



Event Report | June 2022

Road to net-zero: The implications for energy

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Emissions from energy production and consumption must reach net-zero by 2050 if Europe is to meet its objective of reaching “climate neutrality” by mid-century. In this special report, EURACTIV examines the implications for the electricity sector and the energy system as a whole.

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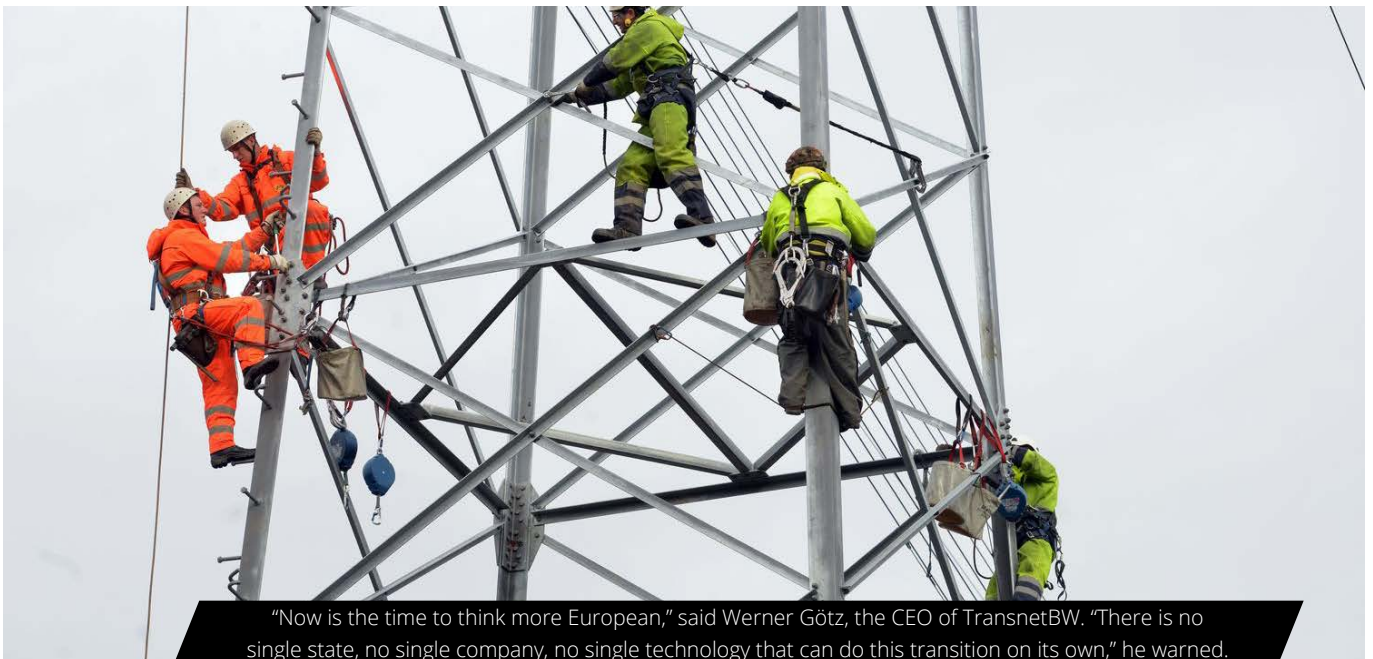


Energy transition ‘only possible with a European approach,’ says German TSO

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By Frédéric Simon | euractiv.com

Languages: [Deutsch](#)



“Now is the time to think more European,” said Werner Götz, the CEO of TransnetBW. “There is no single state, no single company, no single technology that can do this transition on its own,” he warned.

[TransnetBW]

The energy transition can only be implemented efficiently if it is planned and performed jointly at the European level, according to the power grid operator of Germany's Baden-Württemberg region.

TransnetBW, one of Germany's four electricity transmission grid operators, launched a new study on Monday (27 June), which calls for greater EU involvement in energy planning to reduce the cost of the transition to a zero-emission energy system.

While Russia's war in Ukraine focuses the EU's attention on gas supplies and energy security, the climate emergency also “calls for a radical transition” to ensure Europe's energy independence, said Bodo Lehmann, the head of the Baden-Württemberg state representation in Brussels.

“While the future is uncertain, the rising impact of climate change and the necessity for a paradigm shift, I think, is undeniable,” explained Werner Götz, the CEO of TransnetBW, who spoke at a Brussels

event on 13 June to present the study's findings.

And the EU's role in driving this transition “is of utmost importance,” he insisted.

“Our conclusion is that the Energiewende is only possible with a European approach,” Götz said.

When TransnetBW launched the study two years ago, it initially focused exclusively on Germany. But the authors quickly realised the European dimension was simply

unavoidable and needed to be factored in.

“Now is the time to think more European,” Götz said. “There is no single state, no single company, no single technology that can do this transition on its own. We have to work together, we need an integrated Europe, we need an integrated approach,” he said.

“And we have to start now.”

‘Massive challenge’

These conclusions are derived from a study commissioned by TransnetBW, which predicts a surge in electricity demand by 2050, with peak load at least tripling by mid-century, putting a huge strain on the electricity grid.

Due to new demand coming from sectors like heating, mobility and industry, electricity demand in the EU is expected to increase from 2,491 TWh in 2020 to 5,190 TWh or 5,833 TWh, depending on the scenarios.

“We can see that there is a massive increase” in electricity demand by 2050, which leads to “a massive challenge for the future,” said Jonas Lotze, project manager for the study at TransnetBW.

Germany’s power grid is in dire need of upgrade to ensure stable supply in a country aiming to source 80% of its electricity from intermittent wind and solar by 2030.

In April, the German government [presented a comprehensive revamp of the country’s electricity sector](#), including plans to complete 19 power grid expansion projects to support the transition to net-zero

emissions by 2050.

Two scenarios, with hydrogen in both

To achieve climate neutrality, the TransnetBW study examines two scenarios: one assuming hydrogen is freely traded on global markets, representing 60% of EU supply, and another with no hydrogen imports at all.

Both scenarios conclude that reducing emissions to net-zero by 2050 is achievable and brings significant benefits in terms of climate protection and decreased reliance on imported oil and gas.

But the study also highlights key bottlenecks, such as the growing need for land to produce electricity from wind and solar, which increases even further in the scenario where hydrogen is produced within Europe, Lotze said.

According to the study, up to 32% of the additional demand for electricity will come from the production of synthetic gases such as hydrogen – so-called power-to-X applications.

This additional demand adds tremendous pressure on the electricity system, with projections showing “a massive overload all over Europe,” highlighting the need to further develop the power grid to avoid congestion and blackouts, Lotze said.

To deal with the extra load, “a massive expansion of 2.8 times the current electrical grid is necessary,” the study says. This means power interconnections between EU countries need to increase from around 70 GW today to at least 200 GW in 2050, Lotze explained.

And gas infrastructure too will play a crucial role, with hydrogen pipelines forming the backbone of a hydrogen network connected to the electricity grid. “In both scenarios, you need a hydrogen grid,” Lotze said.

Catharina Sikow-Magny, director at the European Commission’s energy department, supported the study’s conclusions, saying the shift to renewables will prompt “a huge change in the mix and location” of electricity generation – both centralised, with lots of offshore wind electricity in areas like the North Sea, and decentralised generation from small-scale solar rooftop panels.

“And this needs to be connected to where the consumers are,” she added.

“If we look at the map, nobody lives in the sea, people live in the centre of Europe. So we need to get electricity there. And this obviously crosses borders – TSO borders and member state borders. And that, I think is inevitable if we want to be economical,” Sikow-Magny said.

Of course, the transition can also be self-sustained, with fewer cross-border exchanges of energy, but this will come at a high cost, she said. “We have done some studies on this, and the difference is huge”.

Towards a pan-European electricity grid?

Michael Bloss, a German Green MEP who took part in the same Brussels event, said the time had come to open a debate about the need for a pan-European electricity

grid.

“We need to have more responsibility on the European level,” said Bloss. “If we want to go for 100% renewables, we need such a grid on a European level,” he stressed. “Otherwise it won’t work or we will have over-planning” with unnecessary gas power plants constructed as back-up.

The TransnetBW study supports this, saying the energy transition “can only be implemented efficiently if it is planned and performed jointly at the European level”.

But building a pan-European electricity grid will also require radical changes in how electricity is traded. The EU model for power trading is currently based on bidding zones – or geographical areas where wholesale electricity prices are uniform.

This is why bidding zones also tend to match national boundaries – they reflect grid deployment decisions that were often made decades ago, at a time when electricity was still largely happening within national borders.

The European Commission has tried splitting national bidding zones

into smaller units in order to make them more efficient and cut across borders. But the definition of bidding zones can be a highly political issue and most EU countries were not ready to consider it.

Security of supply remains a competence of EU member states, and it is national authorities or TSOs who are ultimately accountable in the event of a black-out.

“Of course, we need to have rules in place for who’s responsible” to ensure grid stability, Sikow-Magny said. Since electricity cannot be stored, grid operators need a system that is able to react every 15 minutes to fluctuations in demand, she remarked.

“And where the market cannot provide solutions, the TSO would have to do it,” she said.

The TransnetBW study acknowledged this, saying power supply and demand must be envisaged in a radically different way, from a pan-European perspective.

In particular, “the concept of ‘demand determines generation’ can no longer be applied to an energy system with variable renewables,” the study said.

A more efficient energy system also requires “a very high share of flexible demand” coming from power technologies that are not reliant on generation capacity being immediately available, Lotze said.

According to the study, 62% of that demand will need to come from flexible energy sources like demand-side management, battery storage, or hydrogen which can convert excess wind and solar power into gas.

“Today, not that much is flexible,” Lotze conceded.

INTERVIEW

Academic: Integrated EU electricity market is 'least-cost option' for net-zero transition

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By Frédéric Simon | euractiv.com



"With more interconnections and trading across borders, we can lower the variability of renewables. It is a common interest we have, and it is getting stronger as the amount of renewable energy grows in the system," said Leonardo Meeus. [TransnetBW]

With increased interconnection and trading across borders, European countries can lower the variability of wind and solar power and decrease the cost of the transition to clean energy, Leonardo Meeus told EURACTIV.

Leonardo Meeus is a professor at the Vlerick Business School and author of "The Evolution of Electricity Markets in Europe". He was recently appointed as the next Director of the Florence School of Regulation.

The German electricity TSO

TransnetBW just published a study which concluded that Europe needs to at least double its power transmission and production capacity in order to achieve climate neutrality by 2050. According to the study, single EU countries cannot achieve this on their own anymore

and need to cooperate more closely in a more 'Europeanised' electricity system. Looking at the scale of the decarbonisation challenge, do you believe closer integration of EU electricity markets is inevitable?

The study indeed shows that the least cost option is definitely to do the transition at the European level.

Even if the study doesn't calculate the cost of 'non-Europe', it's clear that those massive numbers you cited would be even higher if we tried to do it nationally. And the more we rely on renewables, the greater is the interest to connect electricity markets across national borders.

If my country, Belgium, cannot rely on wind and solar locally, either we need to install a lot of backup generation capacity, or we buy electricity from our neighbours. It is well-known that, if you look at it at the European level, the variability of renewables is much lower, and the more local you go, the more this variability is a challenge. And it's expensive to solve it.

With more interconnections and trading across borders, we can lower the variability of renewables. It is a common interest we have, and it is getting stronger as the amount of renewable energy grows in the system.

As Europeans, we have always had an interest in pooling our resources. But in a net-zero electricity system, this pooling effect is even stronger than before.

What is the cost of not doing it and keeping electricity generation and transmission within national borders?

It has not been calculated, but I think these numbers would be so

ridiculously high that you wouldn't even be able to get there.

If such a change in the Europeanisation of electricity generation and transmission is needed, it seems the political will to do it is currently lacking. We saw it during the last reform of the electricity market: there was huge resistance to the exchange of more electricity across EU borders. Do you think the political debate is moving at the speed required?

I would disconnect the current debate from what has been achieved so far. If you look at what we have done over the last decades to integrate our energy markets, and our networks, it's unprecedented in the world.

So let's not forget that. What has been achieved is massive, so much the case that we almost take it for granted.

What were the main achievements of the past decade in your view?

When the EU started liberalising energy markets, we had almost no experience in Europe. There were just two countries that had functioning electricity markets – the United Kingdom and Norway, that was it.

All the other countries still had to introduce electricity and gas markets at a national level, mostly from scratch, and then start integrating them across EU borders.

And of course, this integration is never fully finished. But we have done a lot. We were able to optimise our electricity flows across Europe on a very granular level.

And that is a massive achievement on an unprecedented

scale. Some parts of the world have done it similarly but on a much smaller scale – maybe the scale of Germany and France – but not on the scale of an entire continent.

That is a big asset we have today. And the only worry most experts have at the moment is that in the current crisis some people start to question everything we have achieved and start going backwards. We know how to go forward, but we are all a bit afraid that some people are now wanting to go backwards.

You're referring to Spain and Portugal capping electricity prices?

Exactly. I have sympathy for the policymakers in those countries who are under pressure to do something, and they do it with the best intentions. I understand also at the European level that they maybe allowed a few things they would normally not allow, with the idea that it would only be temporary.

As long as this is temporary and we go back on track with the integration of the EU electricity market, we will soon forget about it. But many people like me are a bit worried that this will lead to a negative spiral. And we don't want that.

Spain and Portugal are also a bit isolated from the rest of Europe because they lack interconnections – whether gas or electricity. So they may be justified in taking those kinds of measures, in a way.

Well, price volatility would have been much worse if Spain and Portugal had been isolated. This is shown clearly in the ACER assessment that was requested by the European Commission. And it is true for any other country.

Even if markets are not yet perfectly integrated, and even though the interconnection capacity is limited, EU countries still benefit from being interconnected.

It is unfortunate to think that you can be better off on your own. The price volatility was due to an external effect, it was not due to the mechanisms we have set up in Europe. It's a shock that I think nobody had expected.

Transnet is a German transmission system operator located in the south. And in Germany, the big issue is to get all the offshore wind power produced in the north transmitted to the south. But there's always been resistance to building some new power lines because people don't want them. Is Europeanisation a potential solution to this German problem, or is that something Germany should also be dealing with on its own territory?

It's a problem that we have seen everywhere in Europe, even if it's particularly obvious in Germany. And this reluctance to build new power lines is also understandable. I mean, would you like to have these kinds of transmission lines close to your home? No.

These companies have learned that they have to engage more with local communities when they build these projects. And they learned the hard way. Part of it is due to permitting, but it's also partly their responsibility to find the best solutions and to engage with everyone.

During the last 10 years, they took a lot of steps in a good direction. I used to think they were a bit too engineering-oriented when they approached projects, but now

they know that they have to take into account these sensitivities and be more proactive in approaching local communities.

Projects are still done at the local level, so you cannot just solve it at the national or European level, except for the permitting and these kinds of aspects. But it's partly also a local issue, where each company is trying their best and learning also from these experiences on how to engage better with communities.

Ursula von der Leyen, the President of the European Commission, recently announced a revision of EU electricity market rules. Do you think the time is right? And what are the main issues that were not addressed with the previous reform that, in your view, need to be addressed now?

A lot of what we achieved in the last decades is to have a well-functioning spot market for electricity. A short-term market that gives signals on the situation on an hourly basis, and we need that.

But now we are discovering that we should also do a bit more for the long term, making sure that we have the necessary investments. And that discussion was always a difficult one because you often have companies or utilities asking for their investments to be de-risked.

But then, are we sure that this will come at the benefit of the consumers? Are consumers not going to overpay? Should the market not just deliver these investments? And I think in the current debate we are looking at it slightly differently, saying maybe consumers also want to de-risk their exposure to very high prices.

That's the new element for me

– policymakers are now more open to complementing these short-term markets with a bit more organised, long-term dimension.

In addition, we should take the current crisis also as an opportunity to push forward some of the innovations that were already part of the [Clean Energy Package](#) adopted in 2019 and which deserve more attention.

I'm thinking about social innovation for example. The Clean Energy Package introduces this concept of citizen energy communities that allows individual people to invest in clean energy generation capacity. If, as a consumer, you are unhappy with the market prices in the wholesale electricity market, you can now organise yourself and this is a significant step forward.

That was the whole idea of the clean energy package – giving people the possibility to self-organise and invest in their communities. And if you do so, you have an access to the average price of renewables, because you've paid for it yourself. And today, that is much cheaper than the market prices.

These kinds of initiatives were seen as something for a few really motivated people doing it for sustainability purposes. But today, it's pure market logic that would push you in that direction. And that is a good thing – the whole purpose of the initiative was to encourage [citizens to engage](#) with the energy transition and to take things into their own hands.

Starting an energy community won't come naturally to most people, it's not easy to do.

It's true that the awareness of

these possibilities is very low and consumers need to be helped more. There are also a lot of vulnerable consumers, energy-poor, who simply don't have the possibility to enter into these kinds of schemes.

Governments at the national or local level should help people instead of paying them compensation for rising energy bills, which is very expensive. Of course, you can compensate people as a matter of emergency during times of crisis, but if you continue paying compensation over many years, it will become more expensive than helping people invest in these kinds of innovative solutions.

You spoke about de-risking investments for companies, and de-risking energy bills for consumers as well, which could imply trade-offs sometimes between the two. Is there a middle ground between the two?

For me, it's very simple: choice. Often, when we talk about things like capacity mechanisms, which is the technical term to mean de-risking for investors, we think of a centrally determined auction or something where consumers are not directly involved.

But many academics, not only me, argue that consumers should also be asked how much protection they want. For example, you could make sure that everybody is protected for a minimum amount of electricity consumption, which is considered essential for well-being or from a social perspective – heating for example.

That could be especially relevant in the future when our electricity consumption will go up and expand to new areas like heating and transport: everybody should be able

to heat their homes during winter.

But some more luxurious electricity consumptions maybe don't have to be protected as much. And there you could allow some freedom of choice. And then people choose whether they want to be protected for their entire electricity consumption or only for some essential services like heating.

Some argue that access to energy is a basic human right.

Exactly. This is why people need protection for their essential needs. But if you are protected for everything, maybe it becomes too expensive.

One question that often comes up in the EU debate about electricity is the current partition of bidding zones, where wholesale electricity prices are set mainly along national borders. The Commission attempted to split those bidding zones into smaller regional markets during its last electricity market reform but the proposal didn't go through because of national reluctance. Is that something you believe eventually needs to come back on the table because of the challenge of achieving net-zero emissions by 2050?

There are two views about this. Some argue we have bigger problems to deal with at the moment, while others like me – often academics – actually love to bring up this idea on every possible occasion.

And I do think it could be part of the solution. Because what we are doing currently to deal with the crisis, is to accelerate even more the transition towards more renewable energies. And that means location – where the electricity is produced

– matters even more than it does today.

To summarise, renewable energy generation is more distributed and local by nature, and therefore, the bidding zones need to be smaller and more local as well...

Exactly, because otherwise, prices do not reflect the reality of the electricity generation and transmission assets in that region, which underpins the functioning of the market.

All those who argue today in favour of keeping marginal pricing, if they are consistent in their logic, should say, 'okay, marginal pricing also needs to take into account the element of location'.

But, as soon as you do this, you also risk ending up with extreme price fluctuations between EU countries or indeed even within national borders. That could be tricky politically in countries like France where the price of electricity is the same across the whole country and is seen as a key aspect of social cohesion. So, how can you split the bidding zones and yet keep an equalised price of electricity within a certain country? Is that achievable?

We got used to price fluctuations across national borders.

Now, the idea is to apply the same logic within a country. Is that achievable? Well, if politicians see the reality of different prices, they can act on it and invest more in the network, for example.

That way, it also makes it more visible why you are investing in the network – it's to equalise prices. But until you make those investments, the prices will continue to reflect the

reality, which is congestion. Because if you try to hide it, nobody takes it into account and then you have to fix the problem, which is very expensive.

And the more you have to fix congestion, the more costs you accumulate. When these costs are shared by everyone, it's fine. But at some point, they become too high.

And the cost of congestion is getting higher and higher, correct?

Yes, we see that in many countries. Where the uptake of renewables is going faster than investments in transmission capacity, that's typically the countries where you see more congestion costs.

German TSO Transnet has called for a greater Europeanisation of the energy system to minimise the cost of the transition. Do you think there needs to be some sort of Big Bang on Europeanisation of the electricity market that needs to happen at some point?

I don't believe in Big Bangs anymore. When I was a PhD student working on electricity markets, I was

very impatient and frustrated that things in Europe move so slowly.

But now I am a few years older. And when I look back, I am amazed at what we achieved. Even though we took one step at a time, at least for more than two decades we have been moving in the same direction – towards more liberalisation and Europeanisation.

For some people, this may be going too fast, for others too slow. But at least we are aligned and pulling in the same direction and I think that's really fantastic. I think we should all be proud of that.



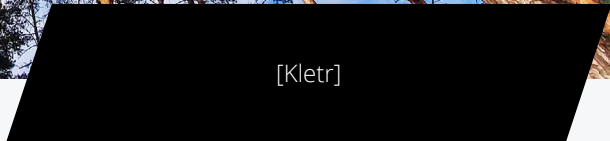
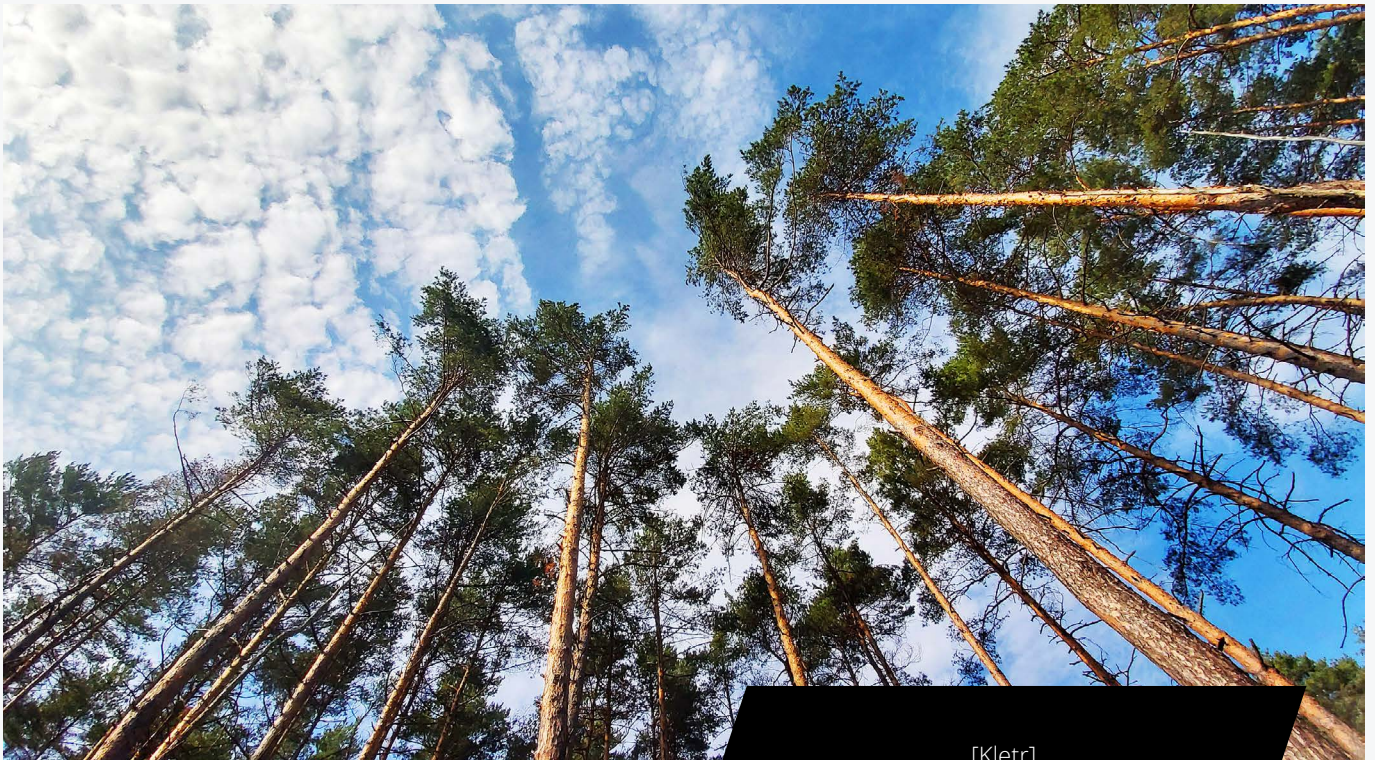
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Becoming climate neutral by 2050: How Europe's energy system has to change

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By Michael Jesberger | TransnetBW



In light of climate change and the war in Ukraine, the European energy system faces an unprecedented transformation. How can this succeed?

Michael Jesberger is the COO of TransnetBW.

Let's assume we are in 2050 and

the Green Deal is a success. We are living in a climate-neutral Europe where renewable energy sources are ubiquitous. It is a fantastic vision – but to get there we need to start from today's reality and make the greatest efforts. There is one goal and many possible paths to get there.

It is not a secret that the task

would in any circumstance be a very challenging one. But the Russian invasion of Ukraine has shattered existing perceptions on the future of Europe's energy system in a climate-neutral world and brought the challenges to a new level. Prior to the invasion, it was commonly accepted that Europe could support its transition by maintaining its external

energy trading relations. This view is now obsolete.

Climate neutrality combined with a resilient energy system – how can Europe achieve this goal? As an electricity transmission system operator, it is crucial for TransnetBW to understand the consequences of these decisions, plan ahead the design of the system and implement concrete projects in order to be able to reach those goals while ensuring security of supply.

In our new study “**Energy System 2050 – Towards a decarbonised Europe**”,

TransnetBW sheds light on the above question. We assume the European Green Deal as a given in 2050 and compare two central scenarios: “Global Markets” (GM), where hydrogen imports outside of Europe are expected, and “Energy Resilient Europe” (ERE), which considers a fully European hydrogen production. We highlight five crucial components which support the 2050 vision: renewable energy, grid infrastructure, sector coupling, hydrogen technology, and joint action at the European level.

Renewable energy: the power of a more independent Europe

The foundation for a climate-neutral energy system is the expansion of renewable energies in the electricity sector.

Onshore and offshore wind turbines as well as rooftop and utility scale photovoltaics need to be expanded drastically. Our most cost-optimal path to reach the Green Deal goals considers that the installed wind power capacity needs to be expanded by up to 5.5 times in the EU27 countries as compared to today's generation capacity. We

therefore need an expansion rate of at least 23 to 27 GW per year from today to 2050.

At the same time, the installed capacity of photovoltaic (PV) systems needs to increase by up to 17.8 times as compared to today's installed capacity, with an expansion rate of at least 69 to 80 GW per year. This makes PV the most important energy source – supporting the importance of the EU's Solar Strategy, recently released in combination with the REPowerEU plan. To achieve this goal, we need to start building this capacity now. **All member states will need to accept to attribute important parts of their land to renewable generation.**

As a result of the increasing electrification of the energy system and the expansion of renewable power plants, the energy transition will decrease the European energy dependence. Comparing our study results for 2050 with the 2020 values, we observe that the **demand for oil is around 72 % lower and for gas it is between 63 % and 83 % lower, depending on the scenario.**

Grid infrastructure: because renewable energy must be transported to where it is needed

Renewable energy is rarely produced where it is consumed. So, this energy must be transported to where it is needed. Transmission grid infrastructure becomes key to transporting this green electricity over long distances. The grid infrastructure depicted in ENTSO-E's most recent Ten-Year Network Development Plan is just the first step of the grid expansion requirement for a successful

energy transition. Actually, the **planned grid for 2035 will not meet the large transmission requirements of the 2050 goals in any of the countries considered by the study.** The system will be critically affected by grid congestions throughout Europe and therefore the power supply system in 2050 requires further development of the transmission grid. In order to meet the electricity demand of a carbon-neutral market, the **EU needs to expand the size of today's electricity interconnection capacity by 2.8 times. Interestingly, this is true for both of our scenarios.** This expansion will be accompanied by growing cross-border electricity trading, which will help put pressure on energy prices. **France, the Netherlands, Poland and Spain will become the biggest net exporters while Germany and Italy will become the largest power importers.**

Hydrogen: the crucial rise of a market and its infrastructure

Undoubtedly, hydrogen will play a major role in the climate-neutral energy system of 2050. It will be intensively used as energy carrier or feedstock in industrial processes and as a fuel for the transport sector. In addition, hydrogen will be used as input for the synthesis of hydrogen derivatives such as synthetic fuels.

But where will the hydrogen production eventually take place? In our global market scenario, 57% of hydrogen production takes place in Europe (especially in Denmark, Poland Greece and the Netherlands) while the remaining 43% is imported from countries outside Europe via H2-pipelines. In the energy

resilient Europe scenario, 100% of the hydrogen production is located in Europe – so no import would be necessary from outside the EU.

In contrast to electricity infrastructure, depending on the path taken, the necessary hydrogen infrastructure capacity in Europe differs quite starkly: If Europe is to become energy resilient, 46% more hydrogen interconnector capacity is required and 50% more electrolyser capacity needs to be built, when comparing to the Global Market scenario. To produce the additional hydrogen in Europe we also need 15% more renewable energy capacity.

In any case, the EU needs to build up a reliable hydrogen system almost from scratch. There is a long way to go. That's why construction planning for a European hydrogen production and grid infrastructure has to start now.

Sector Coupling: because electricity must be thought of in a new way

The idea of “demand determines generation” no longer applies in an energy system with variable renewables. Temporal flexibility must

therefore be guaranteed through storage and demand management in all connected sectors (electricity, heating, transportation or industry). Price volatility could be a key aspect to stimulate flexibility and efficiency and might thus be an important element to be considered in the current discussions of a market design fit for the future.

Joint action at the European Level: no country, company or technology alone will reach the Green Deal goals

For the 2050 vision to become reality, immediate action is as much necessary as pragmatic solutions to the obstacles that we are faced with. Most of the required technology is already available. What hinders the implementation of the energy transition are permits and local opposition.

With its RePowerEU plan, the European Commission has shown the right way forward: We urgently need to push ahead with the expansion of renewables and the energy infrastructure as a whole. The goals are largely agreed upon and understood. Their rapid implementation, however, remains the biggest challenge. An important

barrier to fast progress remains permit granting procedures. Here, the EU needs to pull together with its member states the regions and the municipalities.

European climate neutrality is possible, but only achievable on time if it is done collectively, involving citizens in this inevitable transition, so that communities are proud to be part of the change, whether it is taking place on their rooftops or in their backyards.



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