Where to go?

Assessment of market design options for the European Electricity and Gas Market

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Executive summary

The current energy crisis led policymakers to introduce several **short-term emergency measures**, but it also left room for a more in-depth discussion on the **future market design**. With a market reform on the working programme of the European Commission for the first half of 2023, the time plan has been accelerated and different market design proposals are under discussion. The goal of the European Commission is to mitigate the effect of high gas prices on power prices in the short- and the long term by increasing the share of lower cost renewables for consumers.

Different proposals have been put forward. In June 2022, the European Commission introduced the idea of the Iberian model (a gas price cap for power production) as a short-term option, and the European version of the Greek model (creating two sides of the market, that remunerate inframarginal generators differently) as a mid- to long-term solution. As an alternative, we propose to build a new market design based on the merit order, by implementing the existing regulations, and adding enhanced hedging opportunities and increased system flexibility.

We assess the three proposed market design options based on their impact on the **merit order, renewables, demand-side signals, cross-border flows, and consumer participation** and **vulnerable consumers**.

While the **Iberian model** keeps the merit order intact, it severely deprives renewables of revenue streams. Applied in the long term, this would hamper the buildout of renewables in Europe. Furthermore, the lower wholesale market price leads to an increase of power demand, therefore to higher gas consumption. As costs and benefits differ across countries, it is politically challenging to distribute the costs of the subsidy. With regard to consumer protection, it is unclear whether the benefits outweigh the costs.

The **Greek model** fundamentally changes how prices are set in the market. This has a major impact, as the price signal gives crucial information to market participants, showing levels of scarcity and guiding the dispatch. As all renewables would fall under contracts for difference (CfDs), it would put an end to market-based renewables and hamper their system-friendly design. Demand-side flexibility is crucially needed for the future power market system.

Yet, as the consumer sees an average price, incentives and signals for flexibility provision would be very weak in the Greek model. Creating separate pools for technologies, with a part of them under a regulated income stream, risks to impact cross-border trading. The less generation reacts to the cross-border price signals, the less efficient the market coupling process is.

Looking back at the last decades, a lot was achieved while moving toward a European energy market design. The integration of a pan-European energy market saved billions of Euros and ensured that electricity was used where it was most needed. This is the reason why we propose a new market design that builds on the best practices of the past decades, instead of undoing it. To make the system future-proof, we suggest to build on **the merit order-based integrated energy market**, and adopt the following measures:

1. **Implement** existing regulations
   - If all existing regulations would have been implemented, the impacts of the energy crisis would be milder, as more demand-side flexibility could have been activated.
   - Important topics to address include the increase of **cross-border flows, demand-side flexibility, the bidding zone review**, and the **integration of balancing markets**.

2. <u>Extend the **hedging** opportunities</u>
   - Incentivise fixed price long- and medium-term retail contracts, and
   - Power Purchase Agreements **(PPAs)** as long-term purchase contracts, with baseload Contracts for Difference **(CfDs)** as subsidy mechanism where needed.

3. <u>Increase the system **flexibility**</u>
   - Through the **aggregation** and **integration** of flexibility into the system, and
   - Additional **incentives for flexibility** where needed, for example through a capacity mechanism.

	Iberian model: cap the price of gas used in power generation	EU Greek model: remunerate two sides of the market differently	Keeping the merit order: future-proofing the market design
Merit Order	Limited impact in short-term, but over-incentives gas asset build-out	Model fundamentally changes how prices are set in the market. Large part of capacity would not respond to price signals	Merit order as the most efficient mechanism to coordinate demand and supply is kept, RES have price-lowering impact
Renewables	Severely deprives RES of revenue streams, reduces RES build-out	A market-based build-out of RES is no longer possible. This is a step back in market and system integration	Incentivises system-friendly RES build-out
Demand-side signals	Increases power consumption through lower wholesale price, and thus gas consumption	In absence of marginal price signal, demand response and flexibility provision is weakened	Keeping the merit order ensures that dispatch signals persist for all market participants, including the demand-side
Cross-border flows	Impacts cross-border flows and leads to need for redistribution, which is politically challenging	Less share of generation would be part of the market mechanism and therefore react to the differing price signals of the market coupling process	Integrated European market with flow-based market coupling maximises the efficiency of cross-border flows
Consumer participation & vulnerable consumers	Benefits through power price savings might not outweigh the costs of the subsidy in combination with the price cap	It is unlikely that the Greek model will contribute to lower system costs and thus ultimately benefit through lower power prices	Model protects vulnerable consumers by introducing hedging opportunities and block tariffs

1. Introduction

Europe is currently facing an unprecedented energy crisis. The unprovoked Russian invasion of Ukraine caused gas prices to skyrocket. These were further enhanced by an all-time low in available electricity generation capacity, due to unavailability of French nuclear power plants and low hydro generation. The resulting extraordinarily high gas and power prices led policy makers to introduce several **short-term emergency measures**, such as a revenue cap on electricity generation and mandatory demand reduction goals (EPICO 2022).

In addition to short-term interventions, more fundamental questions arose: **Is the current market design still fit for purpose?** How can the benefit of lower cost renewables be sustainably brought to consumers, including vulnerable consumers? How can the market design contribute to lower system costs? How can consumers become less vulnerable to price hikes, as the ones displayed in the current crises? How can security of supply be guaranteed in a more and more renewable energy system?

In the short term, the discussion focused on reducing the impact of high gas prices on the power price. For a future market design, this discussion entails more aspects. The integration of large renewable capacity while phasing out coal, and later gas, will increase price volatility and demand-side response, and hydrogen will lead to very high prices in some hours, even more than the current energy crisis. The European Commission will revise the internal electricity market design in the first quarter of 2023, therefore addressing how to design a market suitable to handle these developments. To mitigate the impact of high gas prices on power prices, the European Commission outlined an approach in a non-paper on 20 October 2022. It suggested the introduction of an **"Iberian model"** as a pan-European design option, in which the price of gas to be used in power production is capped.

It also touches upon the possibility to Europeanise the **"Greek model"**, that foresees to remunerate the two sides of the market (inframarginal and other producers) differently. This would be a mid- to long-term option mitigating the effect of high gas prices on power prices, by increasing the impact of lower cost renewables on consumers. This paper analyses the impact of the Iberian and the Greek model as the two currently discussed options and explores a third option: Building a future-proof market design based on the merit order, by securing investment in renewables, and allow for stronger long-term hedging opportunities for consumers to shield them against price spikes and volatility.

2. The Iberian Model: Capping the price of gas used in power generation

To mitigate the current impact of high gas prices on power prices, member states are discussing the introduction of an EU-wide gas price cap for power generation, also part of the European Commission's non-paper (2022).

How does the model work?

Gas-fired power plants would receive a subsidy, which covers the difference between the actual gas price observed on the day ahead Title Transfer Facility (TTF) exchange, and the capped target gas price in between 100 and 120 EUR/MWh_{Th}. The proposed cap is similar to the Iberian gas cap model, which has been effective in Spain and Portugal since July 2022, but it differs as it does not apply to fuel costs of other thermal generators.

What are the proposed benefits?

The idea behind the Iberian model is that the power savings that result from the lower clearing price (caused by the lower input gas price) will outweigh the cost of the subsidy, leading to a positive net effect. The chosen cap of 100-120 EUR/ MWh_{Th} is meant to not affect the merit order, as the target price of the cap is set sufficiently high to avoid a switch within the merit order, which would reduce the use of alternative generation technologies. As the cap is set EU-wide, the Council expects low distortions in the EU compared to the Iberian Cap adopted in Spain and Portugal.

What is the impact of the model?

Merit Order

Regarding the proposed benefits, a cap level of 100-120 EUR/ MWh_{Th} indeed does not seem to change the merit order. However, it still constitutes a subsidy for a specific technology, therefore potentially distorting the market. If this measure was applied for a long-term, the subsidy for gas would lead to more gas assets for the system, given that prices (or price expectations) are high.

Renewables

As the lower gas input price will lead to lower power market prices, renewables will provide lower revenue streams. Given that the model would only be implemented as a short-term measure, and that the revenue cap extracts surplus of renewable producers, the additional impact is limited if the model is applied for no longer than the revenue cap. However, if it is applied even after the revenue caps are phased out, it would severely deprive renewables of revenue streams. This would hamper the build-out of renewables in Europe.

Demand-side signals

Compared to a general gas price cap, the Iberian model does not distort the gas wholesale market. This means that member states can still attract gas and LNG. It also means that gas saving incentives for the industry are kept.

However, reducing the price of gas for power production leads to lower wholesale market prices, because gas, as an input cost for power production of gas assets, is cheaper, and the gas power plant will thus bid into the market with a lower price. The resulting lower wholesale market price in turn increases power consumption. This higher power demand ultimately increases gas consumption in the power sector, as gas power plants are the marginal technology that can increase generation.

This increase in gas use contradicts the need to save gas, given its scarcity. In Spain, when the cap was applied, we observed 12% increase in renewable generation and 2% increase in demand between 15 June and 10 August. Parallelly, there was a 154% increase in combined cycle gas turbine (CCGT) generation, due to an increase in exports towards France, and low hydro participation due to extremely high temperatures. The consistent application of the gas price cap for power generation on the EU level would lead to a different result, as limited out of EU cross-border flows mitigate the strong export effects.

Cross-border flows

In the case of the Iberian cap in Spain and Portugal, distortion in cross-border flows have been observed. After the application of the price cap, up to 60GWh/day were exported from Spain to France, with the interconnection capacity fully in use most of the time. The model entails the possibility that subsidised electricity would flow to non-EU countries, which would profit from the cap without paying the costs. Any attempt to avoid these flows would require a substantial change to the EU market coupling mechanism, as also recognized in the non-paper. It remains unclear if increased flows to non-EU member can be avoided effectively.

The non-paper sees a gas price cap for power production as a harmonised solution for Europe, but the introduction of the model would benefit countries to a different extent. Subsidies would be highest in countries that have a high share of gas assets, such as Germany, the Netherlands, and Italy. Other countries that mainly import gas-fired power, such as France, would benefit strongly from the mechanism. The total cost of electricity in a country (wholesale closing price plus cost of subsidy) would therefore differ according to the share of gas in the generation mix. The diverging impact on different countries also show that the mechanism would impact cross-border flows within the EU. A redistribution of costs and benefits would therefore be needed, which is politically challenging.

Consumer participation and vulnerable consumers

The interaction between the gas price cap for power generation and the revenue cap (as implemented as one of the short-term emergency measures) needs to be taken into account. Given that the revenue cap skims excess profits above the revenue cap that are then distributed to the end consumer, the additional effect of a lower clearing price might be reduced.

If rents of inframarginal generators are already collected through the revenue cap, it is unclear whether the gas price cap for power generation can lead to a net positive impact. Benefits through power price savings might not outweigh the costs of the subsidy in combination with the revenue cap. Additionally, part of the excess profits that would have been used to alleviate consumers from high prices would be redistributed to gas asset operators.

Here too, the impact differs if the Iberian model is extended and would be in place after the revenue cap is phased out. In this case, the impact on consumers depends on the ratio of saved power costs through lower power prices versus the subsidy to be paid for the gas, ultimately also paid by the end consumer. As the price cap leads to lower revenue for renewables, making it even more exposed to gas prices. This can lead to a higher need for renewable subsidies, which in turn also leads to higher payments of consumers.

Excursus: The Finnish model – implementing a technical price limit

Another discussed proposal is to abolish the technical price limit of the coupled Day-Ahead market, currently set to 4000 EUR/MWh. The price limit adjusts automatically if the cap is triggered. However, the purpose of this price limit is of technical nature. It is meant to decrease the risk of market participants that would arise if technical errors or bidding mistakes could lead to extremely high prices, resulting in very large open positions. Abolishing this price cap has a big impact on risk management, but little impact on the average market clearing price. This is because the price limit adjust itself automatically when triggered, so it will not limit the market clearing price in a regular way.

3. The European version of the Greek model: Two sides of the market

In order to mitigate the effect of high gas prices on power prices by increasing the impact of lower cost renewables on consumers, the European Commission wants to structurally reform two sides of the electricity market. The mechanism is outlined in the non-paper of the European Commission and would complement the short-term introduction of the Iberian model. The proposed long-term solution is based on the Greek model as proposed by the Greek government in July 2022 (Greece 2022).

How does the model work?

The "original" Greek proposal aims at decoupling electricity prices from gas prices by adopting a market design that distinguishes between resources that operate when available versus on-demand resources, separating the wholesale power market into two segments. This extends beyond inframarginal revenue caps as already applied in Greece as it suggest a real market split. The Commission proposal differs from the "original" Greek model insofar as it is much less detailed. Also, it does not explicitly mention a market split ("two-staged day-ahead market"), but it does not exclude it either.

The non-paper suggests remunerating inframarginal generators via CfDs based on their 'true' production costs. This would affect various inframarginal generators such as renewables and nuclear. The two-sided CfDs would be independent from the marginal price. Its price would be established by tendering based on actual production costs of technologies. The open question is which price the CfDs would be settled against, and how the actual production costs would be integrated in the tender. CfDs that are currently applied in the market are settled against the spot market price.

CfDs would be accompanied by the other side of the marked: Volatile generation would be complemented by gas-fired assets until alternative technologies are available. The remuneration of those generators should be based on a remaining so-called "well-functioning short-term market", that ensures that the cheapest and most efficient technology is used at any moment. According to the proposal, this can be ensured through a well-integrated and interconnected market, that creates a level playing field for alternative technologies, such as storage and demand response. The model would be directly applied only to new capacity entering the market. The existing generators' current inframarginal cap of

180 EUR/MWh could be integrated into the wholesale market to incentivise transition into CfDs.

What are the proposed benefits?

According to the proposal, the change to CfDs could be implemented very swiftly for new capacity. The model aims to bring the benefit of lower cost renewables to consumers in a lasting way.

What is the impact of the model?

<u>Merit Order</u>

The model fundamentally changes how prices are set in the market. This has a major impact, as the price signal gives crucial information to market participants, shows scarcity, and guides the dispatch.

The 'original' Greek model proposed a market split. This would eliminate dispatch signals for pooled generation. In the Commission's proposal, a market split is not mentioned explicitly, so we assume 'standard' CfD conditions. Still, under a far-reaching CfD scheme (high share of generation, e.g. renewables, nuclear), a large and diverse share of the market would act as one entity and not respond to markets' price signals.

<u>Renewables</u>

The proposal is a true game-changer for market-based renewables. Effectively, all renewables would fall under a subsidy-scheme. A market-based build-out of renewables is no longer possible. This is a stark contrast to the target model of the last decades, and it impacts renewable build-out. The build-out would fully depend on governmental targets, as the extra build out would happen if renewables cannot generate market-based revenues.

Additionally, renewables have been more and more exposed to price signals in the past. This increased system integration, as renewables had an incentive to behave in a system-friendly way. This means that renewables bridge the gap between their own production profile and the consumption profile. Examples for system-friendly design are the orientation of solar assets, the over dimension of capacity, or the colocation with storage. If renewables were no longer exposed to the price signal, that would constitute a return to the 'produce-and-forget' approach, thus giving no incentive for renewables to respond to the price signal.

However, the more renewable capacity there is in the system, the more important it is that renewables have an incentive for system-friendly design, i.e. in terms of co-location with storage or technical parameters for system integration. For example, if renewables keep producing when the electricity market price is negative, because they are remunerated anyway, this would increase the need of the system for further flexibility.

Moreover, the government might phase high costs, in case of falling wholesale power market prices. In this case, instead of generating revenues, the government would have to pay subsidies to the renewable assets.

<u>Demand-side signals</u>

As pointed out by Maurer, Schlecht & Hirth (2022), the model impacts decisions at the level of demand. The problem of deviating bidding behaviour under CfD schemes remains (less reaction to dispatch signals, distorting bidding behaviour at low positive and negative prices etc.). Thus, market inertia would increase.

If consumers paid an average price between the constant pool prices and the marginal price of the other market side, effective demand response and flexibility provision is weakened. In the future energy system with a higher share of renewables, it is important that flexibility exists both on the demand and on the supply side to be able to absorb a high share of intermittent production. Both demand and reduction increase, as well as additional flexible generation, can complement production of renewable energy. Demand can be shifted to periods with a lot of renewable generation and thus low marginal power prices.

On the other hand, demand can be delayed, or other flexible generation increased, in times of low renewable generation and thus high marginal power prices. In case of an average price, the much-needed reaction to renewable surplus situations is observed less. Similarly, in a moment of scarcity, the price signal would be washed down. This hinders the development of flexible technologies such as storage, hydrogen, and demand-side response, that are much needed to reach a net zero power system.

Cross-border flows

Creating separate pools for technologies, with a part of them under a regulated income stream, risks to impact cross-border trading. Less share of generation would be part of the market mechanism, therefore reacting to the differing price signals of the market coupling process. This is problematic because it would potentially hamper important balancing effects between member states.

Cross-border trading allows electricity to flow where it is most needed. It therefore strengthens not only the solidarity principle, but also allow for cost saving: countries can rely on imports and exports and have not to build the same amount of capacity that would be needed in an isolated system. The growing benefits of market coupling especially in the light of an increasing share of renewables could not be realised.

Consumer participation and vulnerable consumers

Given the drawbacks of the model, it is unlikely that the Greek model will contribute to lower system costs, to ultimately benefit end consumers, including vulnerable consumers, through lower power prices.

To summarise, the Greek model would constitute a step backwards in European market integration.

4. Keeping the merit order: Future-proofing the market design

The goal of the reform of the energy market design is to ensure affordable clean energy for end consumers.

This includes decoupling the power price from the price of gas. To assess this target, it is important to understand that the gas and power price are not inherently linked. The gas price only impacts the power price when gas-fuelled assets are running, therefore setting the price. The less gas-fuelled power plants are needed to fulfil demand, the lower the impact on the power price. With more renewable build-out and more alternative technologies replacing gas, the impact of the gas price on the power price will slowly decrease.

The crisis has shown that we need a market design that encourages the build out of renewables and flexible technologies. The merit order is of crucial help here. This is because the low short-term marginal costs of renewables are not enough to cover their entire cost. They need to realise the inframarginal rents to cover their initial investment costs (CAPEX). On the other hand, the build-out of flexible generation is incentivised through spreads between high and low prices, depending on the price-setting technology.

Looking back at the last decades, a lot was achieved while building a European energy market design. The market integration across Europe saved billions of Euros and ensured that electricity was used where it was most needed. In the current crisis, the market mechanism helped to ensure gas and electricity market savings through price signals. It helped to distribute electricity efficiently, e.g. to France when the local nuclear generation was not available. The role of the market and the merit order as coordination mechanism will be even more important in a European system with more renewable capacities.

This is the reason why we propose a new market design that builds on what was achieved in the past decades, instead of undoing it. Keeping the European internal energy market, while making it future proof for a renewable-based system, allows consumers to profit from low costs of renewables.

How does the model work and what are the proposed benefits?

The model builds on the existing market design, characterized by integrated long-term and short-term power markets based on a merit order. However, crucial reforms ensure that consumers profit from low costs of renewables and that the system is fit for a high share of renewables.

1. <u>Implementing the existing power market regulation</u>

Several improvements to the existing market design have been agreed on in European regulations, but they have not yet been implemented in all member states. This includes a list of topics addressed in the Clean Energy Package, such as the increase of cross-border flows, demand-side flexibility, the bidding zone review, and the integration of balancing markets. It is important to note that, for example, regarding the implementation of the demand-side flexibility regulations, countries are lagging behind substantially. This means that during the current crisis, demand-side flexibility was not available to the extent it would have been, had the regulation been implemented. This worsened the situation. Consequently, implementing these changes will strengthen the power markets and lead to more integration across Europe.

2. <u>Ensure consumer protection by introducing more hedging opportunities</u>

The current crisis revealed that the current market outcome in terms of consumer protection is perceived as problematic, as consumers are exposed to short-term price signals. However, the incentive structure leads to little hedging on the site of consumers. Different mechanisms can contribute to price security for consumers:

   a. Tariff design

Different tariff mechanisms can lead to a higher hedging share. This includes higher incentives for consumers and retailers to hedge, a better linkage of forward markets across borders longer term fixed-price retail contracts for consumers (while still allowing for time-dynamic tariffs to value flexibility should the consumer wish to do so). A temporary introduction of block tariffs can be helpful in mitigating the impact of the current crisis for vulnerable consumers while keeping short-term incentives for demand reduction. It is important that this stays a temporary measure as it would otherwise reduce incentives for energy efficiency measures.

   b. Low cost of renewables as hedging element

In principle, long-term contracts are the right solution to secure the low renewables cost for consumers. This could be done either through a more regulated approach (CfDs) or via the market (PPAs).

CfDs make the build-out of renewables more foreseeable, and lead to revenues for the state in times of high prices. On the other hand, renewables under CfDs have little incentive for system-friendly design. Furthermore, if wholesale power prices decrease again, the government needs to pay subsidies to the assets. Also, the combination with market-based renewable build-out is not possible. As a generator gets a fixed price under a CfD, they have an incentive to just follow the 'produce-and-forget' approach. This constitutes a step back in market integration. This problem is stronger when CfDs are settled hourly, as generators have no incentive to follow price developments over time but get the exact same price for every hour.

State-set incentives for system-friendly behaviour are thus needed, for example the rule that no subsidy is paid in case of negative prices. Increasing the settlement period is not the solution. This is because a longer settlement period (i.e. monthly or yearly) does increase a system-friendly design, but creates dispatch distortions: In case the generator foresees a higher reference wholesale price than its strike price, it has to pay back the difference to the state. If the generator now observes an hourly price that is lower than the payback amount, it will not dispatch, as it would make a loss. This can lead to renewables not injecting in the grid even though the price is positive, which in turn leads to overall higher prices.

A PPA is an alternative to CfDs. PPAs are market-based instruments that fulfil the hedging purpose and do not require subsidies. On the other hand, the renewable build-out is less predictable and the state does not get any money back in times of high prices. However, the offtaker of the PPA can get a payment in times of high prices. As the offtaker might be a retailer, this can favour end consumers. Also, a PPA inhibits more incentives for system friendly behaviour, because the offtaker of a PPA has a strong incentive to design the PPA in a way that aligns with its consumption profile.

Our recommendation is to follow the market-based route of renewable build-out in general. Where subsidies are needed, baseload CfDs are a suitable option. In contrast to 'pay-as-produced'-CfDs, the reference price is not the capture price (the price achieved in hours of renewable production), but the baseload price. This means that generators either earn or pay back the difference between the baseload price and their strike price. Consequently, generators have an incentive to minimize the difference between the capture price and the wholesale price to maximise their revenues. This is achieved by behaving in a system-friendly way, which allows to realise a price profile close to the baseload price. As a result, renewable generators would follow closer the consumption profile of consumers and design their asset in a way to achieve this, i.e. through technical parameters, co-location with storages or additional power purchases.

3. Increase system flexibility

A higher share of renewables in the system leads to a high need for flexibility in the system. It is of utmost importance that the market design incentives flexible generation and demand. The merit order and the resulting price signals deliver valuable incentives for flexible generation. However, we recommend taking additional measures to further increase system flexibility.

a. Aggregation and integration of flexibility

A lot has been achieved in the regulatory framework through the Clean Energy Package. Demand-side flexibility allows consumers to realise monetary benefits. Enabling business models for aggregation of flexibility and integration of flexibility into all markets will be key. This requires the swift implementation of smart metering and flexible tariffs.

b. Additional flexibility build-out

Capacity mechanisms have been introduced in several countries in the last years. If designed well, they ensure investment in low-carbon dispatchable technologies and contribute to security of supply. It is important to ensure a low-carbon, technology-neutral and harmonized design on the European level.

Capacity markets can also be designed in a way to support baseload CfDs. The generator would need to purchase additional energy in case of a baseload profile, which can be very expensive in case of hours with low renewable production. A capacity market can hedge this risk, if it introduces a price cap for generators participating in the capacity market and redistributes the revenues to those paying for the capacity market, it constitutes a hedging against price peaks for the baseload CfD generator.

What is the impact of the model?

Merit Order

The proposed market design would keep the merit order as the most efficient mechanism to coordinate demand and supply. Due to the merit order, the renewables build-out will have a price-lowering impact in the long term, and decouple power prices from gas and hydrogen prices.

Renewables

The proposed model would allow to build-out renewables, while passing their low cost through to the end consumer both via the merit order and through long-term contracts. Designing the subsidy mechanisms as a baseload-CfD allows the state to generate revenues while keeping incentives for the generator. As they get paid for a baseload profile, they have high incentives to adapt their dispatch behaviour to the end consumers' consumption, or to bridge the gap by trading additional power or acquiring flexibility. This ensures a system-friendly design.

Demand-side signals

Demand-side flexibility is urgently needed to complement renewables, and to decrease the dependency on gas. Keeping the merit order ensures that dispatch signals persist for all market participants, including the demand-side.

Cross-border flows

The proposed model builds on the integrated European market with flow-based market coupling that maximises the efficiency of cross-border flows. This also strengthens the solidarity principle, as electricity flows where it is most needed. This is efficient, because it would be extremely expensive for every country to ensure security supply on their own. Harmonised capacity markets can further contribute to efficient cross-border flows.

Consumer participation and vulnerable consumers

The difficulty of any proposed model is that, on the one hand, consumers need the possibility to enter hedges and to protect themselves from too much exposure to the short-term market price, should they wish so. On the other, demand-side flexibility is urgently needed on a renewable based system. The solution to this is to offer different tariffs for different consumers.

The current market design has flaws when it comes to consumer protection. Consumers do not fully profit from the low costs of renewables, and prices are oriented towards short-term markets. The proposed model protects vulnerable consumers by introducing hedging opportunities and temporary block tariffs for vulnerable consumers. Capacity markets would ensure that investment in flexible technologies takes place and contribute to security of supply

At the same time, dynamic contracts allow consumers that chose them to benefit from exposure to short-term price signals, which would increase demand flexibility.

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