OCGT: open cycle gas turbines
- CCGT: combined cycle gas turbines

An OCGT is the "basic" form of gas plant and consists of a gas turbine powered by a mix of fuel and compressed air burned in a combustion chamber. The turbine runs a generator which produces electricity. As the heat produced during combustion is lost due to the absence of a recovery system, the system is classified as an open cycle.

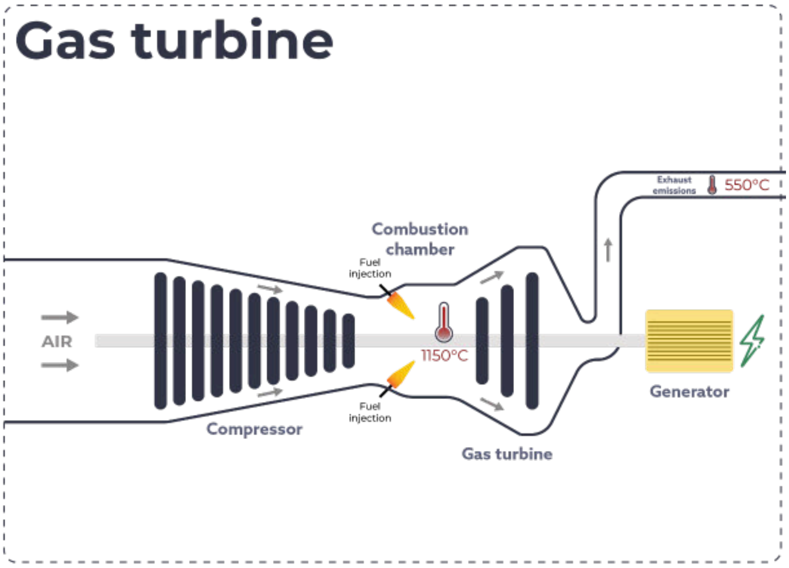

Figure 1: Schematic of OCGT power generation

[4] RTE, Bilan Électrique 2023 Rapport Complet, 2023
[5] Ember, Electricity Data Explorer, accessed November 2025
[6] Global Energy Monitor, Global Oil and Gas Plant Tracker, January 2026 release
[7] Ember, Electricity Data Explorer, accessed November 2025

Figure 2: OCGT power station

The efficiency of modern OCGTs is typically around 35-45% at maximum load, dropping quickly at partial load.[8] Thanks to their basic design, OCGTs are quite agile, with a fast response time to reach full power – from 2 to 10 minutes. They also require lower upfront costs than CCGTs. As OCGTs are less efficient, more fuel is required per unit of power output, and greenhouse gas (GHG) emissions are high. Both of these things result in an important operational cost. Their lower efficiency also involves increased emissions per MWh of nitrogen oxide (NOx), carbon monoxide (CO), volatile organic compounds (VOCs), and particulate matter (PM).

A CCGT consists of an OCGT combined with an additional steam turbine that uses the waste heat from the gas turbine's exhaust gases. These hot gases pass through a recovery system which uses the heat to warm up water and produce steam. The steam runs a steam turbine, which generates additional electricity through a second generator.

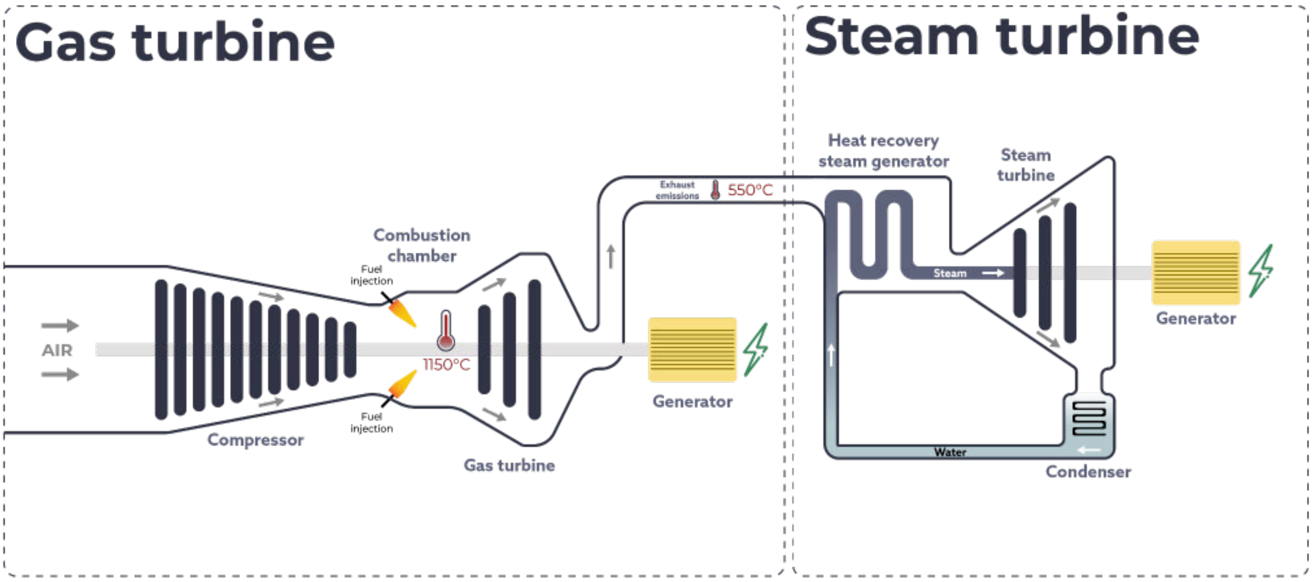

Figure 3: Schematic of CCGT power generation

[8] Ipieca, IOGP (International Association of Oil & Gas Producers), Open-cycle gas turbines (2022), November 2022

The overall efficiency of a CCGT is up to 65%.[10] The increased complexity of CCGTs compared to OCGTs implies larger installation, more challenging operation and maintenance, and higher inertia. CCGTs have an increased response time to reach full power – from 1 to 3 hours for a hot start to 4 to 12 hours for a cold start[11] – and higher upfront costs. With improved fuel consumption and lower GHG emissions (350–400 gCO2/kWh), the operational costs of CCGTs are lower than those of OCGTs. In the long run, the profitability of CCGTs are higher than OCGTs.

	OCGT	**CCGT**
System	Gas turbine	Gas turbine + steam turbine
Efficiency	35-45%	Up to 65%
CO2eq emissions	500–700 gCO2/kWh	350–400 gCO2/kWh
Lifetime	25–30 years[9]	
Response time	2 to 10 minutes	1 to 3 hours (hot start) 4 to 12 hours (cold start)
Optimal use	Peakload	Baseload

Table 1: Comparison of OCGT and CCGT key criteria

[9] U.S. Energy Information Administration, Electric generators plan more natural gas-fired capacity after few additions in 2024, June 2025
The design lifetime of CCGT units is typically 25–30 years. However, with comprehensive maintenance, component replacements, and strategic upgrades, their lifetime can be significantly extended.

[10] Ipieca, IOGP (International Association of Oil & Gas Producers), Combined-cycle gas turbines, November 2022
[11] A cold start is an initial startup following a relatively long period of the plant not running – turbine and auxiliary components are at or near ambient temperature. A hot start occurs when the plant is on continuous duty and the turbine and auxiliary components are still at, or are close to, normal operating temperature and pressure profile.

3. Gas plant usage and limits

OCGTs are mostly used for specific industrial applications with important size and complexity constraints (they are small with a low level of complexity) and quick startup needs – such as pipeline fossil gas compression/boosting stations in the oil and gas industry. In the power system, they are mainly used for peaking applications, providing variable and intermittent power when power demand rises quickly. Thanks to their rapid response time of 2 to 10 minutes, OCGTs are suitable to ensure peakload demand – i.e. when significant power demand variation calls for a fast response in the power supply.

Due to the low efficiency of OCGTs, plus their high running costs and high emissions levels, CCGTs are now the preferred technology. Most new gas plants in planning or development are CCGTs – they represent more than 70% of gas plant capacity under development in 2026.[12] CCGTs provide secure and stable baseload generation but are less suitable for peaking applications. However, despite their specific design involving more complexity and inertia, and regardless of the surge in renewables take-up to which they are less adaptive, CCGTs are now generally built expressly for the provision of "flexibility" in support of renewables integration in the power system.

The catch…

CCGTs are composed of a gas turbine combined with a steam turbine. Unlike gas turbines, steam turbines cannot endure quick power modulation. In a CCGT, the gas turbine is made of more heat-resistant – and more costly – materials than the steam turbine because it is subject to higher absolute temperatures and temperature changes than the steam turbine (more than 1000°C versus 500°C). By contrast, a steam turbine needs to follow a rate of increase of 50°C per hour to reach its functioning temperature, strongly limiting a CCGT plant's capacity to quickly increase its functioning temperature (~10 hours to reach 500°C).[13]

Frequent and quick cycling of a CCGT therefore imposes severe thermal loads on the steam turbine due to thermal gradients. This causes premature ageing of its components, increases maintenance costs,[14] and reduces profitability. Furthermore, when running at low load factors,[15] plant efficiency collapses, increasing both fuel cost per unit[16] and emissions pollution. When taking all cost components together –- fuel cost, performance factor, electrical costs (station service), start maintenance adder, and additional labor costs – the average cold start costs 1.5–3 times more than the average hot start.[17]

[12] Global Energy Monitor, Global Oil and Gas Plant Tracker, accessed January 22, 2026
[13] This pace can be increased, but at the expense of the durability and profitability of the plant.
[14] Yuan Kang Wu, Yi-Wen Wang, Literature Review Concerning the Cycling Cost in a Power System with Renewable Power Sources, January 2019
[15] Load below 50%.
[16] IRENA (International Renewable Energy Agency), Innovation landscape brief: Flexibility in conventional power plants, 2019
[17] M. Hermans, E. Delarue, Impact of start-up mode on flexible power plant operation and system cost, June 2016

In short, the suitability of CCGTs for power system flexibility within a day, a week, and between weeks is severely limited and occurs at the expense of their lifespan and profitability.

Besides costs, maintenance, and reliability issues, increased cycling of CCGTs also negatively impacts emissions. Since a CCGT steam turbine cannot be completely turned on during startup before reaching a threshold temperature, the plant initially runs like an OCGT, resulting in increased CO2 and emissions pollution.[18]

Overall, during the startup and shutdown phases, and under part load operations, NOx, CO, and VOC emission levels increase, potentially exceeding admissible and/or legal limits when all functioning phases are taken into consideration.[19] Thus, when CCGTs are used to respond to peak demand, their CO2 emissions savings are reduced while air pollution is increased compared to when they are used for baseload demand or compared to OCGTs.

The limits and negative effects of CCGTs for peaking applications are intrinsic to their structure, and therefore true regardless of the type of fuel used to power the plant – fossil gas, so-called “biogas”, or hydrogen (H2). A plant conversion to biogas or H2 is not a viable solution to the problems.

4. Costly mechanisms to support gas plants

As the integration of renewables in the power system progressively increases, fossil gas will gradually play a comparatively minor role in electricity production.[20] Gas plants are now more frequently responsible for peakload generation, ensuring production matches demand when electricity generation from other energy sources – notably renewables – is too low. A consequence of this is a reduction in the runtime of gas plants, while the development of other peakload technologies (storage, demand side management, grid services) is further shrinking the market share of gas.[21] The overall effect for owners and operators is that their gas plants are becoming less profitable.

In response to this, some countries have set up compensation mechanisms to guarantee gas plant profitability and to keep them ready to run on demand – such as capacity mechanisms in EU countries,[22] and also in the US and South America. Capacity mechanisms are financial support measures designed to ensure reliable options for a secure supply of electricity are available at all times. They remunerate energy suppliers for available capacity, even when it is not running. These measures can cover all controllable sources of power generation – nuclear,

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[18] R. J. Bass, et al., The impact of variable demand upon the performance of a combined cycle gas turbine (CCGT) power plant, Energy, Volume 36, Issue 4, April 2011

[19] J. J. Macak III, Evaluation of Gas Turbine Startup and Shutdown Emissions for New Source Permitting, October 2005

[20] Ember, European Electricity Review 2024, February 2024

[21] Dialogue Earth, Why do natural gas investments so often fail?, December 2023

[22] In Europe, six countries (the UK, France, Italy, Poland, Belgium, and Ireland) have market-based capacity remuneration mechanisms (CRMs) in operation. Three countries (Germany, Sweden, and Finland) have established strategic reserves (SR), where reserves are placed outside of the electricity market and paid for by the central authority.

coal, fossil gas – as well as hydropower, storage, and demand side management. In reality, however, they mainly benefit gas plants.

In Europe between 2015 and 2024, fossil fuel-based power plants were the main recipients of the EU's capacity mechanisms, receiving 53% (€47.7 billion) of total payments (€90 billion). Of this, 48% of payments (€43.5 billion) were delivered to fossil gas plants.[23] The main fossil gas owners and developers in Europe, such as EP Group, Orlen, PGE, and Enel,[24] were paid to keep their gas plants on standby. Additionally, to minimize their exposure to electricity market volatility and to stabilize capacity prices, long-term contracts have been developed – from 10 to 17 years in European countries. Since new build projects are receiving long-term contracts in most capacity markets, some gas plants are now subsidised beyond 2040. The resulting picture is that fossil gas will continue to lead in subsidy payments via long-term contracts until 2035, increasing the risk of fossil fuel lock-in and delays to the decarbonization of the power system.[25]

Capacity markets like Europe's are generally funded via levies and tariffs paid by electricity consumers. Consumers are therefore financing the continuation and development of non-profitable fossil gas assets to the detriment of renewable technologies that would lower their energy bills.[26]

5. Gas turbine shortage

Beyond the technical limits of CCGTs in providing efficient support to renewables, fossil gas plant developments are facing another challenge. New projects are being delayed or withdrawn due to a shortage of turbines – new facilities such as data centers and factories are driving up demand for gas power[27] and creating a supply chain bottleneck. Gas turbine manufacturing is a concentrated industry, with three companies dominating – GE Vernova, Siemens Energy, and Mitsubishi. Together they account for more than 70% of gas turbine production capacity and are struggling to satisfy current demand.[28] At the end of 2025, GE Vernova clients expected to wait until 2030 for their orders, while Mitsubishi's order book is more or less full until 2027-28. The increased demand has also impacted turbine price: a new CCGT gas plant now costs about US$2,600 to US$2,800 per kilowatt compared to US$800 per kilowatt in 2021.

As a consequence, many power utilities have postponed or canceled new gas plant projects. For instance, ENGIE has withdrawn two projects in Texas despite low-interest loan conditions,

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[23] The Green Tank, Brief: Who pays for the cost of capacity mechanisms? The European example and Greece's options, June 2025

[24] Beyond Fossil Fuels, Paid To Pollute: Fossil Fuel Companies Bag €21.4 Billion In Power Bill-Funded Gas Plant Subsidies, June 2025

[25] ACER (European Union Agency for the Cooperation of Energy Regulators), Security of EU electricity supply: 2025 Monitoring Report, November 2025

[26] The Green Tank, Brief: Who pays for the cost of capacity mechanisms? The European example and Greece's options, June 2025

[27] Latitude Media, Where does gas fit in the puzzle of powering AI?, March 2025

[28] Bloomberg, AI-Driven Demand for Gas Turbines Risks a New Energy Crunch, October 2025

citing "equipment procurement constraints."[29] Wattbridge Energy and Constellation Energy, two American power producers who answered the call for similar projects, followed for the same reason.

The current gas turbine shortage is effectively restricting the short- and mid-term potential for new gas plant development. This further increases the risks of banking on fossil gas to meet growing global power demand.

6. How to ensure grid flexibility without gas

The argument that gas is the only "partner" for renewables is increasingly challenged by a mix of sustainable and more competitive flexibility solutions. Storage systems, demand side management, improved interconnections, and grid-enhancing technologies are already proven to be efficient in providing flexibility to the power system.

6.1 Energy storage: from instantaneous to long-term

By using the oversupply of renewable sources when power demand is low, storage decouples production from consumption, mitigating the impact of intermittency.

- Battery energy storage systems (BESS). These are unbeatable for short-duration flexibility (minutes to 4 hours). Their millisecond response time makes them superior to any gas turbine for frequency regulation.
- Pumped hydro storage (PHS). This is the most mature mass storage solution, capable of managing daily and weekly flexibility cycles at a large scale. When renewables are producing more power than needed, the surplus generation is used to pump water from a low reservoir to a high reservoir ready for later use with a turbine to produce power.[30]

6.2 Demand side response (DSR)

Flexibility is no longer just about supply; it is about demand. Through the development of smart grids, consumption can be shifted to match periods of high renewables production.

- Electric vehicles (EV) charging management. This synchronises vehicle charging with peak solar or wind output.
- Industrial load shifting. This incentivizes industries to pause energy-intensive processes during grid stress events.

6.3 Interconnections and geographic smoothing

Interconnections determine the power exchange capabilities between neighbouring countries. For instance, the integration of the European power grid allows for the smoothing of intermittency – since weather patterns vary across the continent, interconnections allow

[29] Latitude Media, Engie's pulled project highlights the worsening economics of gas, February 2025
[30] U.S. Department of Energy, What is Pumped Storage Hydropower?, accessed January 2026

surplus energy from one region to be exported to another. This reduces the need for local fossil fuel-based backup.

6.4 Grid services and stability

Maintaining constant frequency and stable voltage in a power grid is key to ensuring the reliability of supply. Traditionally, large rotating power plants – coal, oil, fossil gas, and nuclear – contribute to maintaining grid stability by providing mechanical inertia through the heavy rotating masses of gas turbines. Today, the grid is moving towards inverter-based resources (IBR) as a replacement to the traditional fossil fuel- and nuclear-based system. These new systems, coupled with advanced software, provide "synthetic inertia" and fast frequency response (FFR). Unlike CCGTs, which require significant startup time, these electronic systems can stabilize grid frequency in a fraction of a second, offering a superior level of reliability for modern power systems.[31]

A combination of these sustainable solutions along with the expansion of renewables like solar and wind supports the creation of optimal conditions for flexible and responsive power systems. These developments are efficient and cost-effective alternatives for power system flexibility compared to fossil gas plants and must be developed as a priority to mitigate climate change, decrease air pollution, and provide affordable electricity to consumers.

[31] OPAL-RT Technologies, An engineer's guide to inverter-based resources in power systems, June 2025

Conclusion

Fossil gas plants – especially the more developed technologies of CCGT plants – are seriously limited when it comes to providing flexibility in support of electricity demand coverage in a renewables-based power system. Their use for peakload applications is a financial, health, and climate risk, while the significant cost of capacity remuneration mechanisms that ensure their profitability falls on consumers and taxpayers. The gas industry portrays fossil gas as a "bridge fuel" for the energy transition and is pushing for gas plants to be used as backup to a renewables-based power system. But this narrative will lead to fossil fuel lock-in and decarbonization delays, and must be disclosed to avert these avoidable outcomes. The current gas turbine shortage is another incentive to back away from gas.

Reliable, sustainable, and cheaper power system solutions – storage systems, demand side management, interconnections, and grid services – have proven their ability to efficiently respond to peakload demands. Instead of fossil gas plants, these technologies must be developed quickly and at large scale to mitigate global warming, reduce air pollution, and lower electricity bills.

What it means for financial institutions

Based on the various issues and risks posed by fossil gas plants, and the availability of reliable and sustainable alternative solutions for power system flexibility, banks should adopt robust gas power policies[32] to immediately:

- End all dedicated financial support for new gas plant projects.
- Adopt time-bound restrictions for companies involved in gas power expansion, conditioning further financial services against:
  - the immediate end of gas power development;
  - a public commitment by January 2027 to phase-out gas power at a pace compatible with the objectives to decarbonize the power sector by 2035 in OECD and European countries, and by 2045 in the rest of the world*;
  - a detailed asset-by-asset closure timetable (without selling or converting to alternative fuel) by January 2028 that is compatible with the objective to decarbonize the power sector by 2035 in OECD and European countries, and by 2045 in the rest of the world.[33]

Simultaneously, banks should significantly increase financial support to sustainable solutions such as batteries, interconnections, and power grid enhancements, along with financial support for solar and wind power generation.

[32] Reclaim Finance, Recommendations for banks 2025, Banks, See all our recommendations, p.28 – specific recommendations for gas power, 2025
[33] 2040 in China and 2045 in other countries outside of OECD and European countries.