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For a Market Design that Supports Security of Supply and Adequacy

The current energy crisis was created by the low availability of different energy sources and technologies, combining in a perfect storm. As the electricity system decarbonises, gas power plants running on renewable fuels will continue to be an important part of the solution to the energy “trilemma” of ensuring reliable, affordable and decarbonised energy.

It is therefore important not to mix up short-term measures aiming at limiting the impact of the current crisis with long-term measures, which should make the power and energy system fit for net-zero.

In this paper, we first remind about the role of gas power plants in a net-zero energy system and then propose some building blocks for an electricity market design that supports flexible and firm capacity. Our aim is to help build a power system that is reliable and safe while offering consumers the lowest possible prices.

Key messages

- **Gas power plants provide firm, low-carbon electricity, and heat.**
- **The need for flexible and firm capacity is growing, and dispatchable gas power plants are there to fill short- and long-term gaps.**
- **Short-term markets are essential to ensure cost-efficient dispatch of generation and flexibility.**
- **Long-term markets and price signals need to be improved and further developed.**
- **Capacity mechanisms are the most efficient option to ensure system adequacy.**
- **European grids and markets require better remuneration of grid services.**

EUGINE
European Engine Power Plants Association

Transparency Register
ID number 033807913798-84
www.eugine.eu

EUTurbines
European Association of Gas and Steam Turbine Manufacturers

Transparency Register
ID number: 75093131694-63
www.euturbines.eu

Boulevard A. Reyers 80
1030 Brussels
Belgium
Phone +32 (0)2 706-8212
Fax +32 (0)2 706-8210

giovanna.tanda@eugine.eu

Lyoner Str. 18
60528 Frankfurt am Main
Germany
Phone +49 (0)69 6603-1936
Fax +49 (0)69 6603-2936

julia.luna-peter@euturbines.eu

The role of gas power plants in a decarbonised energy system

Gas power plants provide flexible, firm, low-carbon electricity and heat

- Engine- and turbine-based power plants can run on a variety of gases, including biogas, biomethane, hydrogen and their derivates. Other solutions to decarbonise gas power plants, such as post-combustion capture of CO2 (CCUS), exist and are commercially and technologically available.
- Engine and turbine power plants are flexible in their operation and offer important and complementary technical capabilities (read more on the advantages of engine power plants and on turbine technology). They can be activated depending upon system requirements to balance the system in the short-term (within minutes) and the long-term (meeting seasonal demand variations).
- When running as cogeneration plants, engine and turbine power plants produce both heat and electricity and are used in a variety of applications, from households (behind-the-meter generation) to district heating and in industrial applications.
- Engine and turbine power plants provide firm capacity, that is, they can be operated whenever and for however long needed. They also provide auxiliary grid services and thereby help system operators maintain grid frequency and system adequacy.
- Their technical characteristics allow them to participate in all energy markets, providing energy and system services that cannot be delivered to the level required by variable capacity. They therefore allow the system to efficiently absorb increasing shares of intermittent generation. They also play an important role in emergency back-up solutions.
- Flexible, decentral power and cogeneration plants connected to the distribution level can provide local flexibility and can quickly react to market needs, enabling the system to quickly adapt to changes in demand. They are an essential tool to make local networks more reliable and resilient as the share of decentralised, variable generation loads grows.

Engine and turbine power plants produce both heat and electricity and are used in a variety of applications, from large-scale to decentralised generation as well as in industrial applications.

The need for flexible and firm capacity is growing, and dispatchable gas power plants are there to fill the gaps between demand and renewable production

- With growing shares of variable generation, as well as the introduction of new forms of load driven by the electrification and decarbonisation of the transport and heating sectors, the volatility in the electricity supply-demand balance is increasing, requiring significantly higher system flexibility (see ACER Final Assessment of the EU Wholesale Electricity Market Design, Artelys/European Commission Report on Mainstreaming RES: flexibility portfolios).
- The IEA World Energy Outlook (WEO) 2021 estimates that, even as gas power generation on an annual basis decreases in the EU and the US, peak generation (equal to installed capacity) will need to be 10-15% higher in 2030 than in 2020. This needs the availability of firm and reliable capacity during peak demand periods.
- ENTSO-E sees hydrogen power generation as the most promising technology to ensure generation adequacy in periods of low variable renewables (wind, sun) supply.
- In their modelling in a climate-neutral power system in 2035, the German think-tank Agora Energiewende estimated that, in Germany alone, 119 GW of flexibility options, including storage and demand response, will be needed in 2030, of which 61 GW will be provided by H2-ready gas power plants (running as much as possible on hydrogen).

Even as gas power generation on an annual basis decreases, peak generation from firm capacity will need to be 10-15% higher in 2030 than in 2020.

A market design supporting flexible and firm capacity

Short-term markets are essential to ensure cost-efficient dispatch of generation and flexibility

- Short-term markets such as spot (day-ahead and intra-day) and balancing are essential to provide near-delivery price signals for both generation and flexibility. These price signals ensure that capacity is available at moments when it is needed the most.
- In most countries, the role of short-term markets in setting final consumer (retail) prices today is too dominant. The links between short-term wholesale market prices and consumer (retail) prices should be carefully examined.
- While price peaks on the spot market provide helpful price signals, it has to be ensured that their negative impact on consumers stays limited. This will not be achieved by disconnecting gas power plants from wholesale markets but by reviewing the way consumer prices are formed. The presence of gas power plants in spot markets is and will be essential to ensure the grid operates flexibly and reliably, whilst keeping prices at an affordable level during demand peaks.
- Nevertheless, investments in firm capacity are impacted by issues such as the low spread between marginal costs and prices. Price volatility and the ensuing market interventions have led to reduced attractiveness for long-term investors and impact capital costs. From an investment perspective, the share of long-term contracts, including power-purchase agreements (PPAs), capacity mechanisms and others, needs to increase.

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Long-term markets and price signals need to be improved and further developed

- Long-term markets and price signals, essential to drive investments in adequacy and long-term flexibility, need to be improved and promoted. Large H2-ready gas power plants as well as post combustion capture of CO2 on gas assets are capital-intensive projects. With a decreasing number of running hours, their cost-structure will further shift towards capital expenses, away from operating costs.

- As noted by ACER, long-term markets lack liquidity, particularly beyond three years in the future. Long-term (forward) markets can be further developed by increasing competition and cross-border trade.
- Reliable income streams from long-term contracts are a necessary complement to the less predictable spot market income, providing a basis for investments in new capacity, both for renewables and flexible generation.
- Long-term contracts include power purchase agreements (PPAs). They should be further promoted both for low carbon power and heat generation as well as for renewables and firm capacity.

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Capacity mechanisms are the most efficient option to ensure system adequacy

- In the context of unpredictable short-term income streams and inadequate longer-term price signals, capacity remuneration mechanisms are the most efficient way to ensure that system needs are met, and prices are kept below the maximum level of the cost of energy not served (which can potentially reach tens of thousands of euros). (Further in Schittekatte and Meeus, 2021)
- Capacity mechanisms should however not just promote any capacity but capacity that matches energy and grid needs. This includes capabilities like adequate flexible load adaptation and minimum duration of supply but also a location that helps resolve grid constraints.
- Capacity mechanisms should not any longer be regarded as a solution outside of the market to temporarily fix adequacy gaps, but rather as an integral market segment, where reliable capacity is traded. These markets could also integrate other system needs, namely flexibility and grid (ancillary) services, leading to national or EU-wide "resilience markets".

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European grids and markets require appropriate remuneration of grid services

- The efforts to integrate European markets should not be abandoned. As shown by ACER, “cross-border trade delivered 34 billion Euros of benefits in 2021 while helping to smoothen price volatility”. In addition, the Clean Energy Package needs to be fully implemented.
- Current European markets do not consider physical network (transmission grid) constraints. While optimizing day-ahead and intra-day dispatch, the current market set-up leads to very high redispatch costs and thus inefficiencies. Locational price signals and a pro-active utilisation of redispatch costs could help remediate this issue.
- The need for grid (ancillary) services such as frequency control, reactive power control, short circuit power, inertia, black start capability, etc. will be growing as electricity supply becomes more dependent on intermittent renewable energy sources. Member States should work to implement and support cost-efficient and market-based procurement of those services, many of which are still provided as free or mandatory “add-ons” by large power generators today.

Member states should work to implement and support cost-efficient and market-based procurement of grid services.

Learning from the present — increasing renewable and firm capacity as the way forward

There is wide consensus on the fact that gas power plants, running on renewable fuels or abated with carbon capture, will still be needed beyond 2030 and in a fully decarbonised system. While their running hours will decrease, gas power generation will still play an essential role to provide residual load and heat during periods of low renewable energy supply, in flattening the supply and demand curve and, therefore, in reducing extreme price peaks.

The current energy crisis, originating in an unprecedented disruption of fuel supplies, foreshadows what could happen in a future situation of severe supply shortages. Unsurprisingly, the solution to supply shortages is to reduce consumption and build up capacity in all power generation technologies, including gas power generation running on carbon neutral fuels.

The construction of the decarbonised power system and markets starts now. We hope the European Commission and Member States will be up to the challenge. We stand ready to contribute.

EUGINE is the voice of Europe's engine power plant industry. Our members are the leading European manufacturers of engine power plants and their key components.

Engine power plants are a flexible, efficient, reliable and sustainable technology, helping to ensure security of electricity supply and providing (renewable) electricity and heat.

For more information please see www.eugine.eu

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EUTurbines represents the leading European gas and steam turbine manufacturers.

EUTurbines advocates an economic and legislative environment for European turbine manufacturers to develop and grow R&I and manufacturing in Europe and promotes the role of turbine-based power generation in a sustainable, decarbonised European and global energy mix.

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