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SEE ENERGY BRIEF

Monthly Analysis

Europe's New Electricity Market Design and
the Decoupling of Electricity and Gas Prices



Introduction

The current dramatic increase in electricity prices throughout the EU has proved the inadequacy of the current market design of the electricity market, mainly based on the marginal cost of the most expensive source which now is natural gas. This market design, known as “Target Model”, was adopted to enhance the development of renewables when the latter were at an initial stage. Now, however, the energy crisis has underlined the need to decouple electricity prices from soaring gas prices and to adopt a new market model which distinguishes between resources that operate when available and not on-demand and on-demand resources, based on their respective contribution to the electricity mix. This could ensure roughly 50% of lower electricity prices, given that on-demand sources (such as natural gas, nuclear and coal) have a 60% share of the electricity mix, a share that will continue to decline as the energy transition accelerates.

The Need for Redesigning the Electricity Market Model

Since the summer of 2021, the unprecedented hike in natural gas prices in Europe has contributed to a dramatic increase of electricity prices. During the winter of 2021-2022, natural gas prices remained five times higher than in the previous years. In consequence, the wholesale electricity prices more than quadrupled during the same period without any clear sign of de-escalation in the near future. (1)

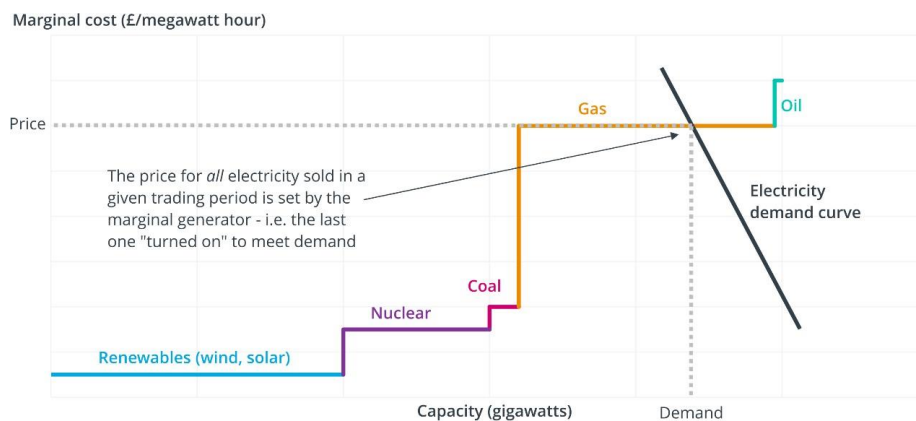
Power generation from natural gas in EU member states represents less than 20% of the total; nonetheless, natural gas constitutes the main marginal price setter. Since gas-based generation is necessary most of the time to balance the system and to provide ancillary services, the most expensive generator (hence the price setter) depends on natural gas. Thus, in more than 2/3 of cases, the wholesale electricity market clearing price reflects the natural gas cost. For example, for a natural gas price of €100/MWh and €80/tCO₂ EU ETS, the wholesale market electricity price is around €220/MWh.

However, the real total average cost of electricity is significantly lower. Nuclear, renewables and hydro, producing almost two-thirds of the total power in EU member states, have a total levelized cost, including capital costs, below €100/MWh. Any revenue above such total costs constitutes an extra profit, which would not have been paid in a well-functioning market. In other words, the total average cost of power generation is systematically roughly 50%-60% less than the marginal cost. Nonetheless, it is the latter that drives market-clearing prices and determines retail prices which households and businesses pay.

The “low or zero marginal cost power resources” cover the largest part of power generation already today, while their contribution to the electricity mix is expected to considerably increase in the coming years. These resources cannot generate power on demand, i.e. they generate power when they are available, and cannot

respond to market signals. Also, they are usually built based on public or private power purchasing agreements, meaning Contracts for Differences (CfD) remunerating the power technology at their total levelized cost over a sufficient period in the future. In this way, these resources get the lowest possible cost of capital, which is important since their financial structure is almost exclusively capital expenditure. Therefore, the extra profits they may get from wholesale markets, as happened last year, due to the uncertain and volatile price setting of natural gas, will hardly facilitate additional investments in such technologies.

Figure 1: Illustration of the “Merit Order” of Generators in the European Wholesale Electricity Market



Source: UK Institute for Government

Therefore, remunerating all resources (including those with zero marginal costs) based on natural gas prices entails an unnecessary additional cost for consumers and an inefficient market. The current electricity market design fails to incorporate the developments in the renewable energy sector, because, contrary to the long-lasting cheaper gas-based power generation, from now on electricity generated from renewable energy sources (RES) will be much cheaper. It is evident that a market designed to apply marginal cost pricing does not fit the purpose when the system is dominated by low carbon and zero marginal cost resources. This leads to a systematic market failure: marginal costs persistently stay above total average costs and there is no way to make them converge, which is exactly what a well-functioning market must do.

Towards Revised Electricity Market Design Principles

The fundamental economic principles are twofold:

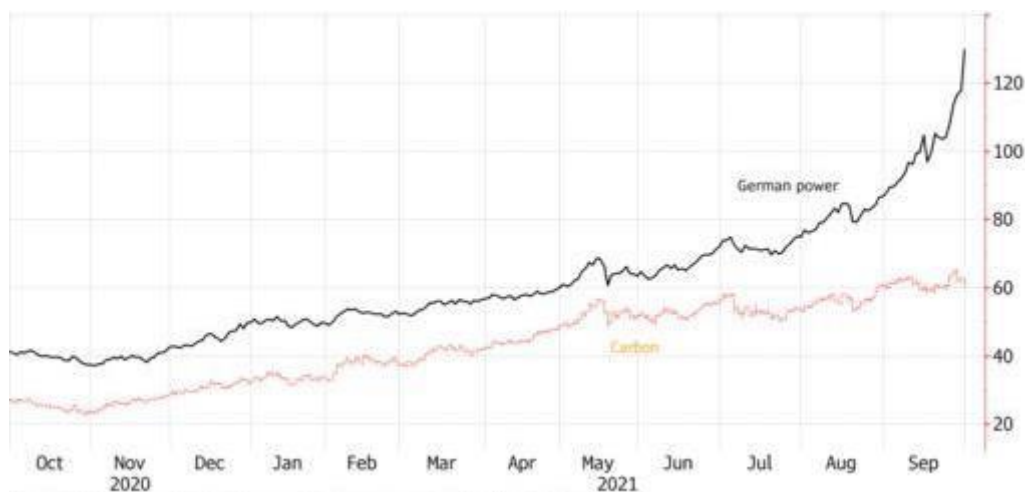
- (a) Remuneration based on CfD (contracts for differences) with prices reflecting total levelized cost is the suitable financial instrument for enabling nuclear, renewables and hydro investment and for bringing up to consumers the low-cost benefits

- (b) Remuneration reflecting scarcity and marginal costs is suitable for resources deployed on-demand to balance the system, provide ancillary services and complement the eventual non-availability of renewables.

The resources that require CfD-based remuneration have the following features: (1) Operate when available, depending on technical and resource characteristics, and not on-demand, (2) Capital expenditure dominates their cost structure, (3) There are no changes in unit cost when increasing or decreasing their operation. Resources with such features are renewables, nuclear, high-efficiency co-generation, and mandatory hydro. In addition, the same category includes electricity storage bundled with intermittent renewables.

The resources that can be included in a spot market in which marginal costs drive market-clearing prices are the fossil fuel plants, hydropower plants operating at peak load times, demand response and electricity storage (unbundled from RES). Such resources are dispatchable and operate on-demand. Also, they incur marginal cost variations when modifying their operation level. Therefore, cost-minimization requires defining a merit order based on increasing marginal costs. Also, the eventual scarcity of resources on- demand (for example in case of shortages) justifies market-clearing prices to be above marginal costs.

Figure 2: In Some Markets, Electricity and Carbon are No Longer Trading in Tandem



Source: Bloomberg

According to the Council of the European Union, the new market design should be based on the following principles:

- The resources that operate when available and not on demand submit volume-based offers in the day-ahead market (DAM), not economic bids. The volume-based offers reflect the best possible forecasts of their operation on the next day. With this offer, they assume responsibility for the

realtime operation, are subject to deviation costs and can participate in the intra-day and balancing markets.

- For their volume-based offers in the DAM, these resources get remuneration depending on contracts for differences concluded with private third parties or the public sector, regardless of the DAM.
- In case these resources declare no coverage by bilateral or public contracts for differences, they may participate in a non-mandatory pool (green power pool) operated by a public body (or a private body adequately empowered) acting as a single buyer and seller to load-serving entities and consumers.
- The volume-based offers of these resources may correspond to bundled resources that may include storage and possibly an aggregation of RES plants.
- The system operator scrutinizes the volume-based offers from the perspective of forecasting accuracy and system operation possibilities and may accept or curtail the volumes declared. The eventual curtailment follows pro-rata rules.
- In the next step, the DAM considers that the accepted volumes of the above resources that operate when available and not on demand are must-take volumes. Thus, the market operator subtracts the accepted volumes from the load declarations. The remaining load (net load) corresponds to the demand that the on-demand resources must meet. Then, the resources submit combined economic and volume offers according to the same rules currently applied and the market is cleared with the same way it is cleared today.
- The load-serving entities and consumers pay at market-clearing prices for the energy purchased in the net-load DAM. They may also buy from the green power pool, if this operates. They also have payment obligations in the context of CfDs, which are independently concluded.
- The above points describe a two-stage DAM: The first stage performs the acceptance and aggregation of the volume-based offers by the resources that operate when available and not on demand. The second stage performs market-clearing of the net load (after subtracting the accepted volumes from the load) using the bids of the on-demand resources.
- The intra-day and balancing markets remain unchanged.
- Although the participants submit bids at the bidding zones, the two-stage DAM performs directly at the level of the coupled markets. The market-clearing of the net load (i.e., second stage) takes into account the interconnection constraints. Thus, the algorithm may lead to different market-clearing prices of the second stage DAM in case of congestion.
- Evidently, the suppliers and consumers pay the weighted sum of the remuneration of resources that operate when available and not on demand and the market-clearing price of meeting the net load

using on-demand resources. The former reflects the total levelized costs of the resources that operate when available and not on demand. The latter corresponds to marginal cost pricing and may reflect natural gas prices.

- Thus, if the first stage of the DAM corresponds, as today, roughly to two-thirds of electricity consumption and for example has an average cost of €80/MWh and the second stage of the DAM clears at €250/MWh reflecting gas generation costs, the consumer would pay $(2/3 \times 80) + (1/3 \times 250) = €137/\text{MWh}$, which is roughly 45% below the cost of electricity when applying the current market design.

New EU Emergency Measures to Tackle the Energy Crisis

On September 30, 2022, EU ministers agreed on new emergency measures to tackle the energy crisis, including a mandatory target to reduce electricity consumption by 5% at peak hours and two new revenue-creating levies to help protect consumers. The measures, proposed by the European Commission on September 14, aim at shielding consumers by seizing the extraordinarily profits made by some energy firms and using those to support households or help them invest in green technologies. (2)

“Our citizens and businesses are eagerly waiting for the EU to come up with concrete proposals on how to take on currently extremely high energy prices,” said Jozef Sikela, the industry and trade minister from the Czech Republic, which currently holds the EU’s rotating Council presidency. “The agreement reached today will bring relief to European citizens and companies. Member states will flatten the curve of electricity demand during peak hours, which will have a direct positive effect on prices. Member states will redistribute surplus profits from the energy sector to those who are struggling to pay their bills,” he said in a statement outlining the main elements of the deal.

EU countries agreed the proposals in around two weeks, after several meetings to hash out the details. In the end, they agreed on the three measures, but included more flexibility for member states to implement them. For instance, EU countries now have more wiggle room to meet the 10% voluntary reduction target for electricity consumption. Malta and Cyprus, being energy islands, are exempted from the 5% mandatory demand reduction target for peak consumption hours. Meanwhile, EU countries have also pushed for more freedom in implementing the two revenue measures. These include a revenue cap of €180 per MWh on cheap electricity and a “solidarity contribution” on revenues made by oil and gas companies.

While Brussels had proposed an EU-wide, uniform approach in the levies, EU countries pushed for more lenience. This includes allowing countries to “set a specific cap” on the market revenues obtained from the sale of electricity produced from hard coal. Governments will also be able to set a higher revenue limit for

producers with investment and operating costs “higher than the Union-wide cap” and exempt their chosen “supplier of last resort” from the mandatory electricity demand reduction target at peak times.

Renewable energy industry nervous

The agreement leaves the door open for EU countries to keep existing national price caps on retail electricity or set new caps and taxes on energy companies at the national level. This is making the renewable energy industry “nervous”, with some warning this could have a severe impact on long-term green investments.

Even though governments are right to protect families and businesses from rising energy bills, “what is decided today could worsen the energy crisis,” the industry body WindEurope warned in a statement on September 30, 2022. “Europe needs big investments in home-grown renewables. Everyone agrees that – and that it is the route out of the crisis. But as it stands, the emergency Regulation will put many renewables investments on hold,” the statement continues.

WindEurope argues that new taxes planned by EU governments on top of these measures would hit total revenue rather than profits and will send renewable investors fleeing to other economies, like the US. Such fears are also echoed by the solar industry, which is calling for emergency measures to accelerate the deployment of renewables. These include training to ensure enough skilled workers are available to install solar panels as well as improvements in permitting, tendering and financing procedures, said SolarPower Europe, a trade association. The final text of the regulation will apply from December 1, 2022 to December 31, 2023. The demand reduction targets will apply until March 31, 2023, while the €180/MWh cap on market revenues from electricity generators will apply until June 30.

The Greek Model

A new model for Greece’s electricity market, intended to contain soaring prices brought about by the energy crisis, came into effect on July 1, 2022 with the introduction, as a first step, of price caps in the wholesale market, setting remuneration upper limits for electricity producers of all categories. A ministerial decision set upper limits per technology used. Hence, the price for hydropower facilities was set at €112/MWh, for renewables at €85/MWh, for natural gas-fueled power stations at €253.98/MWh and for lignite-fired power stations at €206.71/MWh. These limits remained valid for the first one-month period, starting on July 1, 2022. Funds arising from the discrepancy between these upper limits and the average price of the day-ahead market were transferred to the Energy Transition Fund in order to cover subsidy support.

The government hopes its plan will subdue electricity prices to levels of between 20% and 30% higher than last summer. Calculations for a finalized electricity price per kWh, following the deduction of subsidies, will

be based on state-controlled power utility’s (PPC) new price list. The government, guided by the utility’s new price list, will set a single price for all suppliers. The level at which PPC will set the bar remains to be seen. The company’s market dominance will set a standard for the entire market.

It is considered that Greece’s model, activated last July, is more effective than the model applied by the Iberian Peninsula countries and therefore more suitable for EU wide use. The Greek mechanism sets compensation ceilings per power generation technology, while the electricity exchange market is left intact to operate normally on the basis of the System Limit Price. A summary of the main characteristics of the Greek model is shown in Table 1. The revenues recovered are used to subsidize the electricity bills of households and businesses. As to how the mechanism will be implemented, it is reportedly not clear whether it will be mandatory for the 27 EU member states or whether it will be voluntary. That is, it is up to countries to decide whether to adopt it or not. (3)

Table 1: Main characteristics of the Greek Model

Reintroduction of cost-plus price regulation for all electricity generators. Regulated prices differ per technology and revenues used to provide financial support to energy consumers	
Policy objective	To re-regulate all electricity generators and pay them on a cost-plus basis instead of on the basis of the market price for electricity
Impact on consumer prices	The measure would not reduce the day-ahead wholesale market price. The regulation would intervene ex-post. Generated revenues can be used to provide direct relief to energy consumers most suffering from the high prices (e.g., through vouchers to households, and financial support to businesses).
Impact on gas consumption	No increase is expected in gas consumption.
Impact on integrity of the Single Market and impact on security of electricity security	The measure would have a strong impact on the functioning of the internal market as it would remove any price-based competition between generators. As all generators would be regulated based on their costs, also inefficient cost structures would be paid for.
Suitability for swift implementation	Very challenging. To revert to the cost-plus regulation national regulators needs very detailed information about the different plants. This information is in many cases not available and cannot be obtained in short delay.
Budgetary cost	No direct budgetary costs.
Risk of subsidised electricity exports outside the EU	The measure is unlikely to trigger increased exports to third countries.
Impact on decarbonisation	The measure is likely to significantly impact investor certainty, which may mean support may be needed for all future electricity generation. This regulatory risk will be reflected in higher costs of capital and lower renewables deployment in future. The risk is particularly high when all revenues above the costs are clawed-back as it is the case here. The measure is likely to disincentivize the conclusion of long-term PPAs and national hedging strategies.
Conclusion	This option should not be recommended given that it would entirely remove price-based competition between different generation technologies, remunerate generators for inefficient operations and disincentivize investments in new more cost-effective technologies.

Source: Euractiv (4)

The government is also preparing to replace flat-rate electricity subsidies offered to all consumers, regardless of power usage levels, with a new subsidy model rewarding consumers using less electricity. According to government sources, a new model for electricity subsidies will be implemented on October 1 for households, professionals and businesses.

Under the new system, subsidies will be determined by an algorithm taking into account energy savings. Officials have yet to decide whether subsidies will only be awarded to consumers who have achieved specific consumption reduction targets or whether various subsidy levels offered will be inversely related to power usage.

For example, consumption levels of up to 300 KWh in a month could be subsidized by certain amount that would be reduced for consumers exceeding this monthly consumption limit. The subsidy model changes, to be made quickly, are likely to cause complications for suppliers, who are still coming to grips with the existing subsidy system and are not expected to be informed of the new plan's finalized details until just before its launch. Suppliers have already made clear that a subsidy system awarding households and businesses amounts inversely related to consumption levels would be the fairest solution.

Power producers' windfall profit tax formula unchanged

The details of a windfall profit tax imposed on the Greek power producers will remain unchanged, for the time being, despite a political agreement at the Council of EU Energy Ministers on September 30, exempting natural gas-fueled power stations from a price cap. Greek officials estimate the current formula for recovery of windfall profits earned by power producers has accumulated €2.6 billion from July until the present, sources informed, adding producers have sufficient leeway.

The same sources contended the Greek model's principles should not change as they are based on the assumption that gas-fueled power stations purchase gas that is not based on TTF hub prices, but at lower prices, while, at the same time, their offers submitted to the day-ahead market take into account higher TTF prices.

According to the agreement, a ceiling of €180 per MWh will be implemented on the earnings of all power producers of all technologies (RES, nuclear, hydropower without storage, lignite, biofuels and geothermal) except natural gas. This limit will apply until June 30, 2023. The EU energy ministers also agreed on a solidarity tax for fossil fuel producers, which, sources noted, will be set at a rate of 33% for windfall profits in 2022. This extraordinary tax will not generate tax revenues until 2023, once corporate groups have announced their results for 2022. The Greek government plans to impose this solidarity tax also on refineries, which however have expressed strong opposition.

Discussion

As Europe's electricity prices soar, the European Commission is considering that the current electricity market design is not fit for purpose. Governments are weighing market interventions such as price caps and decoupling wholesale power and gas prices.

Europe's current design is a sequence of markets, some continent-wide, where electricity providers such as power plants meet retail suppliers, large industrial customers and others. Some deals are made months or even years before electricity is delivered, as suppliers and customers need clarity over revenues and costs. The reference price for electricity and for the settlement of many long-term agreements is set on the spot market, where the physical delivery of electricity is traded for the next day. Suppliers bid according to how much it would cost to provide an extra unit of power, known as its marginal cost.

The EU plans a "deep and comprehensive" reform of the existing electricity market in order to cope with an underlying energy crisis, which become worse following by Russia's war in Ukraine. The measures include a cap on electricity producers' profits that would raise €140 billion and "cushion" consumers from high prices. As the President of the European Commission Ursula von der Leyen recently said at 2022 "State of the Union" Address, "The current electricity market design – based on merit order – is not doing justice to consumers anymore. They should reap the benefits of low-cost renewables". (5)

At present, the spot market efficiently allocates capacity and provides signals on energy scarcity, offering an incentive for investment in renewables and gas. But to guard against sustained shortfalls in capacity, and thus another price crunch, Europe's energy markets must adapt. Long-term hedging markets are not very liquid, because consumers used to see little need for price security. In the future, they will probably see more.

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