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ENSURING RESILIENT AND SUSTAINABLE ENERGY SECURITY IN EUROPE

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EDITORIAL

ENSURING RESILIENT AND SUSTAINABLE
ENERGY SECURITY IN EUROPE

Europe's Energy Future: Between Urgency and Ambition

Europe stands at a decisive turning point in its energy future. Confronted with competitiveness challenges, geopolitical pressures, and the necessity of strategic autonomy, the European Union must accelerate its adaptation to ensure a secure, sustainable, and competitive energy system. Three major axes emerge: energy independence, technological innovation, and investment in infrastructure.

The war in Ukraine has starkly exposed Europe's energy vulnerabilities. For decades, Europe relied on fossil fuel imports, particularly Russian gas, which accounted for nearly 45% of European consumption before the conflict. This excessive dependence left the continent exposed to geopolitical shocks, forcing the EU to urgently rethink its energy supply.

The REPowerEU plan, launched in May 2022, marked a turning point. By diversifying its energy sources—particularly through increased imports of liquefied natural gas (LNG), a strategy fortunately prepared since 2016, and expanding infrastructure—Europe managed to reduce its dependence on Russian gas much faster than expected. But this is only the first step. The challenge now is to ensure that these short-term adjustments fit into a sustainable and coherent energy strategy.

Europe's ambition is clear: to reach 45% renewable energy by 2030. Solar and wind power will play a central role, with the goal of installing more than 320 GW of solar capacity by 2025 and 600 GW by 2030. However, innovation is not limited to energy production.

Europe must also invest massively in energy efficiency and smart grid management. Currently, 42.5% of distribution infrastructure is over 40 years old. A major modernization effort is needed to integrate renewable energy, improve grid resilience, and reduce energy waste. Without investments in these critical infrastructures, the green energy produced risks being underutilized.

Nuclear energy, as well as new technologies, including small modular reactors (SMRs) and green hydrogen, could also play a key role in achieving true technological neutrality. However, these solutions require funding and a pragmatic approach that avoids regulatory deadlocks.

While the energy transition is an ecological necessity, it is also a matter of economic competitiveness. Today, European businesses pay three to five times more for electricity than their North American counterparts. This energy disparity weakens European industry against competitors like the United States and China, where massive subsidies support business competitiveness.

In February 2025, the EU launched the Action Plan for Affordable Energy. This program aims to lower energy costs, attract investment, and ensure greater resilience against crises. But to be effective, this policy must be accompanied by a truly integrated European energy market, with harmonized taxation and coherent regulation among member states.

Europe can no longer afford to wait. To succeed in its energy transition, it must:

1. Invest massively in infrastructure: €584 billion will be needed by 2030 to modernize electrical grids.
2. Develop technological sovereignty: Currently, 80% of solar panels installed in Europe are manufactured in China. It is urgent to bring the production of strategic equipment back to Europe.
3. Strengthen education and energy efficiency: Raising awareness among citizens and businesses about optimizing their consumption is a priority.

Europe stands at a historic crossroads. The energy transition is underway, but it must be accelerated. With China and the United States advancing rapidly in energy and technology, the Old Continent must stop being a spectator and reclaim its role as a key player in shaping its future. The time for compromise is over—bold decisions must be made.

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Polish Minister of Climate and Environment

Enhancing energy security in **Europe**, diversifying **energy sources**, and reducing dependence on **Russian fossil fuels**

Ministry of Climate and Environment
Republic of Poland

Security, is essential to the daily lives of citizens, Member States and the Union as a whole**. Energy security, on the other hand, is fundamental to economic and social stability.** Given the current geopolitical challenges, it is more important than ever, since our independence and sovereignty are directly linked to energy independence. Therefore, as the Presidency, we **will propose a broad approach to the definition of energy security**. It should include **access to affordable energy, also for energy-intensive** industries, which will allow the EU industry to remain internationally competitive and be socially acceptable. Our goal is to adopt Council conclusions on updating and strengthening the European Energy Security Strategy.

As part of the **new energy security architecture**, we intend to focus on strengthening the physical and cyber resilience of critical infrastructure, as well as supporting – on an equal footing – the development and implementation of all clean energy technologies. Ensuring a stable supply of critical raw materials will also be crucial.

Supporting Ukraine will also be an important item on our agenda - both in terms of rebuilding its energy system and securing the supply of materials and electricity. **Rebuilding and developing its energy infrastructure is crucial for its citizens, the economy and overall defense capabilities - but it is also an investment in the security of the entire EU.** In the long term, we will strive to harmonize Ukraine's energy regulations with EU legislation, further integrate Ukraine's energy system with the EU energy network, and accelerate Ukraine's accession talks in the energy sector.

One of the key issues in the context of ensuring energy security is also to **guarantee stable and predictable energy supplies.** We have already significantly reduced the EU's dependence on Russian energy sources, but further progress and joint efforts are needed. In this regard, **the Polish Presidency will review the progress made in achieving the REPowerEU objectives, especially in terms of eliminating the import of Russian fossil fuels into the Union.** We await the European Commission's roadmap, which will indicate the next steps leading to the EU's full energy independence, including from Russian LNG imports.

We also cannot ignore the **significance of the Clean Industrial Deal and the Action Plan for Affordable Energy.** These documents are essential for the future of the European economy. Many challenges require our attention – from high energy prices to regulatory issues to access to the green technologies necessary for decarbonization. We expect the CID to address these issues, and we will initiate a debate on its energy aspects. Our goal is to make the EU economy more competitive in external markets through the availability of clean energy and modern technologies, and to accelerate and better coordinate the internal energy transition.

During our presidency, we would also like to draw attention to the need to **increase investment in the development of electricity networks, as well as to strengthen efforts towards system integration, development of storage capacity and flexibility.** This is essential for a successful energy transition that supports competitiveness.

The New **Energy Union**: **cleaner**, **cheaper**, and more **connected**

DAN JØRGENSEN

Commissioner for Energy and Housing

The EU is at a crucial turning point for its competitiveness, decarbonisation and security, with a clear need to act.

High energy bills are hurting our homes and businesses. In his 2024 report on European competitiveness, Mario Draghi mentions "energy" over 700 times. We cannot have a stronger Europe without stronger cooperation on energy, providing the basis for jobs, growth, and prosperity.

And the need for a stronger Europe could not be more urgent. On our borders, Russian brutality shakes the foundations of European **security**. Since Putin began his invasion, Europe has spent the equivalent of the cost of 2400 F-35 fighter jets on fossil fuels from Russia. This cannot continue.

As we strive to protect our continent, we must also protect our planet. The energy sector accounts for 75% of Europe's greenhouse gas emissions. The longer it takes to **decarbonise**, the longer we are exposed to volatility – in the prices of fossil fuels and the crises of climate change.

Our challenges are significant. But so is the ability of the European Union to address them.

On 26 February, I presented an **EU Action Plan** to **unlock the full value of our Energy Union**. Let me break down what we are doing and what it will mean for you.

First of all, when it comes to the green transition, we are not backtracking; we are fast tracking. Today, across Europe, wind turbines and solar farms are waiting years to be built. Hundreds of gigawatts of green, affordable energy are waiting to be unleashed. We cannot wait any longer. We will therefore cut the **permitting delays** that hold back the development of renewable projects - enabling a more rapid delivery of affordable green energy for Europeans. We will also make it easier to take up **longer-term contracts for renewable energy**, to ensure that buyers of clean electricity are shielded from short-term volatility in energy markets.

Another key area of focus will be to **strengthen and streamline our Energy Union.** Today, we are only using half the potential of our grids – it is as if Europe had 100 highways, but only used 50, and will need 200 in the future. The Commission will therefore lead closer coordination between Member States in the governance of energy markets, the planning of grid developments, and in preparation for crises.

We will also direct **shared and strategic European investments** to advance efficiency, electrification, and modernisation. To further support investments, we will establish a **tripartite contract for affordable energy**, linking the public sector, clean energy developers and producers, and the energy consuming industry. It's a matter of enhancing scale and ensuring predictability.

Finally, as we decarbonise our economy, demand for gas is declining, but it will remain a significant part of our energy mix for some time. Our Action Plan therefore targets **fairer gas markets**, by improving regulatory oversight and equipping authorities with strong legal powers to sanction market abuses. We also aim for **more competitive gas markets**, for example, by leveraging EU purchasing power get a better deal for imports from reliable LNG suppliers.

What does all of this mean for homes and businesses in Europe? Taken together, we have the potential to deliver €45 billion in savings in 2025, growing to at least €130 billion in annual savings by 2030, and to €260 billion annually as of 2040. Overall, between now and 2040, **we can save up to €2.5 trillion** on fossil fuel imports.

These savings are within our grasp – we cannot let them slip through our fingers. We must work together: the EU, Member States, the private sector, and citizens. By combining our efforts, we can deliver the **full potential** and **fulfil the original promise of Europe**, united in diversity and direction.

Almost 70 years ago, Professor Walter Hallstein, first president of the European Commission, spoke of this promise as he set out the prospects for European unity in a world of daunting challenges: "*If the great venture is to succeed, what we need is not only intelligence, imagination and determination but, above all, confidence in ourselves, and a tough, unyielding will to survive.*"

Let's heed these words and have confidence in ourselves. Through unity, we have not just survived – we have thrived.

We began life as a European Coal and Steel Community. We are now a European community of wind turbines, solar panels, and geothermal generators. Where once we were divided by trenches and the iron curtain, now we are connected, by power lines, cables, and interconnectors.

Now is the moment to **complete what we started 70 years ago**, to build on our strengths and unleash the **full value of our Energy Union.** We cannot afford to wait a moment longer.

Energy Security in the **Baltics**: from synchronization to critical **energy infrastructure protection** model of the EU

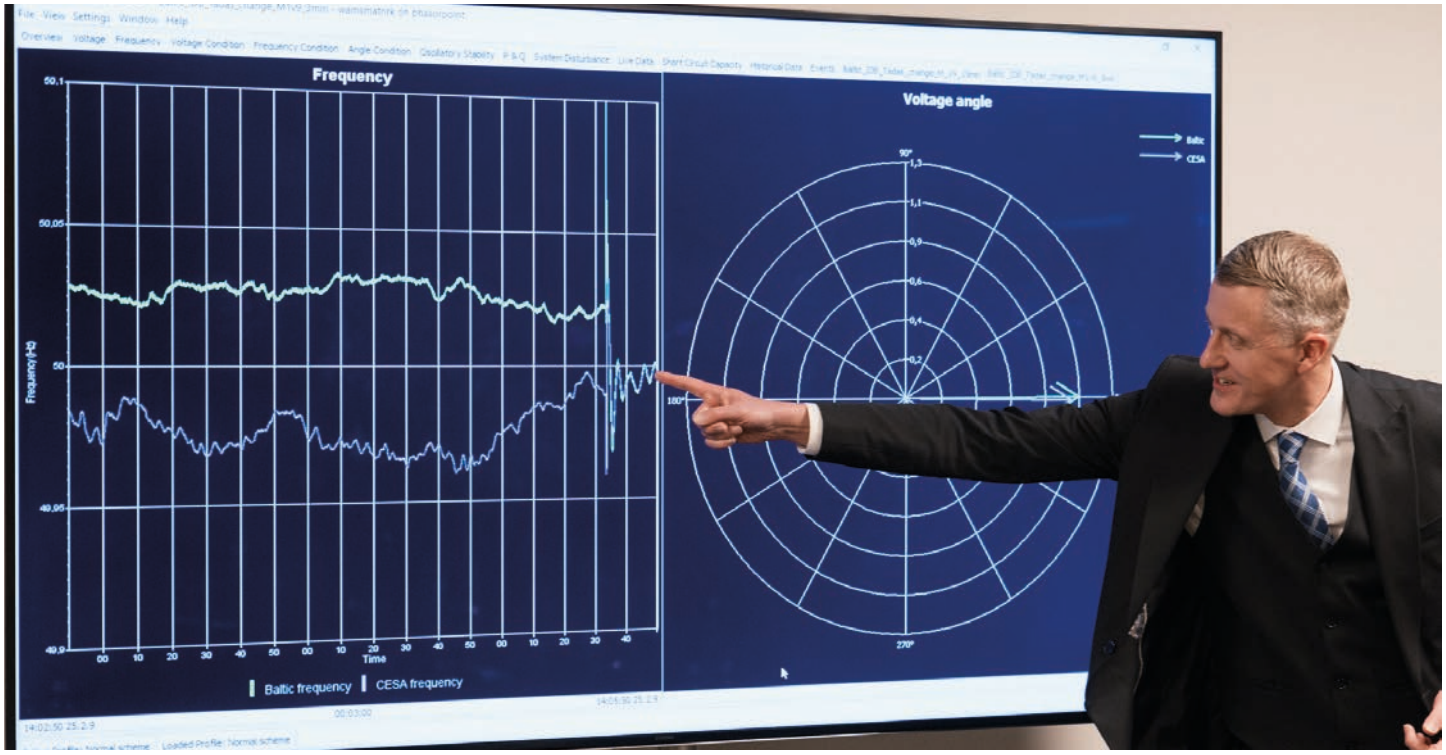
ŽYGIMANTAS **VAIČIŪNAS**

Lithuanian Minister for Energy

The Baltic States' electricity system synchronization with the Continental European Networks on February 9, 2025, marks a historical milestone in energy security and independence of the entire region – a goal accomplished by dedicated efforts of almost two decades. By permanently disconnecting from the IPS/UPS system, the Baltic States have not only reinforced their sovereignty but have also set a precedent for energy resilience within the European Union. This achievement underscores also Lithuania's commitment to strengthening the EU Energy Union, enhancing energy security, and paving the way for a more robust European energy infrastructure.

For 65 years, Lithuania remained dependent on Russian energy systems, leaving it vulnerable to external pressures. Lithuania recognized the strategic necessity of energy independence early on, investing in alternative energy infrastructure and supply diversification. The commissioning of the Klaipėda LNG terminal in 2014 was a decisive step, allowing Lithuania to eliminate reliance on Russian gas imports. In light of Russia's aggression against Ukraine and the energy crisis in Europe, Lithuania, followed by Estonia and Latvia, was the first EU country to completely stop importing Russian pipeline gas and LNG, both *de jure* and *de facto*, setting a benchmark for others to follow.

As geopolitical uncertainties continue to shape the European security landscape, it is crucial to unite efforts to protect and secure critical energy infrastructure, which is vital for completing the EU Energy Union, boosting EU competitiveness, and ensuring a stable and reliable supply of affordable energy. The Baltic region faces unique challenges due to its geographic location and the increasing threats to undersea cables, energy transmission networks, and supply routes. Recognizing these risks, the EU has been intensifying its efforts to ensure infrastructure protection, with European Commission President Ursula von der Leyen outlining four key priorities on February 9, during the Baltic Energy



Baltic States join the synchronous grid of Continental Europe, 9 February 2025 | 2:05 pm

Independence Day in Vilnius: prevention, detection, response and repair, and deterrence. Consequently, the Baltic States are uniquely positioned to spearhead these initiatives and transform themselves into a flagship model of excellence in infrastructure protection and resilience.

Lithuania's and all the Baltic States proactive approach is evident in its extensive national investments in energy security tools, including anti-drone systems, monitoring systems for undersea cables, and emergency reserves of critical transmission network equipment. However, as security threats transcend national borders, a unified European strategy is essential. Lithuania together with Estonia, Latvia and Poland by a Joint Statement on the Protection of Critical Energy Infrastructure Assets signed, on the 9th of February *de facto* advocates for the establishment of a dedicated regional flagship model of excellence in critical energy infrastructure protection and resilience, focusing on the Baltic States as a testbed for broader EU implementation. This initiative aligns with the EU's "Action Plan on Cable Security" and upcoming strategic documents such as the Internal Security Strategy, the Preparedness Union Strategy, and the White Paper on the Future of European Defence.

A coordinated EU-wide effort is necessary to safeguard critical energy assets and ensure the long-term stability of the European energy market. To achieve this, the following actions must be taken – establishing an EU-wide civil-military security and resilience approach, creating and enforcing a dedicated EU investment framework, and promoting synergies with NATO.

One crucial area requiring immediate attention is the protection of submarine cables, which are vital for both communication and electricity transmission across Europe. Ensuring their security will play a critical role in the stability of the Baltic States energy markets and broader European electricity system.

The success of the Baltic States electricity systems synchronization with the Continental European Networks demonstrates that ambitious goals can be realized through political will, investment, and regional cooperation. Lithuania alongside with Estonia, Latvia and Poland stands ready to continue leading by example, advocating for enhanced infrastructure security, and working with European partners to fortify the EU's energy resilience. With modest yet strategic EU investments within the region, substantial progress can be achieved within just 12 months.

By embracing a forward-thinking approach and leveraging their unique position, the Baltic States cannot only secure their own energy future but also contribute to a more secure and resilient European energy landscape. The time to act is now, ensuring that Europe remains prepared for the challenges of tomorrow while capitalizing on the successes of today.

Strengthening Energy Security and Regional Cooperation

LUKÁŠ VLČEK

Minister for Industry and Trade, Czech Repub

Over the past three years, energy security has become a key issue for all of Europe. Russia's invasion of Ukraine not only triggered a humanitarian crisis but also brought significant changes to energy strategy. Europe's Achilles' heel was its dependence on Russian fossil fuels, which allowed Russia to use energy as a tool of coercion. Thanks to the Czech Presidency, Europe-wide measures, and swift actions taken in the Czech Republic, we managed to navigate the crisis and emerge stronger than ever.

One of the key responses to the energy crisis and the weaponization of energy was the diversification of energy sources. At the beginning of 2022, almost all the gas supplied to the Czech Republic came from Russia, with virtually no alternative supplier options. This dependency gave Russia the ability to manipulate supplies and drive up prices. Thanks to joint European efforts and decisive steps by the Czech government, the Czech Republic is now independent of Russian gas. This was achieved through securing alternative supplies and access to liquefied natural gas (LNG) capacity in the Netherlands.

Today, the European gas market has sufficient supply, and from an energy security perspective, no European Union country is facing critical supply issues for households or businesses. The development of renewable energy sources and massive investments in strengthening transmission and distribution networks also play a crucial role in enhancing energy security.

Cross-border energy cooperation and infrastructure connectivity are essential. That is why we are focusing on expanding interconnections between electricity and gas networks. With regards to interconnectivity of electricity Czechia is already more than fulfilling target for 2030 on the level of 15 % interconnectivity and has already more than 30 % with expectation of close to 40 % in 2030. With regards to gas networks Czechia reverse the flows predominately coming from east to flows coming from west. Czechia together with Slovakia

received as a first member countries funding for cross border project focusing on smart grids.

Another critical factor in strengthening energy security is support for technological innovation. The development of battery energy storage, the expansion of smart grids, and the implementation of hydrogen technologies are key areas that will enable greater energy independence and flexibility.

European energy policy has undergone one of the most significant transformations in its history over the past three years. The diversification of energy sources, the strengthening of regional cooperation, and investments in nuclear energy and renewables are all contributing to greater energy resilience and sustainability.

The Czech Republic plays an active role in this process and continues to support the development of strategic energy projects that will ensure the stability, independence, and competitiveness of the European energy sector.

The Crucial Role of **Renewable Energies** in **EU Energy Security**

MARIA **DA GRAÇA CARVALHO**

Portuguese Minister of Energy and Environment

Energy security has been a building block of the European Project since its very beginning, with the creation of the European Coal and Steel Community, in 1952. More recently, especially after the adoption of the so-called 3x20 objectives, in 2008, renewables gained importance in the context of climate change, but also as a mean to ensure Europe's energetic sovereignty.

With the European Green Deal, in 2019, and, one year later, the adoption of the Climate Law, which set a legally binding target to reduce net emissions by at least 55% until 2030, as well as a commitment to achieve negative emissions after 2050, the energy transition became the single most important step towards a more sustainable, resilient and competitive European Union.

And, in 2022, it became evident that this was the right strategy for Europe. The energy crisis, which was considerably worsened by Russia's invasion of Ukraine, had a very severe impact on all of us. According to some estimates, Member-States spent as much as 792 billion euros that year alone in measures aimed at protecting consumers. It was an expensive lesson to learn, but also a well-worth lesson.

After the launch of the Repower EU initiative, in 2022, Member-States worked swiftly and with solidarity to ensure supply, especially to the nations that were more exposed to Russian energy. A considerable effort was made to diversify the pool of EU's external gas providers, favouring diversity and trustworthiness over price. At the same time, storage increased while consumption was reduced.

The main driving force behind this response, however, was our reinforced commitment with the energy transition. The EU, which was already leading the way to decarbonization, doubled down on its efforts to release itself from the fossil fuels dependency.

And it succeeded! Natural gas imports from Russia have dropped by 75% and the importance of renewables is increasing day by day.

This is especially true in the context of electricity production and consumption. When we consider the reality before and after the energy crisis, the facts are undisputable.

Between 2021 and 2024, onshore wind surpassed natural gas as a source for electricity production. Over this period, the first grew from 338.7 TWh to 435.8TWh per year, while the second decreased from 558TWh to 400.1 TWh. Meanwhile, solar power also grew, as the EU started to phase-out from its coal plants. Interestingly enough, nuclear power, which many pointed out as the only solution to compensate for the transition from fossil fuels, also lost protagonism over this period.

In other words, renewables emerged from the energy crisis as the big winners. Those steps that we took out of necessity, in response to the threat that Russia posed to our energy security, ended up becoming the proof of concept for the Green Transition. And this path that we have chosen for ourselves will not change, regardless of the political context, in Russia or elsewhere, and even in spite of the efforts being undertaken by some sectors to disturb the process.

The Portuguese case

For my home country, Portugal, energy security and self-sufficiency, were a concern long before the 2022 crisis. Along with our neighbours Spain, we suffer the consequences of weak interconnections with the rest of Europe, which, in practice, have turned us into an energy island.

This is why we started to invest in renewables sooner than others. And this is why, in 2024, 71% of all the electricity we consumed came from renewable sources. Again, necessity was the main driver behind this process.

In comparison with other Member-States, Portugal is well-placed in the green transition. However, we are by no means complacent with our successes.

Recently, we have approved a new National Energy and Climate Plan (PNEC 2030), setting a target of a 55% greenhouse emissions reduction by the end of this decade, compared to 2005.

We have also increased the target for renewables in gross final energy consumption, from 47% to 51% by 2030.

We want to continue to grow well-established renewables but also invest in hydrogen and biomethane.

We are also investing in grid flexibility and storage, in our quest for a continuous energy supply.

And we are looking at hard to decarbonize sectors, such as transports, investing in sustainable public and private transportation and developing a national consortium with the goal of producing Sustainable aviation fuels.

Portugal is looking towards the future with ambition, and it is with joy and enthusiasm that we see an increasing number of Member-States, not just following that same path but, even more importantly, working side by side to create a true Single Energy Market, which is something that we never truly had in the EU.

There is still much that needs to be done.

We must complete the interconnections that Europe still needs, notably the electrical interconnections in the Pyrenees. We must fulfil our promise to put consumers first, by implementing, at national level, the reforms approved in the new Electricity Market Design. And we must find sustainable energy solutions for harder to decarbonize sectors, such as transports and several key industries.

However, there is no doubt in my mind that we will achieve all of this. It is no longer a matter of if but of when.

MARC **FERRACCI**

French Minister for Industry and Energy

Strategies for **Energy Diversification** and **Carbon Neutrality** Strengthening Highly **Strategic Energy Sectors**

In a context of growing geopolitical divergence and tensions, Europe's high level of dependency to fossil fuels imports appears more and more as a strategic vulnerability. It is indeed difficult to ignore that among the key players of the discussions on the future of Ukraine, two of them are the largest natural gas producers worldwide, while Europe has become the largest importer of LNG worldwide. As pointed out very clearly by Mario Draghi in his seminal report, Europe is facing the end of an era of energy security and geopolitical stability, and these evolutions are two sides of the same coin.

This is a new challenge for Europe, but fortunately, one for which we are well prepared due to the unexpected convergence between this new energy security agenda and the carbon neutrality agenda that has been pursued since 2019 under the European Green Deal. Indeed, decarbonization and the development of clean tech, that were central to the energy transition vision of the first von der Leyen Commission, are increasingly seen as key elements of the geopolitical stance of the second. Strengthening key strategic energy sectors is thus becoming the Union's industrial priority. It is the vision of the Clean Industrial Deal.

First and foremost in this agenda stands electrification, which appears as the most efficient way to decarbonize most of Europe's transportation, heating, and industrial use-cases, and the most important strategic energy sector to strengthen. To my mind, the deployment of EU-made clean technologies in these sectors: battery electric vehicles, heat-pumps, industrial electric furnaces and hydrogen generation for industrial uses, must be the key priorities of our European policies in the next years. The French energy transition agenda puts them front and center. For instance, our national heat-pump development plan aims to produce 1 million heat-pumps per year and 2 million electric battery vehicles per year by 2030.

These new electricity consumptions create a need for an increase in power generation, that must be met by European-made generators. The Net Zero Industry Act (NZIA) provided a clear path for Member-states to ensure that European demand is directed towards European clean industry to ensure its success in a very competitive international landscape. France is willing be the first country to use NZIA resilience criteria in its tenders for renewable energy as of this year. We expect to extend its use to all net zero technologies, from electrolysers to wind-mills, and I hope that our example will be followed by many !

However, I do believe that we need to go even further. Resilience criteria are submit to circumvention and uneasy to verify and deploy. Moreover, they provide low legal security for businesses. In order to really trigger capacity building in Europe in the field of clean techs, I believe that we should take direct inspiration from the US's inflation reduction act, to which we never really answered, and take steps towards using explicit "Made in Europe" criteria for some key technologies, as recommended by Mario Draghi. I am happy to see that the European preference is now front and center in the Commission's ambition, and I will make proposals in this direction in the next months.

But not all use-cases can be electrified. Gas or fuel powered energy generation, large industry furnaces, planes, trains and boats, and even some heating solutions cannot be easily converted to electrical technologies. To ensure strategic autonomy, we thus have to accelerate dramatically the deployment of low-carbon and renewable gases and fuels, that can be produced locally, in Europe.

Biogaz is a key ingredient of this acceleration. Europe climate is ideal for farming. This is a unique geographical chance that we must put to good profit. I am convinced that methanization provides a low-carbon energy that substitutes effectively to imported natural gas and provides important positive externalities to our farmers: income supplements, digestate, contribution to agro-ecological transition. I am committed to a radical acceleration in this production, as France will soon issue new tools to encourage this production.

Biofuels are a similar opportunity. Europe enjoys one of the largest biomass resource on the planet. If we don't have natural gas, we have plants and trees ! This can be the basis for larger biofuel production to ensure that air and sea transport can be ensured with locally produced energy.. RefuelEU and Fuel EU Maritime regulations paved the way, and we have to deliver these targets through an ambitious industrial strategy to develop production capacities in Europe. However, we must also face the reality that we do not have enough biomass worldwide to sustain a continued growth of air and sea transport. E-fuels must come to help here, and I am happy that Europe is a world leader in these technologies.

I strongly believe that our Union's strategic autonomy now depends also on its energy security, which itself relies, in an Europe that does not possess large fossil resources, on a accelerated development of low carbon technologies in Europe. The Commission, under Executive Vice President Séjourné's impulsion, has taken decisive steps to accelerate this transition. France will be the strongest support of this agenda, that embodies both president Macron's competitiveness and strategic autonomies priorities.

Strengthening the Security of **Critical Energy Infrastructure Against Cyber** and Hybrid Threats

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NATO OTAN NORTH ATLANTIC TREATY ORGANIZATION

Disclaimer: The views expressed by the author are his own and do not reflect the official position of the organisation represented.

From the first days of Russia's full-scale invasion of Ukraine – in February 2022, against the backdrop of Russia's illegal annexation of Crimea in 2014 - critical energy infrastructure was in Moscow's target list. First, fuel depots, then refineries, key power grid nodes, heat and power plants, as well as gas infrastructure. It was not a "hybrid threat", but part of a direct military attack, in which Russia used kinetic means - missiles, drones, glide bombs - to destroy Ukraine's critical energy infrastructure and undermine Ukraine's ability to resist the invasion. And while in the beginning Moscow tried to deny targeting civilian energy infrastructure, the systematic nature of these attacks made Russia's intentions clear. Critical energy infrastructure carries energy supplies that are essential for the life of population, functioning of the economy, as well as defence industries and mobility, so destroying it would help Russia to win the war.

Moscow, however, underestimated the resilience of Ukraine's energy system and the ability to organise protection and defence and innovate while doing so, as well as the support from NATO Allies and partners with everything from air defence systems to generators, and Ukraine's resolve to engage in deterrence, as well as action against its adversary's infrastructure. While Ukraine's energy system suffered significant damage, it survived. And Ukraine's experience brought invaluable lessons to Europe on protecting critical energy infrastructure. Even when the sound of flying missiles is no longer heard above Ukraine's power plants, these lessons will remain key for ensuring Ukraine's long-term security, and for Europe's preparedness and readiness to face any threat.

The Ukrainian power system featured significant generation capacity before the war, and was designed with redundancies in place to handle heavy industrial demand. Many European countries can only wish for spare power generation capacity. This means that Europe would need to work much harder to have an energy system that can withstand the test of war. This is, however, an essential part of building deterrence: if adversaries understand that targeting infrastructure would be costly and not necessarily effective, the temptation to pursue such a strategy is supressed. And vice versa: if the cost is small, but benefits are perceived as worthwhile, the appetite for targeting infrastructure increases. So building a resilient energy system is important to its overall security. But it is not enough.

No energy system is without any vulnerabilities. And having enough redundancies to withstand any attacks or disruptions is a tall order. This is also true for the European energy sector. Being a net importer of energy, Europe relies on several key pipelines and import terminals, particularly gas, which can be exposed to a variety of threats - from drones to sabotage. Europe's electricity grid is increasingly interconnected and at the same time more dependent on high voltage direct current (HVDC) undersea cables and substations that are hard to repair and replace. And while the European power grid is more efficient due to smarter, digitised management, it also features a larger cyber "attack surface".

At the same time, Europe is facing a heightened risk environment and motivated threat actors. Moscow, for example, may be tempted to challenge Europe's decisive actions of diversifying away from Russian energy and supporting Ukraine's defence. In this regard, complementing resilience with protection measures, reinforced by NATO's deterrence and defence, is key to comprehensive infrastructure security. To be clear, it would be unfair to expect NATO, or the military in general, to protect all energy infrastructure all of the time: that includes thousands of kilometers of pipelines and power cables - undersea and onshore. But NATO can play an important role of deterring potential attacks against infrastructure, and has already risen to the challenge. After all, no adversary can afford the cost of confrontation with the most powerful Alliance in history. It is for this reason that Allies have clearly stated that deliberate attacks against Allies' critical infrastructure would be met with a united and determined response.

What is left for the adversary wishing harm to Allies' infrastructure is then to hide under the veil of non-attribution. This means actively avoiding exposure by exploiting areas where infrastructure is harder to monitor and attacks are more difficult to detect. For example, undersea, in the cyber domain, or by "blending into the crowd" and conducting sabotage attacks. And while the cost of such "hybrid" or cyber-attacks may be low, the consequences for Europe's energy supply and infrastructure security can be significant, especially when energy markets are tense and any disruption could have cascading effects. In addition, any successful attacks on infrastructure without consequences for the perpetrator raise the appetite for more. The increasing number of cyber and sabotage incidents in Europe may signify attempts to test infrastructure security and our ability to respond.

NATO's resolve to ensure Allies' security is clear. After a number of incidents affecting undersea infrastructure in the Baltic Sea, NATO launched "Baltic Sentry" to enhance NATO's military presence in the Baltic Sea and improve Allies' ability to respond to any destabilizing acts. This builds upon another important step undertaken, through the establishment of a new NATO Maritime Centre for the Security of

Critical Undersea Infrastructure within NATO's Maritime Command in Northwood (UK).

However, to successfully detect suspicious activities, which can disrupt critical infrastructure, as well as deter and counter them, the military needs to play in a team. Energy infrastructure is owned, operated and maintained by industry, which has deep knowledge of their own infrastructure, as well as eyes and ears in the field. Combining industry's knowledge and visibility of infrastructure with the military's expertise on the "red picture", while employing innovative technologies to share and fuse information about suspicious behaviour, is a powerful capability, which makes the perpetrators' attempts to hide in the "grey area" much more difficult.

Over recent years, NATO has taken major steps to enable coordination between Allied militaries, governments and industry operators in securing critical infrastructure: from the NATO Industry Cyber Partnership (NICP) to the NATO Critical Undersea Infrastructure Network. This also underlines the fact that the military and industries alike depend on secure energy infrastructure and supplies for their activities. And while NATO is ramping up its defence capabilities to respond to threats to Europe's security, Europe's energy sector needs to shift to a "wartime mindset" too. In this regard, the EU's Preparedness Union Strategy and efforts to enhance the resilience of the energy sector in the EU are welcome, opening new areas for closer NATO-EU cooperation. But what also helps is the growing awareness and understanding in the private sector that critical energy infrastructure security is a shared responsibility, where the energy industry can play a major role.

There is no better way to strengthen energy infrastructure security than building-in resilience and security measures in new and upgraded infrastructure. All energy industry operators know that retrofitting those measures or dealing with disruptions is more expensive than "security by design", which is a worthwhile investment. This can range from burying power cables into the seabed instead of simply laying them on the sea floor exposed to anchors of the Russian "shadow fleet", to relying on solar inverters and power management controllers from reliable suppliers who would work to prevent vulnerabilities in those systems. In addition, to be ready to operate energy infrastructure and provide essential energy supplies in all scenarios, including during crises, the industry needs to be well prepared and to invest in adaptive security measures - from sensors to cyber defences, to training of their staff and regular exercising. NATO will always be there to help, and play in a team, as an integral part of a networked effort to tackle the current threats and challenges to our collective security.

The **Energy Sovereignty** in the **Data Age**

Interview with

EMMANUEL LEMPERT

Vice-President, Head of Government Affairs for France, Middle East, and Africa at SAP

By Laurent Ulmann,
Editorial Director of The European Files

1. How does the integration of data analytics transform traditional concepts of energy sovereignty?

Traditionally, energy sovereignty focused primarily on securing physical resources and infrastructure. Today, this definition is rapidly evolving as energy value chains and business models transform through deregulation, decarbonization, decentralization, and digitalization.

Data analytics has become the foundation of modern energy sovereignty for several key reasons:

- **Reduced dependence on external energy sources**: By optimizing production, distribution, and consumption, nations can minimize their reliance on imports. Case studies presented at the 2024 SAP Energy and Utilities Conference demonstrated that utilities implementing data-driven optimizations achieved 15-20% reductions in external energy dependencies.
- **Enhanced resilience against supply disruptions**: Predictive analytics helps anticipate potential disruptions and facilitates the implementation of automated mitigation strategies. One European company showcased how its data-driven early warning system provided a critical 72-hour advantage in responding to a major supply constraint.
- **Improved operational visibility**: Comprehensive data collection across the energy value chain offers unprecedented insight into operations, identifying vulnerabilities that might otherwise remain hidden. This visibility is crucial, as it is impossible to secure what cannot be seen.
- **Guided strategic investments**: Data analytics informs national energy production and infrastructure investments, ensuring resources are allocated to projects with the greatest impact on energy security. During the Conference, several utilities shared how data-guided investments redirected billions toward high-yield national capabilities.

Modern cloud-based energy management systems, such as SAP Cloud for Energy, enable companies to leverage Big Data analytics for strategic decision-making. Some implementations have demonstrated the ability to generate reports up to 10 times faster than traditional methods.

2. What role do data platforms play in maintaining grid stability with increasing renewable energy integration?

The transition to renewable energy presents both opportunities and challenges for energy sovereignty. While renewables reduce dependence on imported fossil fuels, they introduce new complexities and potential vulnerabilities that data platforms help manage.

Managing intermittency is a primary challenge, as renewable sources like wind and solar are inherently variable. AI-powered forecasting algorithms now predict renewable energy production with significantly improved accuracy up to 48 hours in advance, enabling proactive grid management and reducing dependence on fossil fuel backup generators. According to the International Renewable Energy Agency, AI-powered energy forecasting can improve the accuracy of renewable energy production predictions by up to 10%.

Data platforms demonstrated at the conference showed how utilities use real-time analytics to maintain stability with renewable energy penetration exceeding 70% in some regions—levels previously deemed impossible without compromising reliability. These platforms leverage solutions specifically designed to manage and analyze metering Big Data, based on global industry standards like the Common Information Model (CIM), which facilitate seamless integration across the energy value chain.

Optimized storage deployment is also essential for renewable-based sovereignty. Data analytics determines the optimal placement, sizing, and operation of storage, maximizing the security value of these investments. One company reported that analytics-driven storage deployment reduced its vulnerability to supply disruptions by 40%.

A particularly compelling case presented at the conference involved a Scandinavian utility that used integrated data platforms to maintain energy security while achieving 85% renewable energy penetration. Their approach combined weather prediction, consumption forecasting, storage optimization, and demand flexibility, all orchestrated by a unified data platform.

3. How are consumers becoming active participants in energy sovereignty through data-driven approaches?

Energy sovereignty is no longer solely the domain of governments and utilities. Consumers are increasingly becoming active participants in energy security, particularly as we move toward decentralized energy networks and electrification.

Advanced analytics enable utilities to coordinate voluntary demand reductions during supply constraints. Presenters at the conference demonstrated how modern demand response programs, powered by AI-based personalization, achieve participation rates up to three times higher than traditional approaches.

"Prosumers"—consumers with their own production and storage

capabilities—strengthen energy sovereignty when properly integrated. Data platforms coordinate these distributed resources effectively. One company reported that its prosumer network now functions as a virtual power plant capable of providing 15% of peak demand.

Personalized consumption insights promote conservation and load shifting. Several utilities presented evidence that data-driven consumer engagement significantly impacts energy usage patterns. This aligns with Lawrence Berkeley National Laboratory findings, which shows that dynamic pricing programs led to an average peak electricity demand reduction of 13% and an overall decrease in total energy consumption of 5-10%. Companies implementing comprehensive customer engagement solutions reported up to 92% automation of customer interactions on self-service portals, simultaneously reducing costs and increasing customer satisfaction.

4. What technological and organizational changes are necessary to fully leverage data for energy sovereignty?

Developing data capabilities for energy sovereignty requires a fundamental transformation of technology, organization, and culture.

Integrated data platforms are essential, as siloed data compromises sovereignty efforts. Leading utilities are implementing unified data platforms that combine operational, customer, market, and external data into cohesive intelligence. SAP Energy Network and SAP Cloud for Energy solutions, highlighted at the conference, illustrate this integration approach.

Edge-to-cloud architecture is crucial. Energy sovereignty requires both centralized intelligence and distributed resilience. Modern architectures process critical data at the edge while leveraging cloud capabilities for deeper analytics, creating systems that remain operational even during connectivity disruptions.

Digital twins represent another major innovation. These comprehensive digital representations of physical assets and systems enhance planning and resilience. Utilities have demonstrated how digital twins enable them to simulate disruptions and optimize responses before events occur. This approach is particularly valuable considering that, according to industry data, an average oil and gas company experiences approximately 27 days of unplanned downtime per year, resulting in losses of up to $38 million—losses that can be significantly reduced through predictive maintenance and digital twin technology.

Beyond technology, organizational changes are necessary. Utilities must evolve from traditional hierarchies to data-driven organizations. This includes creating new roles such as data scientists embedded in operational teams, implementing cross-functional processes, and establishing robust governance frameworks.

Regulatory evolution is also critical. Regulatory frameworks must adapt to enable data-based sovereignty, including incentives for data investments, interoperability standards, and updated security requirements.

The importance of public-private collaboration cannot be overstated. As the UAE's Undersecretary for Energy and Petroleum Affairs stated at COP28 "collaboration is essential to our green energy transition and to ensure the UAE achieves its goal of carbon neutrality by 2050." This shows how technology can assess the individual and joint environmental impact of different industries to measure progress holistically and identify areas where additional efforts are needed.

Despite increasing automation, human talent remains a determining factor. The skills gap is a critical concern, with utilities implementing specialized training programs and partnerships with educational institutions to develop data capabilities within their workforce. This is particularly important as the Global Energy Talent Index reports indicate that over 90% of energy sector workers expect to see demand for new skills due to AI and data analytics, with the majority expecting these technologies to increase both productivity and job satisfaction.

Energy sovereignty has long been based on geological realities and political will. However, the adage "In France, we may not have oil, but we have ideas," which prevailed for many years, encouraged the development of nuclear energy sector. Today, digital technology has become a significant factor in the equation, but the underlying logic remains the same: The infrastructure you control outweighs the natural resources at your disposal. However, the political determination that Paris once demonstrated in this arena is still notably absent.

Tree lessons to **build European energy security** for the **21st century**

THOMAS PELLERIN-CARLIN

MEP (S&D Group- France), ITRE Member

"a certain centre of gravity develops, the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed". Clausewitz, On War.

On February 24th 2022 Europe entered a new era. Ukraine started its fight for its very survival, and to ensure that peace and security can be once again on Europe's horizon. Since then, the EU and its Member States have given around 100 Bn€ to Ukraine. It also spent more than 210 Bn€ to Russia to buy its oil and gas.

This is a paradox. While the EU clearly is on Ukraine's side, it continues to nurture Vladimir Putin's centre of gravity: oil and gas.

How did Europe become so reliant on two energy sources that sustain its enemies? Because of a series of historical choices. Many, such as the Royal Navy's choice to switch from coal to oil, were taken in the age of empire. In the last two centuries, Empires that had their metropolis in Europe could access vast oil resources. The companies we now know as Total, BP, and Shell were created back then to exploit oil in, respectively, Iraq, Iran and Indonesia. As European empires lost their colonial wars, their dependence on imported oil became their Achilles heel. In 1973, oil-producing states chose to strike, creating the first oil shock. To address this massive energy security challenge, 1970s decision makers made three choices we can learn from:

- Energy sufficiency and energy efficiency. From information campaigns in France to investments in biking infrastructure in the Netherlands and new buildings energy performance standards in West Germany. Those measures helped reduce oil consumption for the first time in peacetime history. EU oil consumption peaked in 1973, and soon declined by 5 to 10% in Italy, France, Belgium or the Netherlands. Meanwhile, the Soviet Union prevented the European nations it oppressed to adopt energy efficiency measures, leading to an oil consumption increased by a quarter in Czechoslovakia, a third in Bulgaria or almost by half in Poland in the same period.

- Domestic energy production. The UK and the Netherlands led investment in North Sea oil and gas production. France, Belgium, Germany all launched nuclear power plant construction programmes. Denmark invested in wind power. The exploitation of Europe's meagre oil and gas resources proved useful in the short term, but delayed more structural policies that became inevitable as Dutch gas production peaked as early as 1976, and British oil production peaked in 1999. Meanwhile, the growth of nuclear power encountered political limits. France curtailed its original ambition as its elite acted to protect fossil gas demand. German and Italian democratic choices banned the construction of new nuclear power plants. Danish investment in wind power proved in the end to be globally transformative as it built the basis for the wind power technology we know today.

- Importing oil and gas from other countries. In a grand game of "robbing Peter to pay Paul", Western European governments chose to reduce their reliance on Middle Eastern oil and gas by buying Russian oil and gas. In Austria, Germany and France, this choice for Russian fossil fuels created a small economic elite with political clout that have been consistently lobbying by further energy ties with Russian fossil oligarchs. They consistently pushed for more megaprojects like Nord Stream or Yamal LNG, worsening European dependence on Russian energy.

Today, the EU is not facing a shortage of oil. We live the aftermath of the first gas shock in our history: a massive increase in gas prices created by Vladimir Putin's decision to drastically reduce Russian gas exports to the EU. It started in the summer of 2021 - possibly to create inflation to weaken European resolve ahead of Putin's full-scale invasion of Ukraine. It worsened in the spring of 2022, when Putin retreated his defeated forces from central-Ukraine to lead the attritional war he is still waging in Donbass. Yet, which lessons can we draw from the 1970s reaction?

First: energy efficiency works. European gas consumption peaked in 2010 at 423bcm. It structurally decreased over time as energy efficiency investments in buildings and industry rose. One of the unsung victories of the EU energy efficiency policy is that it probably saved the European industry from a total collapse provoked by a complete shortage of gas in the winter of 2022. Now more than ever, we need to double-down on energy efficiency regulatory implementation and investments. However politically unpopular those measures might be for a fraction of European landlords, they are vital for the very survival of our industry, to ensure the fossil gas we will still need in the two decades to come can come to Europe at an affordable price.

Second: homegrown energy works. The exploitation of oil and gas in the North Sea was a key component of Western-European energy security for a while. But those resources are gone. Today, Europe imports 97% of its oil, 90% of its gas. While nuclear

energy benefits from a surge in popularity, its contribution to energy security remains limited. Nuclear giant EDF hopes that the EU nuclear fleet can grow from 100GW today to 120GW by 2050. But as electricity consumption is expected to increase, the very same EDF study expects the share of nuclear in the power mix to decrease from 25% today to 16% in 2050. With fossil fuels no longer being a viable option, and nuclear's impact being limited (regardless of the democratic choices that still need to be made on this controversial energy source), what can we do? The solution is obvious: renewable energy. The more we deploy wind and solar, the more energy secure we are. Bullies like Putin and Trump can cut off gas supply to Europe, but they cannot stop the wind from blowing in Gdansk or the sun from shining in Madrid. **Any serious European energy security strategy needs to put renewable energy at its core.** Wind and solar electricity generation but also all other renewable energy sources, from mature solutions like solar heating systems and heat pumps, to more innovative ones like deep geothermal, osmotic and tidal energy.

Third: international cooperation. We need to reduce Vladimir Putin's capacity to turn its oil and gas into missiles and mercenaries he throws at Ukraine now - and possibly directly at us in the future. Kaja Kallas should therefore engage with Russian fossil fuel importers, especially India, to provide them with better options. **Our Europe would be more secure, both from a climate and a geopolitical perspective, if Indians were using Danish and Spanish wind turbines, rather than Russian fossil fuels.** Weakening Putin also means that Europe should immediately stop funding his war machine. In the very short term, let's stop importing all Russian gas, including LNG. For the coming two decades, Europe will still need to import some oil and gas. The lower the better. The EU currently has only one significant reliable supplier of gas: Norway. All others (Russia, Algeria, Azerbaïjan, USA, Qatar, Libya) are subject to severe potential geopolitical disruptions. Theoretically, the EU could import LNG from Australia, but geographical distance equals higher economic costs, making Australian LNG imports to Europe outrageously costly. The situation is somewhat similar for oil. With renewables, the energy source is secure and homegrown. With demand-side flexibility, battery and heat storage, as well as less well known renewable energy sources (concentrated solar power, tidal, osmotic), energy security will be almost guaranteed in peacetime. The challenge comes in ensuring some degree of European access to the stock of raw materials and cleantech equipment to build and maintain the system.

Conclusion:

In fossil fuel geopolitics, one problem somewhere leads to oil and gas prices going through the rough in Europe in the coming days, and possible shortage in the coming year. Just like in 1973.

In our clean energy future, only extreme scenarios would seriously threaten European energy security. And even then, pain is delayed, impacts are limited. For instance, if Europe were unable to source any new solar panels and batteries from China, this would have near zero impact on the electricity price for several years, as it does not affect the solar panels that are already in Europe. In that scenario, Europe will start suffering after around 5-10 years, and only if it were to fail to revive its domestic solar PV industry or source solar panels from other places.

As fossil fuel geopolitics are being phased-out and clean energy geopolitics phased-in, Europe should strengthen its geopolitical game. 80% of global lithium reserves lie in democracies, especially Australia and Chile, which also happen to have massive solar and wind potential. Both countries have a vested interest in cooperating more with the EU, to avoid becoming the collateral damage of US renewed imperialism clashing with Chinese expansionism. Strengthening European cooperation with them is vital to ensure Europeans can access critical materials through win-win partnerships. As for access to critical equipment: Europe has the potential to be self-sufficient in battery manufacturing while becoming a global exporter of wind power systems, electrolysers, electricity cables, solar heating systems and heat pumps. The only clear weakness is solar PV, an industry that was destroyed by the Council of the EU in the early 2010s when it chose the maximisation of quarterly profits of European diesel car exporters, over the survival of the nascent European solar PV industry. But it would only take investments of less than 0,1% of the EU GDP for the European solar industry to to be born again.

Let us be clear: the dusk of fossil fuels is probably the best piece of news for European security since the fall of the Soviet Union. The fact that the political forces fighting against clean energy are also allied to Vladimir Putin is not a coincidence. Fossil fuels and Putin's strengths are two sides of the same coin: it is our dependence on fossil fuels that give power to Putin. In my view as a former French soldier, any true patriot, regardless of his political beliefs, should support energy efficiency and renewable energy as the two main priorities for true patriotic energy policymaking. The choice for fossil fuels is the choice for geopolitical weakness and planetary collapse. The Green Deal is Putin's kryptonite. Thanks to the good choices made by our forefathers in the 1970s, we now have all the technologies we need to make Europe energy secure again!

Europe's pathway to **decarbonization** and industrial competitiveness

CATHERINE **MACGREGOR**

CEO of ENGIE

Decarbonization pathways for Europe through 2050: ENGIE's scenario

Over the past decades, Europe has been a global leader in the energy transition, demonstrating commitment and ambition in decarbonizing its economy. Today our continent stands at a crossroads with an unprecedented challenge: maintaining its green leadership while reinforcing its industrial competitiveness and sovereignty. In a shifting geopolitical landscape, Europe must reaffirm its decarbonization ambition and ensure that the energy transition remains a competitive advantage.

The energy transition: a competitive imperative, key for our sovereignty

The energy transition is not just an environmental necessity, it is also an economic opportunity. Other regions of the world such as China, where 50% of new renewable capacity was installed in 2024, are seizing this opportunity. Opposing sustainability and competitiveness is a short-term perception while decarbonization strengthens economic resilience, improves security of supply, and fosters technological innovation and the creation of new jobs. The Clean Industrial Deal is a crucial step in this direction and ensures that Europe remains at the forefront of green industrial leadership.

The energy transition also helps us to reduce dependency on imported supply. It allows us to reshore energy production with homegrown molecules such as biomethane, and homegrown electrons with renewables which, when installed, do not require any important feedstock supply.

2050 net-zero target: the challenge that lies ahead

However, our recent "ENGIE Decarbonization Pathways for Europe 2050" indicate that while the 2030 Fit for 55 targets are within reach—thanks to the rapid deployment of mature technologies such as solar and wind—the real challenge that lies ahead is the 2050 net-zero goal. Currently, 70% of required technologies are still not fully industrialized. We need to boost innovation and scale up new technologies.

Key levers, electrons and molecules

The overwhelming challenge for companies and governments is to conduct this transition in the most affordable manner. All levers should be activated starting with electrification. We must ensure that every electron is "smart", namely decarbonized, efficiently distributed, at the right time, and at the lowest possible cost. This is notably enabled by coupling renewables and batteries: ENGIE is playing its part, targeting 95 GW of installed renewables and battery storage capacities by 2030 worldwide.

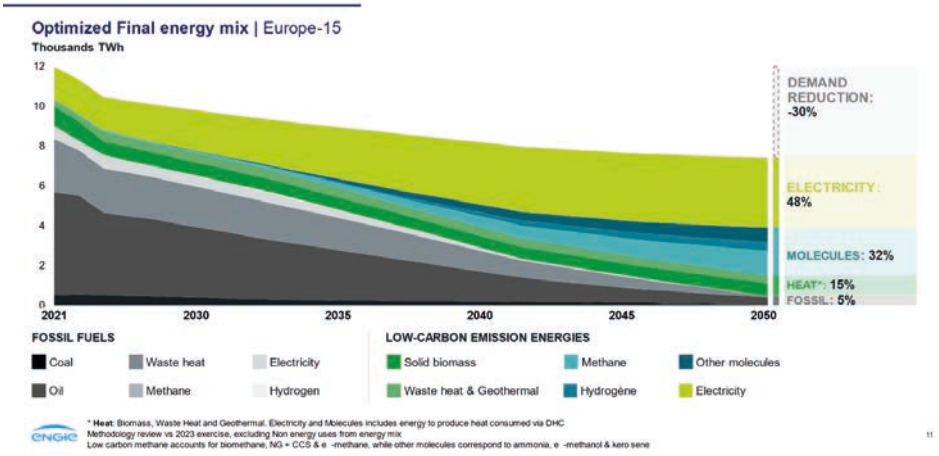
Other technologies have a role to play such as nuclear power in certain European countries. Lastly, with electrification comes the need to develop and reinforce power grids.

Electrification is the first lever of the energy transition, but it will only address approximately 50% of Europe's total energy demand. We must also activate green gases (such as biomethane, hydrogen and its derivatives, e-molecules etc.) to meet certain specific needs. This is the case for industrial feasibility reasons, especially in the hard-to-abate sectors, i.e. heavy industries or transportation, but also to optimize the global energy system and avoid overdeveloping certain electrical capacities at a higher cost. This is what we refer to at ENGIE, as the alliance of electrons and molecules.

For example, biomethane could supply 20% of France's gas consumption by 2030, (which is the equivalent of Russia imports before 2022) enhancing Europe's energy sovereignty. As for hydrogen, though still emerging, it must be pursued as a key flexibility enabler.

Overall, we know how to decarbonize molecules, and we can draw on our experience in other technologies that are now mature.

Final energy demand reduces significantly, with strong electrification complemented by decarbonized gases and heat



Twenty years ago, no one would have imagined that half of the EU's electricity (48%) would come from renewables in 2024!

In parallel, to make the transition cost effective and to provide long-term certainty, a gradually increasing carbon price floor would offer stability, incentivizing decarbonization while generating revenues for climate investments.

Of course, the energy transition requires very substantial investments, but these are within the reach of our economy, at around 2% of GDP per year. They will gradually be offset by savings on fossil fuels. The cost of inaction, on the other hand, is much greater: 10% of GDP for each additional degree, not to mention the ensuing environmental and human drama.

Without these industrial development efforts towards clean energy, I am convinced that we will lose both the climate and competitiveness battle, while weakening our sovereignty.

To successfully overcome this challenge, I see three priorities:

- **First priority, optimizing the energy system on a European scale**

We need to capitalize on the complementarities of our national energy mixes and natural resources (wind in the north, solar the south, hydro, nuclear, green gases in other regions, etc.), without any technological dogma. We must promote cross-border mechanisms such as Power Purchase Agreements, and Capacity Remuneration, that enable long-term investment. These are part of the European energy framework, but we need to make them even easier to implement, learning from the most mature countries, and at the same time push for the development of infrastructures, notably interconnections, to maximize efficiency and resilience.

- **Second priority, the energy transition cannot be achieved at the expense of the industry and consumers**

For the cost of this transition to be bearable by industry actors, public authorities need to accompany and support them in their demand for affordable and reliable decarbonized energy. This includes standards and incentives for sectors such as chemicals and aviation, which need sustainable aviation fuels and green hydrogen. If we set standards without the associated financial support, we will not succeed.

By doing so, Europe will enable manufacturers to make a long-term commitment to offtake decarbonized energy, a commitment that will bring energy players visibility they need to accelerate their own investments.

- **Third, the final challenge is to demonstrate both ambition and pragmatism at European and national level**

We need to reaffirm our targets and provide stability to enable investments, but remain pragmatic when it comes to implementation. For example, for sectors that are not off the ground yet, such as hydrogen: we may need to adjust regulations - the challenge is to get the decarbonization process off the ground rather than limiting development based on color classifications. Another example is to accelerate the permitting processes to ensure a faster deployment of renewables.

All that goes along with the simplification agenda that is currently discussed in Europe, which I welcome.

Europe's responsibility and ENGIE's commitment

Despite the context of green backlash, European citizens overwhelmingly support the energy transition. The survey we conducted in ten European countries paints the picture of a Europe ready to act: 89% of those questioned want the energy transition to move ahead, while only 6% consider back tracking.

This broad consensus underscores our collective responsibility to act decisively. And that is where we have a key role to play. In the eyes of Europe's citizens, after governments, it is the major industrial groups specializing in energy that are the most legitimate players in driving the energy transition forward. ENGIE is up to the task.

Thanks to our integrated business model, we address every aspect of the transition—from energy generation to demand management and infrastructure development. Each year, we invest more than €10 billion to accelerate the energy transition.

The coming years will be decisive. Europe must stay the course and maximize its efforts to build a competitive, resilient, and decarbonized economy. Achieving the energy transition requires unwavering political support at all levels. Governments must act swiftly, in concert with the private sector, to create a framework that supports this transition and that includes all stakeholders. The energy transition is not just a necessity; it is an opportunity for industrial renewal, economic growth, and strategic sovereignty. Now more than ever, let's stay the course!

Reducing Energy Costs in Europe: An Imperative for Competitiveness

IVAN **VEROUGSTRAETE**

MEP (Renew Europe group – Belgium), Vice-Chair ITRE Committee

Europe faces a major economic challenge: its energy prices are among the highest in industrialized economies. This situation threatens the competitiveness of its businesses and burdens households. As the world enters an era of accelerated energy transition, how can the European Union not only reduce costs but also ensure a stable and sustainable energy future?

An Alarming Reality: Energy in Europe Is Too Expensive

The numbers speak for themselves. In 2024, gas prices in the EU were nearly five times higher than in the United States. Industrial electricity prices were two and a half times higher than across the Atlantic. This is not a new phenomenon, but it is becoming increasingly concerning as it hinders European economic development and places European industries at a competitive disadvantage compared to the United States, China, and India.

Why such a disparity? The main explanation lies in the very structure of energy supply in these regions. The United States has benefited from a major energy revolution with the rise of shale gas, allowing it to become a net energy exporter. In contrast, Europe remains highly dependent on fossil fuel imports, particularly liquefied natural gas (LNG).

This reliance on imports leads to considerable additional costs. Unlike the U.S., where gas can be transported directly via pipelines, imported LNG in Europe requires liquefaction, maritime transport, and regasification, all of which increase its final price. In this regard, Mario Draghi's report reminds us that the EU is the world's largest importer of gas and LNG, yet its collective bargaining power remains underutilized.

Furthermore, European market rules pass on the volatility of fossil fuel prices to end users, preventing them from fully benefiting from the advantages of decarbonized electricity production.

All this, not to mention geopolitical tensions and recent crises, has highlighted Europe's vulnerability to energy price fluctuations.

The Four Components of Energy Costs

The final price of electricity and gas in Europe is based on four main components:

1. The cost of energy itself, which depends on fuel prices (gas, coal, oil) and production costs for renewable and nuclear energy.
2. Network costs, covering investment and maintenance of transport and distribution infrastructure.
3. Taxes and levies, often higher in Europe than elsewhere.
4. Charges related to supporting renewable energy, due to its intermittency, funded by consumers through their bills.

In this context, the key question is: how can these costs be lowered without compromising the energy transition?

The Energy Transition: A Key Lever to Reduce Costs

Faced with this situation, one answer stands out: accelerating the transition to clean, domestic energy. Europe has already made significant progress in decarbonization, with a growing share of renewables (wind, solar, hydropower) and a gradual decline in fossil fuels in electricity production.

However, for this transition to result in a real cost reduction, it must be accompanied by appropriate policies. Today, four major levers must be activated to maximize the economic benefits of the energy transition:

1 A Fairer Distribution of Costs

Currently, European households—though this varies widely among member states—often pay more for electricity than industries. On average, a European household pays 50% more per kilowatt-hour than an industrial company. In some countries, this gap is even more pronounced.

Why? Some large industries benefit from preferential rates and exemptions from certain taxes and levies. While this policy aims to protect industrial competitiveness, it also raises questions of fairness.

To ensure a successful energy transition, it is crucial to encourage households to first save energy and then to electrify (electric cars, heat pumps, etc.). If electricity costs remain too high, this transition could be slowed. A fairer distribution of costs and a revision of energy taxation are therefore essential.

2 More Flexible Consumption

With the rise of renewable energy, electricity production is becoming more variable. It is therefore essential to adjust demand accordingly. Today, many consumers are not incentivized to adapt their consumption based on real-time electricity prices, limiting system efficiency.

Mechanisms such as dynamic pricing or incentives for flexibility could allow households and businesses to reduce consumption during peak hours and use more electricity when it is abundant and cheap.

In Germany, for example, some companies participating directly in the wholesale market already adjust their consumption based on price variations, reducing their costs while contributing to grid stability.

3 Better Coordination of Investments at the European Level

Today, each European country makes its energy investment decisions relatively independently (through national energy and

climate plans). However, Europe has a major asset: an interconnected electricity grid, which allows for the optimization of energy production and distribution across the continent.

Better coordination of investments, particularly in renewable energy and electricity transport infrastructure, would reduce costs and strengthen energy security. For instance, developing offshore wind farms in the North Sea could benefit multiple countries simultaneously through enhanced interconnections.

4 Deeper Integration of the European Electricity Market

Finally, Europe must go further in integrating its electricity market. Currently, bottlenecks persist, limiting electricity exchanges between certain countries. The example of the interconnection project between France and Spain, which took years to negotiate, shows that political and technical obstacles still hinder this integration.

To maximize the economic and environmental benefits of the energy transition, it is crucial to invest massively in electricity transport infrastructure and further harmonize regulations between member states.

A Competitive and Sustainable Energy Future

Europe's energy future is at a turning point. The energy transition is a unique opportunity to reduce dependence on imports, stabilize prices, and ensure greater energy sovereignty.

The good news is that renewable technologies are becoming increasingly competitive. Today, generating electricity from solar panels or wind turbines is already cheaper than building new gas or coal power plants in many countries. By 2030, solar power could become the cheapest electricity source almost everywhere in the world.

By optimizing its energy policies, Europe could cut its energy costs in half by 2050, according to some projections. This shift does not depend solely on technology but also on bold political choices.

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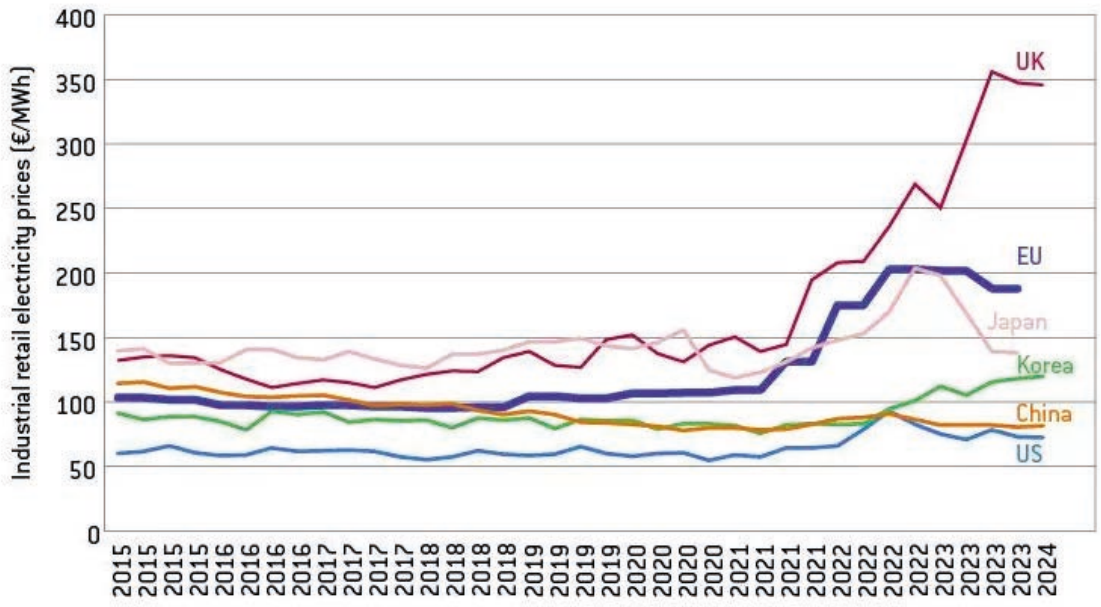
Figure 1: Europe pays more for electricity than its competitors



Source: Bruegel based on Chief Economist Team/DG ENER/European Commission, based on Eurostat (EU), Energy Information Administration (US), Department for Energy Security and Net Zero (UK), International Energy Agency (Japan and Korea), CEIC (China). Note: European Central Bank conversion rates.

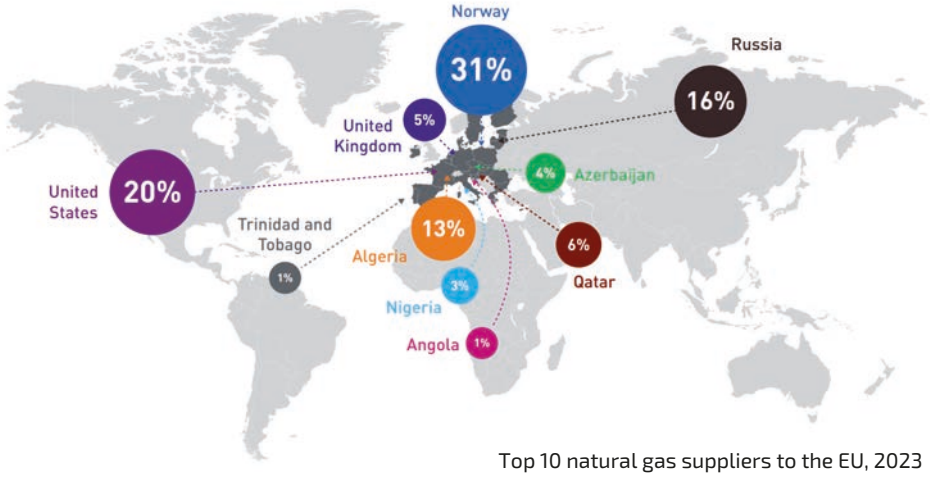
Can Europe strengthen its **energy security** while advancing **decarbonization** and **competitiveness**?

An interview with

FRANÇOIS-RÉGIS MOUTON de LOSTALOT-LASSALLE

Managing Director, IOGP Europe

Top 10 natural gas suppliers to the EU, 2023



Top 10 natural gas suppliers to the EU, 2023

Q: From an oil & gas perspective, has Europe actually made progress on security of supply since 2022?

A: In February 2022, Europe was in a critical gas supply situation, with just under half of its gas supply lost or under threat. This is probably the most serious energy crisis since the 1973 oil shock.

Since then, Europe's energy security has improved in some ways but remains fragile. The EU has successfully reduced Russian gas imports from 45% of total supply in 2021 to around 15% in 2024, an incredible achievement delivered by the gas industry.

Europe weathered the storm thanks to increased reliance on LNG terminals and imports, as well as – unfortunately – significant industrial demand destruction. In doing so, it increased its exposure to spot-based supplies which are, by definition, more exposed to volatility.

Before 2022, the global LNG market was the main source of flexibility. With Russian supplies out of the picture, Europe and Asia -the only 2 continents consuming more gas than they produce- now compete directly for this market, which is expected to remain tight until 2027 when a new wave of global LNG export plants comes on stream. In the meantime, any significant energy supply disruption such as lower wind in the winter, technical issues in nuclear power generation, less hydropower in Brazil, or simply heightened geopolitical tensions and LNG trade uncertainty can create significant volatility.

Without a clear strategy supporting the signature of long-term LNG contracts and promoting domestic oil and gas exploration and production, Europe's energy system will remain fragile and exposed to volatility. The good news is that on both issues, the EU can do something about it if the political will is there.

Q: The EU's regulatory landscape is evolving rapidly, but is it actually helping or hindering energy security?

A: Regulatory uncertainty is something Europe cannot afford right now. To put it simply, there are regulatory deterrents in place today in Europe which aggravate the energy security situation. These are remnants of an overzealous interpretation and application of ESG and climate considerations to policy, to which policymakers are slowly but finally waking up to.

Let me give you a couple of examples:

The EU Methane Regulation, whose concept the oil & gas industry supported from the beginning, ended up imposing prescriptive, disproportionate and unworkable operational and reporting requirements. This created such compliance challenges for European buyers of natural gas that they now hesitate to sign long-term contracts due to potentially high penalties: this explains in part why European buyers have signed three to four times less long-term LNG supply agreements than their Asian counterparts (around 30 vs. around 120) over the past two years. To top it off, it discourages Europe's own oil and gas producers by fear of penalties.

This regulation is a textbook case of a policy meant to push an industry to improve its processes, but which has been hijacked along the way and used against industry without assessing the impact on Europe's security of supply. We call on the Commission to reopen the Regulation through an Omnibus proposal and tackle the problematic provisions.

Sustainability Reporting is another concern. Legislation such as the Corporate Sustainability Due Diligence Directive include unrealistic requirements which have led essential suppliers like Qatar to publicly declare it would prefer to stop selling gas to the EU than face penalties calculated on the basis of their global turnover.

If Europe wants to ensure energy security, it must carry out a fitness check of its regulatory framework. The good news is that it's fully within its power to do so.

Primary energy consumption by source in the EU, 2023

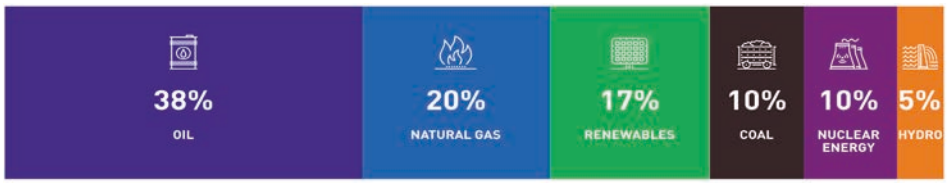


Figure 1: Primary energy consumption by source in the EU, 2023.[1]

Q: Is Europe too idealistic in its energy transition plans?

A: The climate neutrality objective isn't the issue. But Europe represents around 6% of global emissions and must figure out a way to get there without destroying its industrial base. Assumptions underpinning current policies underestimate the long-term role of natural gas in the primary energy mix and overestimate the ability to deploy alternative energies.

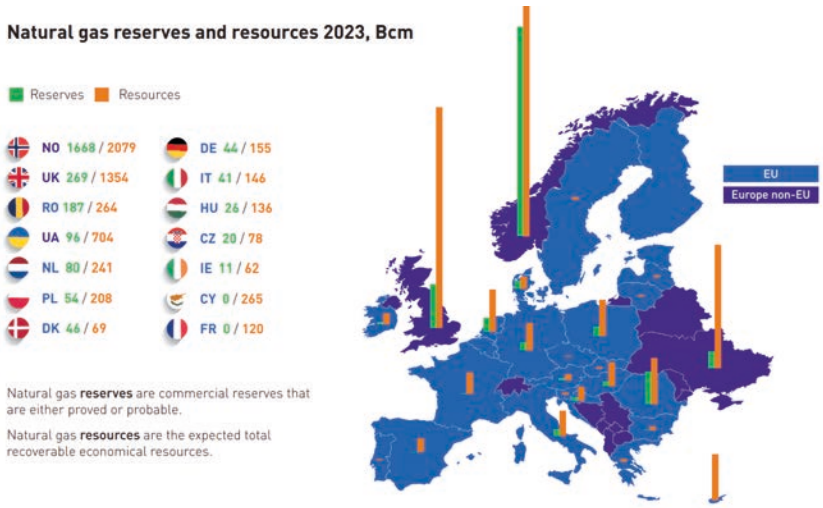
The 'electrification' mantra is alive and kicking in Brussels, despite massive costs incurred by grid expansion and stabilization due to increasingly decentralized and intermittent power generation.

The approach of the past 10-15 years has shown its economic and technical limitations. Supply-side flexibility sources such as gas-fired power plants will be increasingly important, as recently shown by lower wind power generation during a cold winter.

Europe's gas demand seems to have reached a floor after a drop of over 20% since 2022 – largely driven by lower industrial activity and not 'colder showers at home' as some public servants declared. We can either work to secure more gas supplies, or shut down factories and freeze in the winter. Which do we choose?

We need a pragmatic approach that supports decarbonization while maintaining flexibility in energy sourcing. Otherwise businesses will relocate to regions with more stable, or less-climate conscious energy policies.

Natural gas reserves and resources, 2023 (Bcm)



Q: European oil and gas production has declined drastically. Should we reconsider domestic production to strengthen energy security?

A: Absolutely. After 15 years of renewables push, oil and gas still account for around 60% of the EU's energy mix. But the EU has seen a 73% decline in domestic natural gas production and a 43% drop in crude oil output since 2010. While Norway remains a key producer, the EU itself only produced about 42 Bcm of natural gas in 2024 – just 13% of demand. Encouraging production in regions such as the Black Sea and Eastern Mediterranean would provide a strategic buffer to face supply volatility.

This doesn't mean reversing climate commitments at all. The Draghi report itself recommends reassessing domestic supply to counterbalance reliance on global markets. The Commission can encourage Member States to lift remaining exploration and production bans, issue exploration licenses, adapt taxation rates, accelerate administrative processes, just like it's doing for other technologies.

Total natural gas production in Europe (EU-27, UK, Norway), 2024

Q: EU policymakers have introduced various market interventions in response to energy crises. Are these measures solving problems or creating new ones?

A: Emergency measures are necessary when facing a crisis. But turning them into permanent features jeopardizes market functioning and creates distortions that can aggravate a tight situation. Take the Gas Market Correction Mechanism—price caps might seem like a way to protect consumers, but they also risk driving away suppliers and creating artificial shortages. Similarly, joint purchasing of gas, while well-intentioned, has had negligible impact on supply.

The EU's energy market has functioned well when driven by competition and price signals. Emergency measures should remain temporary and targeted, rather than becoming structural barriers to a well-functioning market.

Q: What are the most urgent actions EU policymakers should take right now?

A: Policymakers should focus on five key areas:

1. **Regulatory clarity and stability** – Make sure legislation supports investments, not discourage it, and adjust when needed.
2. **Diversification beyond short-term fixes** – Send clear demand signals, strengthen partnerships with stable suppliers, invest in a broader mix of energy sources, promote domestic oil and gas production.
3. **Infrastructure resilience** – Accelerate LNG, pipeline, and hydrogen-ready infrastructure projects while enhancing security of infrastructures and cyber security.
4. **Pragmatic pathways** – Support realistic pathways that recognize the role of gas while advancing low-carbon solutions. 100% electrification is neither realistic, feasible, or affordable without making tough and unpopular choices.
5. **Market-based solutions** – Avoid over-regulation that could reduce competitiveness and deter long-term investments. Make no mistake: it's mainly the market, not regulation, that got us out of the 2022-2023 crisis.

Q: If you had to give one urgent message to EU policymakers, what would it be?

A: Energy security and economic competitiveness must go hand in hand. The EU cannot afford to jeopardize its industrial base with unrealistic and unbalanced energy policies, focusing on sustainability only. We need a balanced, pragmatic approach that recognizes the continued role of natural gas, strengthens diversification efforts, and ensures a regulatory framework that fosters domestic investment rather than deters it.

The time for clear, decisive, and forward-thinking policy is now. Europe has all the potential to lead in energy innovation and compete in the global race, but only if we create a stable, investment-friendly environment that gives equal consideration to resilience, competitiveness and sustainability.

Renewables are key to **Europe's energy security**. So why does **Europe** seem determined to make people hate them?

DARIO **TAMBURRANO**

MEP (GUE/NGL Group – Italy)

Tuili, Sardinia, Italy. 11 September 2024. A fire destroys 2,000 solar panels stored in a warehouse, waiting to be installed. This was just one of many acts of sabotage against renewable energy projects in Sardinia during the summer of 2024. The attacks coincided with a grassroots campaign for a citizen-led initiative to ban new wind and solar power installations, backed by over 200,000 people. Many locals feel that multinational companies are exploiting their land for profit, with little regard for environmental and social consequences.

Sardinia is not an isolated case. Across Europe, resistance to renewables is growing. In Germany, climate-sceptic Alternative für Deutschland (AfD) secured 20% of the vote in the most recent national elections. One of their key campaign promises? Demolishing existing wind farms and blocking new renewable energy projects.

If Europe is serious about improving its energy security, this trend must be reversed.

Why Renewables Are Key to Energy Security

Europe is a net importer of energy. In 2020, 58% of the energy used in the European Union was imported from third countries—almost all of it fossil fuels.

As long as Europe remains dependent on fossil fuels, true energy security will remain out of reach. Unlike oil and gas, which Europe largely imports, renewable energy can be produced domestically, reducing reliance on external suppliers.

It is true that Europe is not a major producer of wind turbines, solar panels, or batteries, nor does it have significant deposits of critical raw materials such as rare earths and lithium, needed for their production.

However, once installed, renewable technologies generate electricity for their entire lifetime without reliance on foreign suppliers. Batteries help stabilise the intermittency of wind and solar power, reducing the need for gas-fired electricity generation. At the end of their lifecycle, these technologies can be recycled and used to produce the next generation of renewable energy and energy storage solutions. By contrast, continued dependence on fossil fuels means continued exposure to geopolitical crises and price shocks every time we heat our homes or fill our car tanks.

Moreover, renewables are now the most affordable way to generate electricity. Hence, transitioning to renewables should be a win-win-win scenario—enhancing energy security, tackling climate change, and reducing energy costs at once.

Why Are Many Protesting Against Renewables?

Despite record levels of new wind and solar installations, European households and businesses are facing persistently high electricity prices. While prices have dropped from their peak during the energy crisis, they remain, on average, 60% higher than before the escalation of the conflict in Ukraine.

This prolonged period of high energy prices deepened the crisis of energy poverty. Today, between 8% and 16% of EU citizens cannot afford to pay their energy bills. High prices also triggered an industrial crisis, affecting not only energy-intensive industries but also small businesses like bakeries and cafés.

For years, policymakers have promised that expanding renewables would lower costs. Yet, despite record installations, electricity bills remain high. This gap between expectations and reality fuels confusion, frustration, and opposition to renewable energy projects.

Why Prices Remain High Despite Renewables Growth

The core problem lies in how Europe's electricity markets are structured. Under the current marginal pricing mechanism, electricity prices are determined by the most expensive source of generation needed to meet demand at any given moment. In most cases, that is gas-fired power plants.

Even as the share of renewables increases, their lower production costs do not significantly reduce prices, because the price is still set by gas.

This system has two major consequences:

1. **Consumers do not see the benefits of increased renewable capacity.** When new wind and solar farms come online, they generate cheaper electricity, but this does not directly lower household energy bills.
2. **People who invest first-hand in renewable technologies see little financial return.** Households that spent thousands of euros to install heat pumps or switch to electric vehicles expect lower operating costs than fossil fuel-based alternatives. However, with electricity prices remaining high, the expected savings are often negligible.

In this context, opposition to renewable energy projects is understandable. If the switch to renewables immediately lowered energy bills, the opposition would disappear.

The Need for Immediate Action

If European policymakers are serious about maintaining public support for the energy transition - and, by extension, for energy security - they must address this market failure. The European Commission should reform electricity market rules to ensure that consumers directly benefit from the rollout of renewable energy.

A growing political consensus is forming around the need for change. Over 30 Members of the European Parliament from four different political groups (Left, S&D, Greens, ECR) recently co-signed a letter that I drafted, which, among other asks, urged the Commission to evaluate options to decouple renewable energy prices from gas prices.

European policymakers must urgently act on this request and identify a way forward. Citizens and businesses are looking to the European Commission for solutions that make clean energy not just an environmental and security necessity, but also an economic advantage.

The time to act is now.

NICOLÁS **GONZÁLEZ CASARES**

MEP (S&D Group – Spain)

Strengthening the **Energy Security** of the **European Union** through the **Electrification** of **Infrastructures** and Key Sectors

Ensuring reliable and sustainable energy supply for homes, industries, and transportation is central to Europe's economic stability and security. Since late 2021, Europe's heavy dependence on fossil fuels has exposed vulnerabilities that enemies of EU can exploit and is recognized as a primary driver of climate change. Reducing reliance on fossil fuels, particularly from Russian sources (including nuclear from Russia), has become essential to enhance Europe's strategic autonomy and environmental resilience.

The electrification of the economy—replacing fossil-fuel-based technologies with electricity generated from clean, renewable sources—is now a core pillar of the European Union's climate and economic strategy. According to a Draghi report, decarbonization through electrification and renewable energy provides a "unique opportunity for economic growth and industrial strengthening" by reducing energy costs and enhancing competitiveness.

Currently, solar and wind energy are the most cost-effective sources of new electricity generation in many regions, leading to significant reductions in long-term energy costs for both industries and households. The European Commission estimates that policies aimed at accelerating the adoption of renewable energy and improving energy efficiency could result in annual savings of up to €162 billion by 2030.

Sustainable renewable energy sources are essential and their full potential can only be harnessed through electrification. While Europe's electricity system is rapidly decarbonizing— approximately half of the EU's electricity came from renewable sources in the first half of 2024—electricity currently accounts for only 23% of the EU's total energy demand. By contrast, China, meeting around 30% of its demand electrically, demonstrates the strategic importance of electrification, reflected in reduced oil demand projections due, among others, to rapid transport electrification.

Electrification also offers a way to achieve more with less energy. Electric motors are highly efficient and have been quickly integrated into industrial processes. With advancements in battery technology, electric vehicles (EVs) are becoming a well-established option for road transport, sector relying on fossil fuels for 93% of its energy needs. The same principle applies to heating and cooling, where heat pumps can achieve efficiencies exceeding 300%.

Understanding the benefits of electrification is straightforward; however, accelerating its adoption requires supportive policy frameworks, investment in grids infrastructure and a level playing field among various energy carriers and sources. This can be achieved through genuine technological neutrality. For instance, the Directive incorporates multipliers for electricity used in transportation, emphasizing its superior efficiency—EVs are two to three times more energy-efficient than traditional internal combustion engine vehicles.

During negotiations, some groups sought to eliminate these multipliers arguing a false technological neutrality. Thankfully, during the negotiations we managed to retain these multipliers. Without them, Member States would find it easier to meet renewable transport targets using less efficient renewable fuels, which would undermine the clear efficiency benefits of electrification.

Electrifying public and private transport also offers clear advantages in reducing urban pollution and improving air quality. The EU's regulation mandating zero-emission vehicles by 2035 exemplifies real technology-neutral policy accelerating electric vehicle (EV) adoption as the most effective, efficient, and sustainable road transport alternative.

Industry can greatly enhance its competitiveness by accelerating electrification, but this requires affordable electricity prices. However, as Draghi indicates, due to the current marginal price setting mechanism on the electricity market, natural gas was the price more than 60% of the time, despite making up only 20% share of the EU's electricity mix. It is necessary to de-couple the price of renewable energy from the price of fossil fuel-based energy to ensure that the most expensive fossil fuels no longer dictate overall electricity prices.

Rapid implementation of the recent electricity market reform, coupled with the planned short-term market review, will help address these distortions. In addition, the new Affordable Energy Action Plan—aimed at increasing transparency and oversight of gas markets—will further support the goal of making clean power more accessible and cost-effective for all.

With the recent adoption of the Clean Industrial Deal and the Affordable Energy Plan, the European Commission targets 32% electrification of overall energy demand, underscoring affordable, emission-free electricity's critical role in industries such as steel, chemicals, and cement. By 2040, Europe's electricity sector could be almost entirely decarbonized, accounting for half of its final energy consumption. Each electrified vehicle, heat pump, or industrial process eliminates direct emissions previously generated by fossil fuels.

From the consumer perspective, electrification also provides opportunities for active energy management. Recent EU regulations grant new rights such as self-consumption, energy sharing, and renewable energy communities, allowing citizens direct participation in renewable energy benefits.

Greater energy production "Made in Europe" significantly reduces vulnerability to global fossil fuel price fluctuations and supply disruptions, strengthening economic resilience and long-term competitiveness. Ultimately, a highly electrified Europe is more autonomous, channeling resources into internal investments and sustainable growth rather than external fossil fuel dependencies.

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Ensuring Sustainable and Resilient Energy Security in Europe

SANDRINE **MEUNIER**

CEO of NaTran

Energy Systems Integration: The Backbone of a Resilient, Net-zero Future

Under the European Climate Law of 2021, Europe has set an ambitious decarbonization target, aiming for carbon neutrality by 2050. Discussions are ongoing regarding an intermediate target of a 90% reduction in emissions by 2040. These objectives are essential for preserving the planet's climate, but they are also challenging to achieve, raising questions about economic sustainability and social acceptability. **All decarbonized energy sources have a role to play: no single technology or energy source can provide the solution alone.**

Renewable and low-carbon gas technologies — biomethane, hydrogen (H_2), and carbon capture, utilization, and storage (CCUS) — are part of the solution in achieving a quick and sustainable decarbonization of Europe while also strengthening energy security and sovereignty. Their contribution to the EU energy objectives is not only possible, but also essential.

It is in the interest of Europe's energy system to establish an ambitious framework for the development of these technologies. The successful deployment of biomethane, hydrogen, and CCUS will necessarily rely on infrastructure, linking production, consumption, and storage. An interconnected and transnational system allows for cost optimization and ensures supply security — as demonstrated by the gas system, which continued to supply Europe despite the consequences of the war in Ukraine. Existing infrastructure can be adapted to accommodate renewable and low-carbon gases without significant additional costs, as proven by the successful development of biomethane in several European countries, and especially in France. One should keep in mind that Europe has one of the most advanced and interconnected networks globally, particularly in terms of cross-border cooperation, grid resilience, and renewable energy integration. **This network is a crucial strategic asset and a significant competitive advantage in advancing the energy transition and decarbonization goals.**

Biomethane (or renewable methane) can be produced through anaerobic digestion, or other waste-to-energy processes such as pyro-gasification or hydrothermal gasification. It is "made in Europe." It drives an economically valuable dynamic by fostering an expertise-based industry and generating additional income for farmers, while also providing a waste treatment solution and numerous other positive environmental externalities. Anaerobic digestion produces a digestate usable as fertilizer. Biomethane is a dispatchable, storable energy source, that enhances the diversification of our energy mix, complementing intermittent renewable electricity. Moreover, it requires no modifications of end-user equipment. Biomethane is already a significant reality in France, with an installed capacity of 14 TWh per year (equivalent to two nuclear reactor units) and nearly 740 production sites. Every cubic meter of renewable methane produced in France and in Europe strengthens our energy sovereignty. The draft French Energy and Climate Strategy (SFEC), put forward for consultation in November 2024, proposes an acceleration of biomethane deployment by 2030, with a target injection of 44 TWh of biomethane from anaerobic digestion—equivalent to 15% renewable gas in the grid. Other technologies, such as pyro-gasification and hydrothermal gasification, can also produce renewable and low-carbon biomethane using currently underutilized or not valued inputs. These technologies offer solutions for processing waste that is otherwise difficult to manage (such as liquid

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waste or biologically hazardous materials). **Europe would greatly benefit from setting ambitious targets for biomethane production from methanization, and from supporting the development of second-generation technologies, as was envisioned in the 2022 RePowerEU plan, which a imed for 350 TWh of biomethane production by 2030.**

A second decarbonization solution is hydrogen, an energy carrier that connects electric and gas systems. It's a key solution provided by the gas system for decarbonization. Its advantages are well known: low-carbon production and combustion, the ability to be stored in large volumes for months, and suitability for high-temperature industrial processes. Consequently, hydrogen is a major component of European decarbonization plans. The new EU gas and hydrogen directive 2024/1788/EU establishes a regulatory framework for the development of this energy carrier. As stated in Article 55 of this directive, hydrogen transport infrastructure — like methane networks — must be planned to connect production, consumption, and storage while ensuring consistency with other energy sources, such as methane and electricity.

NaTran (formerly GRTgaz) is actively developing concrete cross-border hydrogen pipeline projects, following expectations expressed by market players. These projects include MosaHyc and RhYn with Germany and the H2Med-BarMar project, which will connect Portugal, Spain, France, and Germany via hydrogen pipelines. **The H2Med corridor will play a key role in strengthening Europe's energy security by enabling the transport of approximately 10% of the continent's projected hydrogen demand by 2030.**

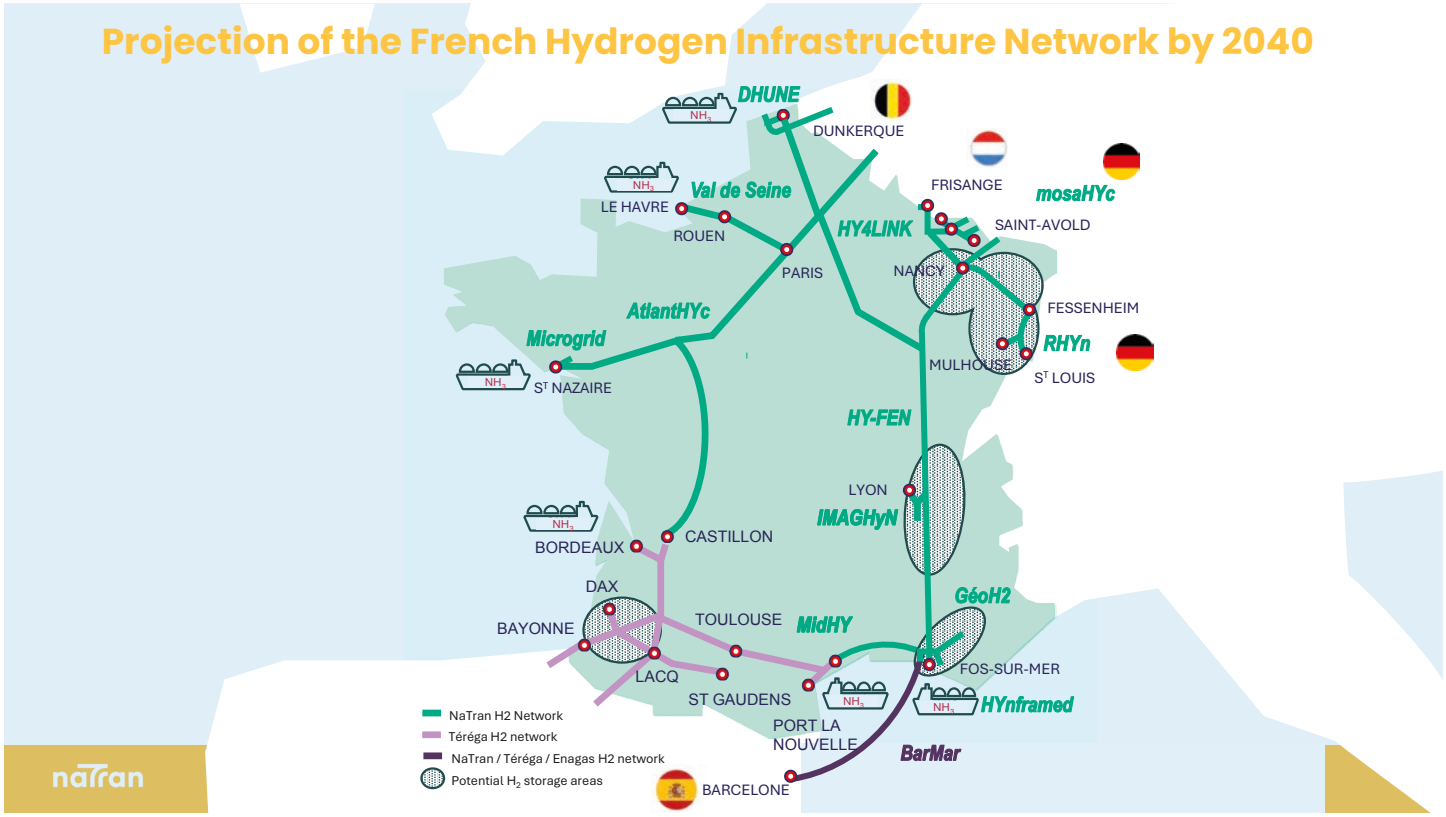
A third complementary decarbonization solution using gas technologies is carbon capture, utilization, and storage (CCUS). This technology is particularly suited for certain industries, especially those where emissions result from chemical reactions inherent to production processes (such as cement manufacturing) or for capturing emissions from bioenergy combustion (BECCS), enabling large-scale negative emissions. CCUS is thus set to play a crucial role in achieving long-term carbon neutrality.

To optimize the development of hydrogen and CO_2 networks while keeping costs under control, national and European master plans must be established to achieve an optimal techno-economic balance.

In conclusion, a European decarbonization strategy only based on a massive electrification of end uses would put at risk our energy system, in terms of resilience and sovereignty. A diversified mix of solutions, integrating renewable and low-carbon gas solutions "made in Europe," offers a more balanced approach — especially considering that all sources of energy are subject to geopolitical constraints to varying degrees (including electricity, due to imports of photovoltaic and wind power equipment, batteries, electric vehicles, and nuclear fuel).

In complement to electricity, the gas system provides essential flexibility, storability, and resilience to the energy system, while fostering value creation within Europe through concrete solutions tailored to users' needs — particularly industrial users — to reach carbon neutrality: renewable and low-carbon methane, hydrogen, and CO_2 capture and storage. Therefore, a joint master planning of gas (methane, hydrogen, and CO_2) and electricity networks is essential to ensure a resilient and economically sustainable energy transition. **The new EU energy policy framework must remain open and supportive of all cost-efficient technologies that drive the energy transition.**

Projection of the French Hydrogen Infrastructure Network by 2040



DIMITRIS **TSIODRAS**

Member of the European Parliament (EPP, ITRE Committee)

Enhancing Energy Supply Security in **Europe**: **Greece's Strategic** Role as a Key Energy Hub

The global energy landscape is undergoing profound changes, driven by shifting geopolitical dynamics, climate challenges, and rapid technological advancements. In particular, the 2022 energy crisis, triggered by Russia's invasion in Ukraine, placed energy security at the forefront of the EU political agenda, accelerating efforts to reduce its dependence on imported fossil fuels and protect European consumers from volatile energy prices.

At this critical juncture, Europe must strike a balance between energy security, competitiveness, and decarbonisation. While the EU has set ambitious targets to decarbonise its energy sector, these goals must align with the need for stable, secure, and affordable energy supplies. Additionally, the urgency of completing a fully integrated internal energy market has never been more prominent. The Affordable Energy Action Plan, presented by the European Commission in February 2025, outlines an ambitious framework to advance the Energy Union, with the internal energy market already generating €34 billion annually in benefits, which could potentially increasing to €43 billion per year by 2030 with further integration.

A truly integrated and competitive internal energy market not only needs a common regulatory framework but also significant investment in cross-border interconnectivity. Studies suggest that investing €2 billion annually in cross-border networks could yield €5 billion euros in benefits per year for European citizens. However, the internal energy market remains fragmented, with national energy grids often operating in isolation.

To overcome these challenges, expanding interconnections between national energy grids is essential for reducing energy shortages, mitigating price disparities, and improving the efficiency of energy distribution across Europe.

Greece, with its advanced energy infrastructure, growing LNG capacity, and expanding renewable energy projects, is reinforcing its position as an energy gateway for Europe.

As the EU accelerates its efforts to diversify energy sources and reduce dependence on Russian gas, Greece at the intersection of Europe, the Middle East, Africa, and Asia has emerged as a key energy hub, facilitating the transit of natural gas, electricity, and renewable energy to European markets.

By enhancing interconnectivity and supporting energy diversification, Greece is not only strengthening regional security but also shaping Europe's transition towards a more sustainable, resilient, and independent energy future.

As the continent navigates evolving challenges related to energy production and supply, the clean energy transition remains essential to ensuring sustainable, secure and affordable energy for both businesses and citizens. The future energy security architecture must integrate renewable energy sources, such as wind, solar, and hydroelectric power, as well as low-carbon gases like hydrogen and biomethane fostering a greener and more resilient energy system. In this context, regions with high potential for renewable electricity generation will be pivotal in shaping Europe's energy future. Among them, the Mediterranean basin holds strategic importance.

A notable example is the Greece-Egypt Interconnector (GREGY), a project designed to transport 100% green energy from Egypt to Greece, and ultimately to European markets. Recognized as an EU Project of Common Interest, it is expected to be operational by 2030.

The European Commission established a Gas Market Task Force to comprehensively action to address vulnerabilities in the EU gas market, to scrutinise EU natural gas markets and, where necessary, take actions to strengthen them. This initiative was propelled by a letter sent by Greek Prime Minister Kyriakos Mitsotakis to European Commission President Ursula von der Leyen, calling for decisive action.

Another critical initiative is the Gas Interconnector Greece-Bulgaria (IGB), inaugurated in October 2022. This interconnector has already strengthened energy diversification in Southeast Europe, facilitating the integration of new energy sources, such as liquefied natural gas (LNG). Furthermore, the operation of the first Greek Floating Storage and Regasification Unit (FSRU) in Alexandroupolis in October 2024 marks an important milestone in the country's enhanced regional energy role.

Energy security and resilience remains among the EU's most pressing challenges of our time, requiring a multifaceted approach that prioritises diversification of energy sources to reduce dependence on volatile imports, technological innovation to enhance energy efficiency and sustainability, and strategic infrastructure investments to strengthen cross-border energy grids. By focusing on these key elements, Europe can maintain both the quantitative and qualitative security of its energy supply, reduce vulnerabilities, and secure a sustainable, low-carbon energy future for generations to come. Greece is ready to contribute to reach these objectives.

BRUNO **TOBBACK**

MEP (S&D Group – Belgium)

Ensuring Europe's energy independence in the face of **geopolitical crises**: bringing clean and affordable **energy** to people and **businesses**

Clean, affordable and, above all, secure energy for families and businesses. This is what can make or break the future of European prosperity and industry. Today, we are paying the price for our years of dependence on imported energy from Russia, the United States and Qatar. Cutting that dependence means: producing our own energy. In Europe, sustainability, safety and competitiveness go hand in hand. The future is renewable. It is hard to overstate the importance of affordable energy. Companies cite high energy bills as the number one cause for their declining competitiveness. In just a few years, electricity prices for businesses have doubled. In the case of other fuels, such as LNG, today we pay up to five times more than in other countries. The availability of affordable energy is crucial not only for our businesses but also for our households. More than 4 million households in Europe fail to pay their energy bills.

If we want to attract investment in e.g. energy-intensive industries, investments in strong and developed European energy networks and the availability of affordable renewable energy are crucial. Our competitors have understood this well. The speed at which China is investing in solar and wind energy today is unimaginable. The country accounts for more than 40 per cent of global renewable energy investment and produces more renewable energy technology than any other country in the world. In the US, a significant part of the Inflation Reduction Act funds went into producing green hydrogen as cheaply as possible, which at one point became available even at a quasi-zero price.

For Europe, that future lies with renewable sustainable energy. Today, European countries spend some €400 billion annually on importing gas and oil, because fossil fuels are simply not abundantly available here. And they never will be.

That we were nevertheless able to build an industrial ecosystem on them is a consequence of the post- WWII world order, in which the USA was our partner in limiting the power of oil cartels. Today, those same United States are part of the oil and gas cartel.

Which leaves us with the choice of buying expensive gas from Putin or buying expensive gas from Donald Trump. In the current geopolitical climate, both choices are equally unattractive because both suppliers have proved that they are willing to use our dependence against us as and when it suits them.

And even though expensive and imported gas makes up only 22% of our energy mix, it determines the price of over half our energy consumption.

So, the energy transition is not just about climate, it is more than ever about our prosperity. It allows us to increase our energy security while reducing our dependence on third countries. The fact that this also allows us to get rid of the volatile prices of fossil fuels while lowering energy prices is a win-win.

Highways of the 21st century

But reducing our dependence is not enough on its own. We are on track to meet our renewable energy production targets. We can accelerate that transition by both ramping up investment capacity and accelerating the roll-out of renewable projects. For member states, this is an important task. Today, it takes up to seven years to permit and realise a new renewable energy project. In today's world, Europe can hardly afford such delays. In its recently announced Clean and Affordable Energy Action Plan, the Commission reiterated its desire to shorten that permit period, but in practice it is the Member States that must do the heavy lifting.

Although we are investing more than ever in the production of affordable renewable energy and its availability has only increased in recent years, this has not led to a drop in our energy prices. This is partly due to the functioning of the market, but also to the lack of smart energy infrastructure. We are producing abundant renewable energy, but we are not getting it to our businesses and households.

We need to expand and strengthen our grids and use them more efficiently. And we need to eliminate missing links between different member states. Today, we are too much a collection of 27 small energy grids. Better and more coordinated planning –preferably on a European level- will help absorb the high costs of such investments and reduce their impact on energy bills.

Better coordination would also help to bridge the gap that too often exists between renewable energy investments and grid development. Too often we are building wind turbines that cannot yet be connected and building grids without installing production capacity. Addressing that mismatch is crucial to bringing affordable electricity to businesses and households as soon as possible.

Investment in such energy infrastructure is incredibly expensive. For many Member States, this is an obstacle, but it is precisely where Europe can add value. Not only with public funds, but also by steering available private capital and financial institutions in the same direction.

If the Commission also manages to turn the ambition of the action plan into concrete proposals that are quickly realisable and implementable now, then we will be well on our way. By devoting European resources to modern energy networks and new connections between member states, such as between Belgium and Denmark or France and Spain, we are laying the foundations for tomorrow's prosperity, building our strategic autonomy, strengthening the competitiveness of our industry and making affordable energy available to families and businesses.

Energy networks can do for our prosperity in 21st century what highways did for our parents and grandparents in 20th century. Let us be as bold as they were and invest our public resources in tomorrow's prosperity, jobs and industry. It is more than ever time to put our money where our interests are.

Europe's energy future is running out of time

NELSON LAGE

President of ADENE – Portuguese Energy Agency

Energy is the pillar of modern society. Without energy, no innovation, no economic growth or progress. And yet, energy security, long taken for granted for decades, has a completely different reality today. Geopolitical tensions, market volatility, new technology leaders and decarbonization requirements have unleashed the perfect storm. For Europe, this is not just an energy challenge, but a long-term strategic issue.

The Ukrainian conflict, which is more than three years now, has unveiled weaknesses that could no longer be ignored. Europe has been relying for decades on external providers to satisfy its energy needs, something that has unveiled huge vulnerabilities when fuels have been employed as weapons of politics. At the same time, rising global demand for energy, driven by digitalization and economic recovery across geographies, has made access to energy sources more disputed and uncertain.

Europe has seen an unprecedented transformation of the energy sector in the past three years. Before the war, almost half of the gas consumed in the European Union (EU) was Russian. Today, this dependence has been substantially cut back. The EU reaction was to invest in liquefied natural gas (LNG), develop strategic infrastructure, and accelerate the electrification of the economy. What had been considered a long-term climate goal now became an urgent imperative to provide economic and geopolitical stability.

Portugal, in contrast to some of its European partners, was more prepared for this new reality. Without Russian gas via pipelines, the country invested early in LNG installations and has significantly bet on renewable energy sources. At present, the successful strategy puts Portugal in an advantageous position to lead the energy transition in Europe. In January 2025, figures show that 79.9% of the national electricity matrix is now renewable, with fossil fuel thermal power only representing 14.5% of production.

Energy security today is not merely ensuring provision of energy. Having a stable, dependable supply of electricity and gas is important, but that is not enough. One must have an assured resilient, diversified and sustainable energy system that can withstand geopolitics crises, market volatility and rising global demand. The Ukraine conflict was merely the beginning of the iceberg of an unfolding long-troubled energy crisis. Underneath, there are decades of structural vulnerabilities, underinvestment in networks and too much bureaucracy, and it is evident that diversifying energy sources and speeding up the shift to renewables are no longer options but pressing imperatives.

Never have there been such strategic decisions for European leaders to make about the energy fate of the Old Continent. In a situation marked by consecutive crises, exponential growth in global demand for energy and strategic products, and environmental concerns, the assurance of a stable energy supply requires far more than diversification of sources and technological progress. Improved energy efficiency and energy education are required, creating citizens and companies with greater awareness and resilience as consumers.

Efficiency in energy consumption should no longer be regarded as a technical specification or secondary benefit. It is, nevertheless, a key tool for the European energy system and cost stabilization. European companies spend between three to five times higher prices on natural gas compared to their North American counterparts. At the same time, Europeans continue to pay top dollar for power, whereas energy in America and China is cheaper, an aspect which deciphers the industrial competitiveness of Europeans.

When we look at China, we see how things get even worse in Europe. The government of Beijing subsidizes the companies directly through subsidies and tax breaks, providing them with an enormous competitive advantage. As of 2023, nearly 99% of Chinese companies had received direct subsidies, totaling more than 32 billion euros. These supports, together with lower energy prices, offer an environment where Chinese companies can compete mercilessly in the global market, but European companies are faced with barriers that put them at a disadvantage.

US President Donald Trump has recently imposed a 25% tariff on US imports from the European Union on key industries such as the auto industry. This, to reduce the US trade deficit, is mounting pressure on the already struggling European economy which is struggling with domestic issues and global competition.

Be aware that it is not by chance that the EU prices are high. They are due to a combination of several factors such as low investment in energy infrastructure, persistence of traditional rules of the market and heavy tax for energy. Europe needs to change the taxation policy for energy, harmonize taxation of gas and electricity and invest in a competitive energy market across EU member states.

The other significant concern of Europe is investment in power grids. The growth of the economy depends on new infrastructure to ensure that the market can be integrated with renewable energy and produce energy storage technology. However, with a fragmented market, Europe is failing to exploit the maximum use of renewable energy in European space. This obstacle will not enable

the green economy to grow and incorporate new technologies such as artificial intelligence (AI) applied to energy management.

Europe needs to find solutions that render it more energy independent and use its resources to the fullest, not just to ensure its energy security, but also to remain competitive in an increasingly troubled world. The US and China are progressing so much that pressure is building on the European economy. If the continent is to continue playing leadership and attaining sustainable economic growth, then it must invest in an innovative, efficient and sustainable strategy.

But between ambition and reality there's a disturbing margin. Over the past decade, Europe's share of world revenue from technology dropped from 22% to 18%, but that of the US increased from 30% to 38%. The US and China take the lead instead in new areas such as AI and 5G, whilst Europe remains still more focused on traditional technologies. This innovation deficit is a threat to the short-term competitiveness of Europe that very much exists.

The AI race is one such great illustration of this transformation at the global level and waning European hegemony. The fierce war between companies like OpenAI's ChatGPT and DeepSeek, a new Chinese company that has become a challenger of US dominance in AI, is an indicator of how nodes of innovation are anchored in non-European countries. While the US and China are investing heavily in new technologies, Europe is trying to find its niche but is hampered by straitjacket regulations, a dearth of investment and the lack of technology giants that can compete globally.

The answer has been well-known for some time, and it lies in the expansion of investment in R&D, supporting innovative start-ups and promoting strategic collaboration between Member States. ADENE has played a central role in this in Portugal, stimulating innovation in the energy sector, encouraging collaboration between energy institutions and agencies, and supporting the establishment of policies to ensure a more efficient and sustainable energy market.

In 2025, ADENE reinforces such engagement with strategic action that advances citizens, businesses and policymakers towards more effective and sustainable consumption of energy. Some of the high-performing initiatives include the Energy Route, due to spread this year to Portuguese-speaking African countries, promoting cross-national energy literacy. This will raise awareness for youths and adults alike on how individual simple changes to daily lifestyles could make significant differences as savings and ensure that the future becomes sustainable.

ADENE Academy is also a key vehicle for the training of energy sector technicians and managers, certifying professionals in the creation of new areas of the energy transition, including efficient building management, sustainable mobility and industry decarbonization. The Building Energy Certification System is still an example of how to promote energy efficiency in the real estate sector, making owners and tenants conscious of the benefits of investing in more energy-efficient buildings, not only for environmental purposes, but also economically.

But innovation is not enough if society does not prepare itself for the transition. Energy literacy must be a priority. There is no point in installing millions of solar panels if no one knows how to unlock their full potential. Energy efficiency starts at home, in small gestures, and is transferred to business, which needs to invest in smart solutions to save money and become competitive.

Europe is at a crossroads. The transition is underway but needs to be accelerated. To achieve a more sustainable and resilient Europe, we must invest today. Energy efficiency is no luxury, but the basis for the continent's security, economic growth and energy independence.

Power Generation Autonomy and Grid Resiliency Hold Key to EU Energy Security

PHILIPPE PIRON

CEO, Electrification Systems, GE Vernova

The European Union cannot achieve its full potential either economically or strategically without energy security.

Energy is fundamental to our lives and businesses. Any disruption to our energy supply whether from weather, external geopolitical forces, cyber-attack or supply chain dysfunction could cause far-reaching, unrecoverable damage. At the same time, demand for electricity is growing as data centers come online and heavy industry electrifies to decarbonize.

Creating energy security requires that we focus on several key elements: power generation autonomy, grid resiliency and stability, a secure supply chain, and affordability.

Russia's invasion of Ukraine in 2022 put on display the vulnerabilities of European energy generation. In 2022, underwater saboteurs bombed the Nord Stream pipeline, which carried gas from Russia to Germany. At the start of 2025, with the Russia-Ukraine conflict ongoing, Ukraine ended an agreement that allowed Russian natural gas to transit through Ukraine via the Urengoy-Pomary-Uzhgorod pipeline to the rest of Europe. While Europe enjoyed this cheap and abundant energy flow for decades, it made us dependent.

At the time the war began, Europe produced just 37% of the energy it consumed and the EU's main supplier of oil, petroleum products, natural gas and solid fossil fuels in 2022 was Russia. To avoid catastrophe, Europe deployed renewables and accelerated electrification.

The push to generate and deploy wind and solar power to compensate for the halt in the flow of Russian energy revealed a second area of weakness in Europe's aging and technologically dated power grid.

As reliance on renewable energy and electrification grows, the grid is struggling to keep pace, causing congestion and delays. Generated renewable energy is lost every day because the grid does not have the capacity or technology to integrate it. Data centers, which consume large amounts of electricity, cannot get the grid hook ups they desperately need. Increasingly, extreme weather events overtax the grid, causing brownouts and blackouts. Old grid technology, lacking modern threat detection systems, is vulnerable to cyber-attack.

Moreover, the Ukrainian-Russian conflict demonstrated the mission-criticality of power grids in terms of security of power supply and, therefore, national security. Since 2022, Ukrainian infrastructure and institutions have experienced approximately 2,500 cyberattacks per year, surging 70% to 4,350 cyberattacks in 2024 according to the Computer Emergency Response Team for Ukraine (CERT-UA). More than half of these missile and drone cyber-attacks targeted the Ukrainian electrical grid. During the 2022-2023 period, approximately half of Ukraine's grid substations were destroyed or severely damaged. In 2024, more than 200 grid substations were destroyed, while only a dozen power generation sites, were under attack demonstrating the strategic importance of the electrical network infrastructure. Indeed, the electrical network is the foundation of all mission-critical infrastructure, including water treatment, telecommunications, and military command and control systems. Therefore, the power grid resiliency is of vital importance for energy and national security.

To create grid resiliency, Europe must right-size the grid to account for existing and future electrification, as well as stockpile necessary buffer stocks of spares in case of major crisis, such as conflicts, natural calamities, and supply chain disruption. That means expanding, modernizing and upgrading existing infrastructure to weed out obsolete technology while also weaving in cyber security to protect the grid and digitalization to manage it. But Europe also must build new infrastructure to account for the many ways we generate energy.

Power generation is increasingly complex. Where once a centralized plant generated energy that radiated outward to customers, now our energy sources are distributed from

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offshore wind to solar panels to nuclear and more. They can be intermittent and variable as well as firm. And where once power flowed in only one direction from the central generator to the user, now it is bidirectional with consumer/producers pushing power back onto the grid. Digitalization -- grid automation equipment, associated telecom solutions and network orchestration software - is essential for managing a decentralized, multi-directional grid, and energy storage allows us to overcome the intermittency issues inherent in renewable energy.

A third area of vulnerability is the security of the supply chain. For example, High Voltage Direct Current projects take seven to nine years from design to execution. Any geopolitical disruption of the supply chain that causes an escalation of prices or unavailability of key materials can delay or even halt the construction of essential infrastructure and impact the EU operational readiness.

The EU can take steps now to overcome these weaknesses while also bolstering European energy systems against future threats and uncertainties. The grid must be the cornerstone of these efforts.

Throughout Europe, countries alone and in partnership are taking big steps to localize energy generation. Wind produced more electricity in the EU than gas for the first time in 2023. In 2024, transmission system operator (TSO) TenneT transmitted about 20.8 terawatt hours of wind energy from the German North Sea to land, generating enough electricity to meet the power needs of 6.5 million households. More renewable power will come online in 2025.

Yet all this generation will come to nought if Europe's transmission systems do not make the substantial investments to upgrade, expand and digitalize the grid to relieve the grid congestion that limits our ability to fully deploy low-carbon energy sources, take advantage of local generation and reduce our dependence on outside energy sources.

The EU can accelerate this transition with a combination of investment incentives, policy changes and a broadening of its focus beyond energy generation to a whole system approach.

First, securing capital investment in grid expansion and modernization is a fundamental challenge due to the very significant financial needs. According to IEA, worldwide grid investments will equal the clean energy generation investment until 2030, culminating in $0.6 to $0.7 trillion per year. The EU can

facilitate investment into electricity system technologies, such as bulk power transmission and interconnection links, grid digitalization and energy storage, by setting the right conditions with long-term grid planning and well-defined deployment timing.

Such investments will also require market reform. As the energy system is becoming more decentralized, we need better integration of local, regional, and national markets in Europe, which will ultimately create better cost efficiency as well as strengthen security.

Second, grid deployment is slowed by an onerous permitting process and remuneration issues. The EU could tackle these issues by creating a planning and legal framework that helps remove these roadblocks. Speed is essential for European industry to remain competitive as it electrifies and decarbonizes. As the International Energy Agency notes, the average time to deploy a transmission line in China is two years versus eight to 10 years in the EU. Additionally, the EU should take steps to protect its intellectual property for grid technologies.

Third, the EU can take steps to encourage the onshoring or near-shoring of systems, equipment and materials essential to the building and maintenance of our energy infrastructure. The recent geopolitical turmoil and the current commercial tensions advocate for a multi-continental or regional globalization of grid supply chains.

Finally, different countries within the EU bring different things to the energy picture whether its North Sea wind from Germany or solar energy from Spain. To take full advantage of Europe's homegrown energy generation, we need widespread cooperation among regulators and regulatory schemes, utility operators, TSOs and governments to create a borderless super-grid that would enable high volumes of electricity to cross the continent.

These investments will impose direct and indirect costs on countries and consumers in the short term, but over the medium-and-long term, ratepayers will win as increasing electrification and decreasing renewables cost will drop rates. Today, onshore wind and solar photovoltaic energy are cheaper than new fossil fuel plants almost everywhere. The average cost of variable renewable energy generation is expected to drop further.

Investments in grid infrastructure will ultimately pay off in lower energy bills for consumers and industry while protecting the EU from external disruptions to its energy supply. New grid infrastructure is essential if Europe wants to future-proof its energy sector. The grid of the future is foundational to our collective energy security.

Current and future contributions of **nuclear energy** to **energy security**

CHRISTOPHE **GRUDLER**

MEP (Renew Europe - MoDem)

Europe faces a dual challenge: ensuring its energy security while meeting climate targets. In this context, nuclear energy plays a central role by providing stable, low-carbon, and competitive electricity, complementing renewables. More than just a transition solution, nuclear power is a pillar of Europe's energy sovereignty.

Nuclear Energy already contributes to Europe's energy security

With 98 GW of installed capacity, nuclear energy currently accounts for 24% of the EU's electricity production, ensuring grid stability by providing dispatchable electricity that benefits all Member States. As the share of renewables increases, nuclear power acts as a baseload energy source, adapting to demand fluctuations and renewable intermittency, ensuring constant and competitive energy supply.

It is also crucial to remember that nuclear energy already provides decarbonized electricity. In 2024, 75% of the electricity produced in the EU was carbon-free, thanks to a combination of renewables and nuclear power.

The coming mass electrification makes this complementarity essential and must be addressed without discrimination. Studies indicate that electricity demand is expected to triple by 2050. Ensuring a reliable and fossil fuel-independent energy supply is crucial, as fossil fuels remain highly imported. In this context, it is always preferable to consume locally produced nuclear electricity in Europe rather than burn imported gas.

The global nuclear revival places atomic energy at the core of energy policies

The trend is clear: the updated National Energy and Climate Plans (NECPs) of EU Member States project 150 GW of nuclear capacity by 2050, far beyond the status quo estimates of the European Commission. These national strategies send a strong signal, highlighting nuclear energy's key role in achieving carbon neutrality.

Internationally, the momentum is similar. At the last two COP summits, over 30 countries committed to tripling global nuclear capacity by 2050, backed by the OECD Nuclear Energy Agency (NEA), which emphasizes that such an expansion would significantly help countries meet their climate goals while enhancing energy security.

Small Modular Reactors (SMRs) also present new opportunities by replacing coal plants, powering industrial sites, data centers, and remote areas, further strengthening nuclear energy's appeal as a viable energy solution. Therefore, we need all forms of nuclear technologies, from SMRs to large-scale reactors.

In this context, European industry must rise to the challenge. The EU's climate and industrial strategy must provide a stable and ambitious framework to accelerate nuclear development.

A strengthened European commitment must translate into concrete actions across the entire value chain

The Clean Industrial Deal, unveiled in late February, marks a turning point: the European Commission finally acknowledges nuclear energy's role in industrial competitiveness and energy security. The extension of long-term contracts (PPAs and CfDs) to nuclear power, in line with the electricity market design reform, along with the European Investment Bank's (EIB) pilot project to guarantee these contracts, are major advances to secure investment.

However, this roadmap must be backed by concrete actions and reflected in key upcoming political decisions, such as the next Multi-annual Financial Framework (MFF) and the revision of State aid rules. Declaring victory prematurely would be a mistake.

To sustain this momentum, it is essential not to overlook a key component of the nuclear sector: the fuel cycle. While Europe controls the entire nuclear value chain, uranium supply, enrichment, and recycling remain critical concerns. We must diversify supply sources and strengthen enrichment and recycling capacities, with projects similar to the strategic expansion of the Georges Besse II plant at Tricastin in France, announced in late 2024. Such projects bring significant strategic value, reinforcing Europe's long-term energy autonomy.

Conclusion

Europe has the capability to ensure sovereign, decarbonized, and competitive energy. Nuclear power is an asset, not an option—it must be fully integrated into the EU's energy and industrial priorities and not be limited to SMRs alone. The entire value chain must be considered.


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REPowerEU: A European path to energy security and strategic autonomy

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Europe needs affordable, secure and competitive energy. Russia's war of aggression against Ukraine severely tested the European Union's energy security. Dependence on Russian fossil fuels has revealed vulnerabilities that needed to be addressed urgently. REPowerEU was launched in May 2022 to make the energy supply more resilient, reduce fossil fuel dependencies and drive a strategic orientation of European energy policy.

Europe's energy supply has always been heavily reliant on fossil fuels, more than 60% of which were imported from abroad in past decades. Before the war, 45% of the natural gas consumed in the EU came from Russia. The Kremlin used this vulnerability to exert geopolitical pressure. However, Europe was able to significantly reduce its dependence within a very short period of time by taking targeted measures. New energy partnerships were established, LNG imports from the US, Qatar and Norway were expanded, and alternative pipelines were developed. At the same time, the expansion of renewable energy was accelerated to ensure a secure and sustainable energy supply in the long term.

With REPowerEU, the EU is sending a clear signal for change. By 2030, renewable energy is to cover 45% of total energy consumption. Solar energy will play a key role here: the EU plans to install over 320 GW of solar capacity by 2025 and more than 600 GW by 2030. At the same time, wind power is to be expanded to make energy generation less dependent on the weather. This will be accompanied by investments in grid infrastructure to facilitate the integration of renewable energy and avoid supply bottlenecks. In addition, the EU aims to increase its green hydrogen capacity to 20 million tons per year by 2030 to replace fossil fuels, particularly in industry and heavy transport.

A central component of REPowerEU is the diversification of energy sources. The drastic decline in Russian imports shows that Europe is able to realign its energy supply faster than expected. At the same time, however, it must be ensured that new dependencies are avoided. The increased, pragmatic use of hydrogen and low-carbon fuels as an energy carrier will play a key role here. The expansion of wind, solar and hydroelectric power will also be driven forward, although technological openness remains necessary. In this context, the EU also considers nuclear power in the form of Small Modular Reactors (SMR) and fusion power.

In addition to increasing energy production, improving energy efficiency is a crucial factor. Energy efficiency in buildings, digital power grids and intelligent load control should help to reduce energy consumption. Studies show that a consistent efficiency strategy can achieve savings of up to 20% of total energy demand by 2030.

Nevertheless, there are challenges in financing these measures. In particular, European industry needs stable and competitive energy prices in order to remain internationally competitive. Excessive burdens could harm competitiveness and should therefore be avoided. The EU has therefore published the Affordable Energy Action Plan on 26 February 2025. The Plan is based on four pillars and entails lowering energy costs for all, completing the Energy Union, attracting investments and ensuring delivery as well as being ready for potential crises. The Action plan aims to save €260 billion annually by 2040 for consumers and businesses. It also addresses critical energy security issues, such as reinforcing the physical integration of the Baltic States with Central and Northern Europe.

An often-overlooked aspect of energy security is the protection of critical infrastructure against cyber and hybrid threats. Cyberattacks on European energy suppliers in the past have shown how vulnerable the system is. Investing in IT security and closer international cooperation are therefore essential to counter these threats. To strengthen energy sovereignty, European production of key technologies such as solar panels, wind turbines and batteries should also be increased. Currently, 80% of the photovoltaic inverters used in Europe come from China – a dependency that must be reduced to ensure long-term energy security.

REPowerEU marks a decisive step towards an independent, sustainable, and secure energy supply in Europe and is now complemented by necessary new initiatives. The coming years will show whether these ambitious goals can be achieved. It is clear that consistent implementation and further investment are needed to make the transition from short-term emergency measures to a long-term stable energy policy. Securing the energy supply must go hand in hand with economic competitiveness to ensure a sustainable future for Europe.

The potential of **nuclear fusion** as a **sustainable solution** for global **energy security**

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The quest to demonstrate fusion energy as a practical source of power has occupied scientists and engineers for more than six decades. The longevity and persistence of this effort reflects both the great potential of fusion, and the great challenges in bringing it to reality. The emergence of private sector investment in fusion projects in recent years is a welcome development, complementary to public sector research; but it remains difficult to predict with precision when fusion will be ready to contribute meaningfully to the global energy supply.

Fusion's potential is tied to its predicted advantages. As with nuclear fission, nuclear fusion is expected to provide baseload power with minimal to no carbon emissions. The energy released by the fusion reaction is intense, several times stronger than the energy released from fission. Fusion also offers safety advantages: unlike fission, fusion does not rely on a chain reaction, nor does it build up decay heat, so the physics of fusion cannot lead to a Chernobyl-style core meltdown. The quantities of radioactive waste from fusion are likely to be a small fraction of the waste from fission, with much shorter half-lives. And the fuel for fusion is viewed as abundant: deuterium can be extracted from water, including seawater; and tritium, while scarce in itself, can be bred from lithium, which is abundant in the earth's crust.

But within each of these "advantages" also lies another challenge, a flip side of the coin. While safety is an advantage, it also means that sustaining the fusion reaction for long periods is difficult, requiring sophisticated control systems, careful choice of the materials that house the fusion reaction, and avoidance of plasma disruptions. Achieving "steady-state" operations at high efficiency has yet to be demonstrated by any fusion device. The recent breakthroughs by China's Experimental Advanced Superconducting Tokamak (EAST) and France's Tungsten Environment in Steady-state Tokamak (WEST), involving plasma pulses lasting more than 20 minutes, are noteworthy achievements; but in fusion terms, these were relatively low energy plasmas, not involving deuterium-tritium fusion.

In other words: the global fusion community is making progress, in both the public and private sector, but the end goal remains elusive. When I am asked "When will fusion be commercially available?"—a common question from journalists and politicians alike—I answer honestly: "I don't know."

ITER, a collaboration of 35 countries located in the south of France and the largest nuclear fusion project in the world, is designed to achieve and sustain fusion reactions at a scale that will enable the study of a controlled "burning" (largely self-heating) plasma. ITER is designed to achieve 400-second pulses of deuterium-tritium fusion with a thermal output of 500 megawatts—and to achieve "steady-state" operations at somewhat lower energy.

But achieving sustained fusion reactions is only one piece of the puzzle. ITER will contribute to addressing several other key remaining challenges, in an integrated manner; and further R&D will be needed to deliver a credible design for a next-phase demonstration reactor.

Materials resistant to extreme conditions: The extremely high energy of the neutron coming from the nuclear fusion reaction is both an advantage and a challenge. The intense flux of these high-energy neutrons

A current view of the ITER Assembly Hall, where vacuum vessel sectors and large magnets can be seen in stages of tokamak pre-assembly

Aerial view of the ITER worksite in southern France

and other particles generated during fusion reactions subject the structural materials of the fusion device—in ITER's case, a tokamak—to extreme conditions. Identifying materials capable of withstanding these conditions while maintaining structural integrity is a top priority across the fusion research community. These materials must be compatible with enabling plasma purity—minimizing plasma interactions with the "first wall" surrounding the fusion plasma. They must also be able to withstand the extreme thermal, radiation and vacuum environments inside the reactor without requiring frequent costly replacement. And since the walls of the tokamak become radioactive from bombardment by fusion neutrons, the material must be chosen carefully to achieve the desired goal of not generating long-lived radioactive waste. ITER has chosen tungsten as the best-suited first wall material available today; but more materials science R&D is needed to identify materials that can withstand the rigors of long-term fusion operation. Could the use of AI accelerate this search? Time will tell.

Robotics for maintenance: The harsh environments generated by nuclear fusion operations make these reactors inaccessible to human operators. Maintenance and repair tasks must thus be performed remotely using advanced robotic systems. ITER is developing state-of-the-art remote handling technologies to address the challenge, but ensuring the reliability and efficiency of these systems in a fusion environment remains a significant engineering hurdle. Current research is focused on enhancing the dexterity, agility and autonomy of remote handling systems to enable efficient maintenance operations in future fusion power plants and to optimize the size of associated maintenance facilities.

Tritium fuel cycle: Tritium, an isotope of hydrogen, is a key fuel for deuterium-tritium (D-T) fusion reactors. However, tritium is scarce in nature; for use in fusion, it must be produced artificially. Additionally, tritium has a relatively short (12.3 year) half-life. While tritium breeding has been demonstrated at small scales, the development of efficient techniques for large-scale, sustained tritium breeding—as well as for extracting and processing the tritium for re-use as fuel—is essential to make a D-T fusion reactor practical. ITER will conduct experiments to test tritium breeding blankets and fuel cycle technologies, but further research is needed to demonstrate the feasibility of industrial tritium production and recycling.

Heat exhaust management in the divertor region: Another primary challenge in fusion reactor design is managing the heat and particle exhaust from the plasma. In tokamaks like ITER, this is accomplished through a component called the divertor, which extracts heat and particles from the plasma and protects the tokamak walls from damage. The extreme power density conditions in the divertor region present significant engineering challenges. ITER is pioneering novel divertor designs and cooling techniques at the present limits of technology. Ongoing research is needed to optimize heat exhaust management in future reactors.

Efficient heat removal for electricity generation: While nuclear fusion produces intense energy, the physical structure of tokamak fusion reactors is that of a geometric heat source, poorly configured to efficiently remove the heat produced from the fusion reaction. Traditional heat removal designs used in fossil fuel or nuclear fission plants interface directly with the heat generation process—often with the water flowing directly past the fuel, both as a moderator of the reaction (in the case of fission), and as an efficient transport mechanism for harnessing the heat energy. In a fusion reactor, by contrast, any such interface would disrupt the plasma and stop the fusion reaction. ITER's design will demonstrate heat removal, but more R&D is needed to raise the efficiency for practical electricity generation.

With these challenges as context, we can now come to a better—if still imperfect—answer to the question. Does nuclear fusion have the potential to be a sustainable energy solution?

Clearly, the answer is yes. Fusion holds incredible *potential* for energy production. The more critical question is when? and what will it take? The near-term potential for fusion commercialization, in our view, remains low; it would require multiple extraordinary breakthroughs. The medium- to long-term potential is much more positive. The challenges of ITER have demonstrated many of the hurdles to be overcome, but we are making strong progress. In parallel, the private sector is beginning to contribute meaningfully, often using concepts and designs which—although less tested and involving higher risk—may in some cases address fusion's challenges in new, innovative ways.

These public and private sector efforts are complementary. The more we work together, with appropriate funding and shared solutions, the higher the potential, and—possibly—the faster we can bring fusion to reality.

GIOGIO GORI
MEP, (S&D Group – Italy)

Reducing the **energy dependence** of **European industries** while accelerating their transition to decarbonized practices

The European industry is at the heart of the continent's economy, yet it remains highly vulnerable to energy price volatility, supply disruptions and unfair competition. The energy crisis triggered by geopolitical tensions has laid bare the strategic weakness of Europe's reliance on imported fossil fuels. According to Eurostat, the EU's energy import dependency reached **55.5% in 2023**, with natural gas and crude oil representing the largest shares — a dependency that weighs heavily on **energy-intensive industries (EIIs)** such as steel, cement, chemicals and glass.

To address this structural vulnerability, **targeted support mechanisms** are needed. **Power Purchase Agreements (PPAs)** and **Contracts for Difference (CfDs)** offer a predictable price framework for renewable electricity, but their uptake remains hampered due to their complexity and **the lack of de-risking measures**, especially for SMEs. As Rapporteur of the European Parliament's oral question with resolution on energy-intensive industries, I am working to translate these concepts into concrete proposals.

Indeed, the text urges the Commission to explore additional ways to decouple fossil fuel prices from electricity prices, to address the barriers limiting the spread of long-term agreements, including with risk reduction instruments and public guarantees, and to **bring forward the analysis of short-term electricity markets under the recently reformed Electricity Market Design (EMD)** to **2025**.

The '**anticipation-restitution**' **model** implemented in Italy presents another innovative approach, allowing EIIs to access renewable energy at a fixed price in exchange for commitments to invest in the same amount of new renewable capacity. This mechanism — known as **Energy Release 2.0** — was introduced by the Italian Government in **2025** to support energy-intensive industries in their energy transition. The programme allows companies to receive electricity at a capped price for three years from the Italian Energy Services Manager (GSE), on the condition that they commit to building new renewable energy plants within 40 months. The electricity received must be returned over **20 years** at the same price through **two-way contracts for difference**. The new plants — solar, wind, or hydroelectric — must have a capacity **at least double** the amount of the energy initially provided, promoting self-consumption and boosting renewable energy production. Instruments like this not only reduce exposure to fossil fuel markets, but also create **direct incentives** for industrial participation in the energy transition.

Nevertheless, in the short to medium term - while keeping our decarbonisation objectives - tools are needed to ensure gas supply at a mitigated price, especially for those sectors that cannot rely substantially on electrification due to high up-front costs, low technological maturity or poor market readiness. Demand aggregation and **joint gas purchasing mechanisms** — already tested through the **EU Energy Platform** — have shown promising results in mitigating price volatility, but their **scalability** and **long-term governance** require further refinement.

Our resolution also calls for better **integration of the energy system**, in particular by **strengthening cross-border interconnections.** Furthermore, it highlights that both private and public support will be needed: to this aim we propose to top-up InvestEU, to increase funding for EIIs in the next MFF, also through the Competitiveness Fund, and to make **efficient use of national ETS revenues**, essential to supporting industrial decarbonisation.

When it comes to preserve the level playing field for our industry, the Commission should also find a long-term solution to address unfair competition and structural overcapacity, before the expiry of the existing **steel safeguard measures**. Furthermore, ensuring the effective implementation of the **Carbon Border Adjustment Mechanism (CBAM)** and creating '**green**' **lead markets** for European products — including by introducing **non-price criteria** into public procurement — will play a key role in aligning industrial competitiveness with climate objectives.

These measures can help European industries reduce their energy dependence while accelerating their transformation. The transition will require **sustained investment**, **regulatory predictability and simplification**, and a renewed industrial policy strategy capable of combining **competitiveness with climate neutrality** — a challenge that we must tackle collectively to preserve the future of the European industry.

Electricity grids - enabler of the energy transition

ANNA STÜRGKH

MEP (Renew Europe Group - Austria)

Electricity grids are the veins of our electricity system. Without them functioning properly our electricity system will collapse. Back in the days, our electricity system was marked by big power plants—mainly gas or coal—that transported electricity via transmission lines to substations, where it was then distributed to consumers via distribution grids. However, this has changed. Electricity is increasingly generated by renewable sources. Renewable electricity is cheaper than fossil-based electricity and makes Europe independent from imports. However, this renewable electricity needs to be fed into the grid. Forecasts expect that by 2030, 70% of renewable and decentralised energy generation will be injected into the distribution grid. On the other hand, the way we consume energy changes. Heat pumps, electric vehicles or industrial electrification will increase the electricity consumption. In addition, the sun doesn't always shine and the wind doesn't always blow, so the generation of renewables won't necessarily happen when the electricity is needed. Therefore, we see massive changes that the European transmission and distribution grids will need to respond to.

40 % of the European distribution grids is over 40 years old, and need to be updated. The transmission capacity across borders must also be increased. The more integrated European electricity markets are, the cheaper the energy bill for consumers. Hence, if the grid won't be updated and extended, it will be expensive for customers and renewable energy will be wasted - a lose-lose situation. In other words, urgent grid investments are essential to decarbonise the European power system.

The European Parliament's own initiative report is looking exactly into these challenges: what is needed to modernise our electricity grid: Firstly, the planning of the European cross-border electricity lines needs to be improved. The underlying legislative framework needs to be strengthened. There is still too much of a national focus rather than improving the cross border angle. A stronger involvement of the European energy regulator - ACER - will bring the European focus to grid planning. Furthermore, distribution grids shall play a bigger role in the relevant planning framework and shall also be able to achieve the so-called PCI status (Project of Common Interest).

Secondly, there is the issue of financing. Estimates say that around 584 billion EUR investments into grids are needed by 2030. This is why public EU funding like through the Connecting Europe Facility (CEF) must be guaranteed and increased, nationally managed EU funds like the Cohesion Fund or the Recovery and Resilience Facility must ensure that the Member States make sure that these funds are also used for grid enhancement and build-out and private investments should be increased, by limiting the investment risks.

Thirdly, digital and innovative technologies must be considered as alternatives to grid expansion. The deployment of so-called grid enhancing technologies should be incentivised, as they often are a cheaper and faster alternative to building new lines. Making use of digital tools and data sharing can enable flexibility through local flexibility markets. Flexible connection agreements can already be implemented now, and can contribute to increasing the grid's efficiency.

Lastly, speaking about grid investments crossing borders, it needs to be clear who benefits and who pays the bill. This concerns countries like Austria being a transit country or Denmark with huge offshore generation. Cost-sharing mechanisms do currently not properly reflect the costs and benefits for Member States.

Fortunately, the European Commission has acknowledged some of the problems addressed in the report and announced certain measures, such as the Grids Package foreseen for the beginning of 2026. Only an integrated energy system will help keeping energy bills low. Therefore, it is my commitment to help getting closer to the completion of the energy union.

Scaling homegrown **clean technologies** is integral to **Europe's energy** sovereignty

DIEGO PAVIA

CEO at InnoEnergy (Europe's most active clean tech investor)

Europe's clean energy transition has always been a balancing act. Sustainability and affordability have dominated the agenda in recent years, shaping discussions around the Clean Industrial Deal and defining Europe's approach to clean technology. But recent geopolitical events have brought energy security back into sharp focus. The war in Ukraine exposed the dangers of external energy dependence and RePowerEU took the first steps in addressing it. But as Europe now faces the prospect of fending for itself, the imperative is clearer than ever: resilience is as critical as sustainability and competitiveness.

Regardless of which pillar of the energy trilemma you prioritise, the solution remains the same: scaling a strong, domestic clean tech sector. By securing control over our energy supplies and production technologies, we can reduce reliance on volatile foreign supply chains, cut emissions, and create thousands of jobs across the EU. We must now double down on scaling this sector.

It is easy to dwell on the challenges ahead, but we should not overlook the progress already made. The EU's regulatory framework has played a crucial role, particularly through demand-side measures like the Fit for 55 package, which has generated a strong pipeline of new projects. Sectoral targets have driven investment across value chains, from batteries to green hydrogen, creating strong conditions for new ventures to emerge. As an example from our portfolio, CorPower – its recent Series A funding was underpinned by clear policy signals from the EU Renewable Energy Directive, which requires Member States to source 5% of its renewable energy from innovative technologies like wave power.

More recently, the focus has shifted to supply-side measures. The Net-Zero Industry Act, committing the EU to producing 40% of its clean technology demand domestically, is a decisive step toward capturing the economic benefits of the transition while strengthening Europe's industrial resilience. This provision alone is already strengthening the pipeline of industrial projects.

But a pipeline of projects is not enough. The Clean Industrial Deal must deliver a coherent industrial strategy that safeguards Europe's clean tech champions and unlocks the finance needed to scale. President von der Leyen's pledge to make this a Commission of scale-ups and investment is promising—but now, ambition must turn into action.

Drawing on InnoEnergy's track record as an investor supporting over 200 clean tech companies to date (3 of which are industrial unicorns) and having mobilised €25 billion investment, I outline the three critical pillars needed to secure Europe's clean transition and scale homegrown clean technologies.

Securing sustained and certain demand for clean tech made in Europe

Europe has no shortage of talented entrepreneurs and clean tech start-ups – InnoEnergy's own portfolio of over 200 active clean tech champions is testament to that. What it needs are the right conditions for investment to flow at speed and scale. For investors, predictability is paramount: stable political commitments to climate action, a clear regulatory framework, and certainty of demand. When offtake is predictable, so are revenues, and investment decisions are far easier.

Europe has made real progress with a clear political message: there is no turning back on climate ambition. The EU's climate neutrality target, soon to be complemented by a binding 2040 goal of 90% emission reduction, is key to maintaining investor confidence. Specific targets, like those in the Renewable Energy

Credits: CorPower Ocean's wave energy converters

Holosolis industrial plant in Hambach, France to start operations in 2027

Directive, and enforcement mechanisms like penalties for non-compliance, are crucial to translating Europe's climate ambition into certainty.

The Net-Zero Industry Act and the Clean Industrial Deal take an important step by ensuring that when public money is spent – whether through auctions for renewables, public procurement, or national support schemes – it supports homegrown clean tech. Successful implementation of local content requirements across the board, including for EU funding programs would further strengthen demand for EU-made technology.

Still, more could be done to mobilise private purchasers. While no single approach fits all sectors, voluntary commitments have proven effective in some industries. For instance, to decarbonise their supply chain, Heineken became a seed investor of the low-carbon fertiliser producer FertigHy we launched. Others, like sustainable aviation fuels, require binding mandates. A targeted, product-specific approach could also drive further demand. Setting clear targets for low-carbon materials in industries such as premium cars, batteries and foods would have significant impact.

Mobilising private capital remains Europe's biggest untapped opportunity

The investment opportunity for clean tech cannot be underestimated. But the scale of investment required – estimated at €450 billion additional annual investment 2030 as outlined by Mario Draghi –calls for a fundamental shift in how Europe finances its clean industrial transformation. InnoEnergy's portfolio alone will require €160bn before 2030.

The Clean Industrial Deal recognises this, introducing new financing measures. The expansion of InvestEU, with an additional €2.5 billion in guarantees, is a welcome step in de-risking investments. Similarly, earmarking Innovation Fund revenues for clean tech manufacturing – both in CAPEX and production phase – sends a good market signal.

But public finance cannot bear the cost alone. Private capital must do the heavy lifting. Yet, we're still missing the right financial instruments to mobilise funds at scale, ensuring that every public euro unlocks several more from institutional and other private investors.

One solution is a dedicated fund raising €70 billion in private capital through green bonds, de-risked by a €1–2 billion annual provision from the EU budget as a guarantee. Over 15 years, such a vehicle could unlock up to €500 billion of private capital for clean tech scale-ups by tapping into Europe's vast, under-utilised pension and insurance savings.

Guarantees have already proven effective in mobilising private investment through InvestEU, but not at the required scale. This approach offers a dual benefit: allowing European citizens to invest in the continent's industrial future while finally enabling cross-border capital pooling, something fragmented European markets have long struggled with.

This instrument could serve as the flagship initiative within the Competitiveness Fund, which will house an array of financial instruments under the new long-term EU budget.

There is no time to lose. With 2030 targets on the horizon, investment decisions must be taken now to ensure projects are operational in time.

The right conditions for building clean industrial plants

The final pillar to enable clean tech to ramp up and reach scale focus on the practical bottlenecks encountered by projects building their plants: access to affordable, decarbonised energy, land, and faster permitting.

For projects building clean solutions for hard-to-abate sectors, long-term access to clean and affordable electricity is essential. Recognising this, the Clean Industrial Deal includes a €500 million Power Purchase Agreement (PPA) program to support SMEs and energy-intensive industries. This initiative will help de-risk clean tech start-ups, enabling them to secure long-term contracts at stable prices. Its swift deployment will be critical.

While much progress has been made on permitting, it remains a significant bottleneck. Authorities at all levels – EU, national, regional, and local – must accelerate efforts to streamline, digitise, and prioritise permits for strategic clean tech projects. The European Commission's should make sure that regulations under the revised Renewable Energy Directive and the Net-Zero Industry Act swiftly translate into real results.

Finally, access to land must not be overlooked. Industrial sites must be well-connected to logistics and energy infrastructure, yet bureaucratic delays continue to slow development. Prioritising brownfield redevelopment - repurposing former industrial sites – can accelerate market entry.

France is leading by example. It has identified 22,000 hectares of industrial land needed by 2030, much of it repurposed. To fast-track access, 55 turnkey industrial sites have been earmarked, including 10 gigafactory-proof locations, backed by €1 billion in government funding. Holosolis, a photovoltaic manufacturer InnoEnergy launched in 2023, demonstrates this approach can deliver results. The company was able to establish its factory on a previously permitted site, bypassing administrative delays. Scaling this model across Europe should now be a priority.

Conclusion

Scaling homegrown clean technologies is not just central to Europe's decarbonisation agenda, it is critical for energy security and long-term growth. The pipeline of projects is strong, and the policy framework is robust. The challenge now is execution. By ensuring predictable demand, mobilising private capital, and removing barriers to scale, Europe can cement its leadership in clean tech, and secure its economic and energy future.

ZBYNĚK **BOLDIŠ**
President ENTSO-E

SONYA **TWOHIG**
ENTSO-E Secretary-General

Connecting European Grids – Supporting Energy Security

"Energy security is not only a matter of ensuring a steady supply of resources but also a cornerstone of European integration, where the pursuit of collective energy independence strengthens both economic cooperation and geopolitical stability, fostering deeper unity among Member States."

"This achievement exemplifies the strength of European collaboration and technical excellence. ENTSO-E and its member TSOs remain committed to advancing the integration of Europe's electricity networks, reinforcing security of supply, and supporting the transition towards a more resilient and sustainable energy future."

A Historic Milestone for the European Energy Union

On 9 February 2025, Estonia, Latvia, and Lithuania successfully synchronised their electricity grids with the European power system. This marks a major step towards energy independence for the Baltic States, permanently severing their reliance on the Russian power system.

With this synchronisation, the Baltic states now have full control over their electricity systems, ensuring stable and reliable frequency management. This transition significantly strengthens regional energy security, reinforcing Europe's commitment to a more interconnected and resilient power grid. By joining one of the world's largest synchronous electricity areas, serving nearly over 500 million consumers, Estonia, Latvia, and Lithuania have taken a decisive step towards long-term energy stability.

This achievement follows the emergency synchronisation of Ukraine and Moldova with the electricity system of Continental Europe in 2022. The determination and expertise of Ukrainian professionals, who have managed to keep the grid operational despite relentless attacks on energy infrastructure, remain a testament to the resilience and skill within the European electricity sector.

The synchronisation of Ukraine and Moldova with the European power system marked a significant milestone in enhancing their energy security and facilitating their integration into the European electricity market. This emergency synchronisation, made possible by the remarkable resilience of Ukrainian professionals, ensured grid stability amidst continuous attacks on infrastructure. Their ability to maintain operations under such conditions highlighted the strength of the Ukrainian energy sector.

Furthermore, the synchronisation led to increased transmission capacities, playing a critical role in the deeper integration of Ukraine and Moldova into the European energy network. This expanded capacity not only bolstered their energy security but also contributed to the overall stability and resilience of the European electricity grid, promoting greater interconnection and cooperation across borders.

A European Success Story

Achieving full synchronisation of the Baltics, on the other hand, was the result of years of preparation and close cooperation between the Baltic Transmission System Operators (TSOs) with the support of the TSOs from Poland and Germany who played a key role in enabling the connection to the European grid. Extensive grid upgrades and technical enhancements were essential for the successful completion of this transition.

The European Union and ENTSO-E were instrumental throughout the process, providing financial support, regulatory guidance, and operational expertise. Their contributions ensured that the synchronisation was carried out efficiently and in line with European energy objectives. The synchronisation of the Baltic states with the European system is a transformative milestone that strengthens energy security and independence while demonstrating the power of European cooperation.

Strengthening Grid Stability and Energy Security

By integrating with the Continental European Power System, the Baltic states now have full control over their electricity grids, no longer relying on Russian or Belarusian systems for frequency management. This transition removes a key vulnerability and significantly reduces external risks, further enhancing the stability of the European electricity network.

As part of the European power system, the Baltic TSOs are able to balance electricity generation and consumption across a much larger and more stable synchronous area. This not only increases the reliability of their own power systems but also contributes to the overall security and efficiency of the European electricity market. The move strengthens regional energy resilience, ensuring that future challenges can be met with greater flexibility and coordination.

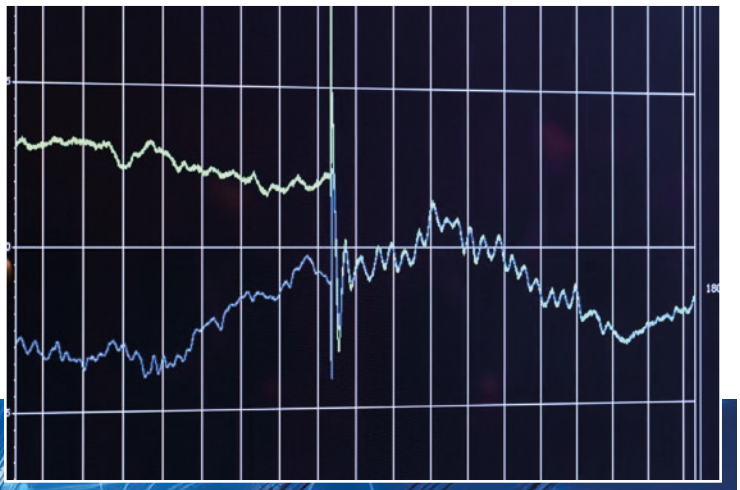
A Testament to European Solidarity

The synchronisation of the Baltic states, alongside the emergency synchronisation of Ukraine and Moldova in 2022, stands as a powerful demonstration of European solidarity. Both efforts reflect Europe's collective commitment to enhancing energy security, grid resilience, and strategic autonomy in times of uncertainty. These achievements highlight the EU's ability to come together efficiently in addressing evolving energy challenges.

ENTSO-E and its member TSOs have been at the forefront of these initiatives, providing crucial technical and operational support to ensure seamless transitions. Their combined expertise and coordination have been essential in making these synchronisations successful, reinforcing Europe's capacity to adapt and innovate for a more secure and interconnected energy future.

Looking to the future of transmission grid security and reliability, the focus on critical infrastructure protection will be a high priority in the Baltic Sea region and within the EU. For this reason, the TSOs are keen to work together with the European Commission and energy market participants to cooperate on the prevention and protection of critical infrastructure.

As Europe continues its journey towards a sustainable and resilient energy landscape, these synchronisations exemplify the positive impact of cooperation, innovation, and strategic investments in achieving shared energy goals.



Europe's energy security: the strategic role of electricity

CHRISTIAN **BUCHEL**

President of UFE

Three years ago, Russia's invasion of Ukraine turned the European energy scene upside down. Dependence on Russian gas, long seen as a simple economic constraint, emerged as a major strategic vulnerability. The ensuing crisis forced a radical overhaul of European energy policies, with a refocus on security of supply, diversification of energy sources and accelerated electrification.

Today, energy sovereignty has become vital for Europe.

Electricity is the keystone of this sovereignty, not least because we can draw on the strengths that have long been built up in Europe: the electricity system is interconnected, it is largely decarbonised in several countries and is in the process of being decarbonised in all of them, and can rely on a European-based industry, from equipment manufacturers to electricity companies, many of which are among the largest in the world.

A strategy of resilience in the face of geopolitical shocks

The energy crisis of 2022 was a wake-up call: in the space of a few months, Europe reorganised its gas supply channels, increasing the number of agreements with Norway, the United States and Qatar. The development of liquefied natural gas (LNG) terminals has reduced the EU's dependence on Russian gas from 45% to less than 15%. However, this shift has an economic and environmental cost. LNG is more expensive and has a higher carbon footprint than pipeline gas. That is why Europe must now clearly capitalize on its greatest asset: electricity! Wherever processes and technology allow, we must now electrify on a massive scale! This is a fight we must wage for our competitiveness, for our sovereignty and, because climate change has not been diluted by geopolitics, for the climate!

Europe must get off fossil fuels, and it can!

The REPowerEU plan, adopted in 2022, aims to rapidly deploy low-carbon electricity capacity based on two pillars: nuclear and renewable energies. Electricity grids have been clearly identified as the cornerstone of this deployment, as they connect the decarbonised electricity to consumers, while guaranteeing the stability, flexibility and resilience of the European energy system.

Electricity, the cornerstone of energy security in Europe

Europe has acknowledged the need to control its energy destiny. While in recent years a large part of European regulation has been devoted to the production of decarbonised electricity, it is now becoming urgent and essential to electrify the downstream sectors : industry, transport and heating/cooling. Electric cars, heat pumps, electrical processes in industry and the service sector, building control technologies, etc.: our European industry knows how to produce them! Let's encourage and steer their deployment now, and that's how we'll reduce our need for hydrocarbons.

Europe's electrification rate has stagnated at 23% for the past ten years, even though it is expected to account for half of the EU's final energy consumption by 2040. Meanwhile, China has increased its electrification rate by 7 pp since 2015.

Only 31% of the energy consumed by industry is electric, whereas a further 43% could be immediately electrified and a further 14% by 2030[1]. Let's set targets and monitor them!

A massive breakthrough in the electrification of uses should be our energy priority.

Europe must launch a structured, prioritised and financed plan for the electrification of the industrial, mobility and building sectors, with the aim of reaching 50% by 2040.

At the same time, the transition must remain competitive. Faced with the United States and China, Europe must guarantee its manufacturers affordable and stable electricity. This requires strategic investment planning, greater coordination between Member States and an ambitious industrial policy to develop a European energy technology industry.

Three years after the shock of 2022, Europe has embarked on a profound transformation. Energy security is now based on a low-carbon electricity model, supported by nuclear power and renewable energies, and consolidated by modern, interconnected infrastructures. This transformation, which is essential for the continent's economic and climate sovereignty, must be speeded up if Europe is to have a secure, sustainable and competitive energy future.

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Interconnection of European Energy Networks, Foundation of Energy Security

JENS GEIER

MEP (S&D Group – Germany)

A few weeks ago, Estonia, Lithuania and Latvia synchronised their Energy grid with the European Grid by cutting the connection to the Russian controlled BRELL System via the overhead transmission line LitPol link that connects Poland and Lithuania, which share a common border. A milestone for deepening of the European Energy Union, which would not be possible without the cooperation of European Member States. The Recent reports of destroyed subsea interconnectors in the Baltic Sea by rusty ships with estimated strong connection to Russia put not only a spotlight on the vulnerability of the European Union with regard to their critical infrastructure, it highlights also todays importance of these cross country interconnectors with regard to current European Energy Network infrastructure.

Grid interconnectors—high-voltage transmission lines for electricity and pipelines for gas and in the future hydrogen—are crucial to Europe's energy security, economic stability, and geopolitical resilience. They facilitate cross-border energy flows, balancing supply and demand while integrating renewable energy sources.

Europe has already many electricity interconnectors helping to share power and improve energy security. For example **LitPol Link** (Lithuania-Poland), **Estlink 1 and the recently damaged Estlink 2** between Estonia-Finland, **Alegro** between Belgium and Germany or the **Spain-France Interconnector**. More are about to come such as the **Celtic Interconnector** between France and Ireland. These connections help balance supply, increase the use of renewables, and make the electricity network across the EU more reliable. Electricity interconnectors enable energy diversification by allowing countries to share power, reducing dependence on single suppliers. They help balance supply and demand, preventing blackouts and stabilize the grid, especially during peak periods. For example, surplus wind power from the North Sea can be transmitted to regions with higher demand quick and stable. This has Economic and geopolitical benefits. Cross-border electricity trading lowers energy costs and increases market efficiency, encouraging investment in renewable energy projects. Interconnectors also reduce dependence on external energy suppliers, strengthening Europe's geopolitical resilience and security. Every new connection point strengthens therefore the European grid.

One may think, that compared to electricity, gas interconnectors play a minor role, even become obsolete, since Europe is pulling out of fossil fuels. However, this would neglect the role of hydrogen on the long run and the significance of a European pipeline grid for becoming independent from Russian gas. These pipelines allow gas to flow across borders and if needed in changing directions, ensuring supply even in times of political instability or supply disruptions. After the gas crises of 2006 and 2009, the EU reinforced its security of gas supply notably by adopting the first security of gas supply Regulation No 994/2010 in 2010.

Europe has several important gas interconnectors essential for the transport of natural gas, improving energy security and supply. Some key ones include the **Balticconnector** between Finland and Estonia), **GIPL** between Poland and Lithuania, the **BRUA Pipeline** connecting Bulgaria, Romania, Hungary, and Austria, The **Trans Adriatic Pipeline (TAP)** brings gas from Azerbaijan to Greece, Albania, and Italy or the **Spain-France Gas Interconnectors,** which help integrate the Iberian market with the rest of Europe. These Interconnectors contributing to a stable gas flow, reduce reliance on single suppliers, and enhance energy resilience in the EU. A well-connected gas network reduces price volatility, strengthens energy trade, and provides flexibility in sourcing gas from multiple suppliers. This enhances EU solidarity, the risk preparedness and its geopolitical resilience.

With the development of the European Hydrogen infrastructure on the short and on the long run, interconnectors are of great importance too. With the creation and repurposing of new pipelines for the hydrogen grid, interconnectors on strategic entry exit points are needed. The ramp up of the hydrogen economy requires particularly in the beginning imports from third countries next to the internal production. To not delay this ramp up of the hydrogen economy a solid infrastructure has to be build. Additionally also for transport of CO_2 the lessons learnt from connecting the EU can and should be taken into account to contribute to a strong European grids from day one.

As the European legislators, we will not ignore this challenge Therefore the EU calls in the grid action plan and in the affordable energy act for more interconnectors but also for more attention on the protection of the critical infrastructure online and offline. In addition, a broader energy system integration connecting electricity, gas, heat, hydrogen plus storage solutions will be of importance. In the European Parliament, we are a ready to support the Commission with our ideas to ensure that upcoming legislation make sure that interconnectors will be built on strategic places according to the needs more effective and are adequately financed. This is good for European security and the consumer

Hydrogen Valleys: Europe's Pathway to Sustainable Competitiveness

MIRELA **ATANASIU**

Head of Unit Operations and Communication, Clean Hydrogen Partnership

Supported by the Clean Hydrogen Partnership (Clean Hydrogen JU), Hydrogen Valleys are the type of strategic initiative Europe needs to achieve its competitiveness goals while continuing to work towards climate neutrality.

Europe is at a critical juncture in the global race towards sustainability and economic resilience, with Hydrogen Valleys emerging as a key tool for securing its competitive edge.

The Clean Hydrogen Partnership has been a pioneer in supporting such initiatives, recognizing their potential to transform Europe's energy landscape. Hydrogen Valleys function as integrated regional ecosystems, encompassing hydrogen production, storage, distribution, and end-use applications. By uniting multiple sectors—including mobility, industry, and energy—the valleys exemplify how renewable energy can be leveraged to enhance regional competitiveness, create jobs, and stimulate economic growth.

Hydrogen Valleys support critical EU policy objectives, such as those for a more competitive European industry – the competitiveness compass and the clean industrial deal, and the REPowerEU Plan for affordable, secure and sustainable energy for Europe, which aims to double the number of Hydrogen Valleys in the EU by 2025. With €215 million allocated by the Clean Hydrogen JU to 18 Hydrogen Valley projects to date, these initiatives have attracted more than €1.2 billion in investments, underscoring Europe's commitment to regional integration, industrial growth, and climate neutrality. Each euro invested by the Clean Hydrogen JU has attracted substantial private co-funding, highlighting the trust and confidence in hydrogen as a competitive solution in several sectors.

By creating demand for hydrogen solutions, Hydrogen Valleys stimulate European supply chains, attract private investment in hydrogen production, and support the scale-up of key manufacturing sectors such as electrolysers, fuel cells, and storage technologies. This aligns directly with the Draghi Report's call for Europe to regain its competitive edge by fostering industrial scale-up and reducing dependence on foreign supply chains. Moreover, Hydrogen Valleys serve as innovation hubs where European companies refine technologies, build local expertise, create jobs, and improve cost-efficiency - key to securing the EU's leadership in the hydrogen economy.

Projects like TRIĒRĒS in Corinthia, Greece, are optimizing green hydrogen supply chains and significantly reducing greenhouse gas emissions. Recognized as the "Hydrogen Valley of the Year 2024," TRIĒRĒS focuses on developing infrastructure and logistical models to optimize the green hydrogen supply chain. The project aims to produce 2,410 tonnes of green hydrogen annually through electrolysis, utilizing renewable energy sources to decarbonize the economy and reduce greenhouse gas emissions.

Similarly, the Green Hysland initiative in Mallorca has established a robust renewable hydrogen production and distribution system, demonstrating how islands can achieve energy independence and sustainability. This project is deploying a fully integrated hydrogen ecosystem on the island of Mallorca. It encompasses 7.5 MW of electrolysis capacity linked to local photovoltaic plants, supplying green hydrogen for mobility, heat, and power applications. By integrating production, distribution, and end-use, Green Hysland aims to set a precedent for decarbonizing island economies and contributing to the EU's net-zero targets.

In France, the IMAGHyNE project in Auvergne-Rhône-Alpes represents one of Europe's largest hydrogen valleys, significantly scaling up electrolyser capacity and creating a flexible, resilient hydrogen infrastructure. With a budget of €200 million, this six-year project aims to deploy 57 MW of new electrolysis capacity to produce 8,000 tonnes of low-carbon hydrogen annually. The initiative integrates a flexible hydrogen supply chain, including underground storage and distribution infrastructure, to meet the energy needs of high-emitting sectors.

In conclusion, Europe's Hydrogen Valleys are not just about technology; they are vital engines of economic resilience, innovation, and competitiveness. Through strategic investments, targeted innovation, and regional collaboration, these projects position Europe firmly at the forefront of the global clean energy transition, delivering on economic, environmental, and strategic objectives.

Grid, Baby, Grid: Why **Ireland** and **Europe** Must Expand and **Modernise Their Electricity** Infrastructure Now

SEÁN KELLY

MEP for Ireland and Leader of Fine Gael in the European Parliament. Kelly sits on the European Parliament's Committees on Industry, Research & Energy (ITRE) and is currently the EPP's Lead Negotiator for the Report "Electricity grids: the backbone of the EU energy system"

2025 has begun at pace in Brussels, with the new Commission setting out its priorities for the next five years. At the heart of every discussion is competitiveness—how Europe can remain strong in an increasingly volatile geopolitical landscape.

Competitiveness requires energy security, economic growth, and a cost-effective transition to Net-Zero. Achieving all this demands a modern, expanded electricity grid. Yet, across Ireland and the EU, outdated grid infrastructure, planning delays, and political inertia are stalling progress. If we are serious about meeting climate goals, enhancing competitiveness and ensuring affordable renewable energy, grid investment must be a political priority.

In other words: *Grid, baby, grid.*

The Grid We Have vs. The Grid We Need

Europe's electricity grid is largely a relic of the 20th century, designed for a centralised fossil fuel-powered economy. Today, our energy system must integrate high volumes of decentralised, variable renewables while accommodating rising electricity demand from industries, heat pumps, electric vehicles, and data centres. To keep pace, we need a major upgrade to transmission and distribution networks.

Around 40% of Europe's distribution grids are over 40 years old. By 2030, nearly half a trillion euros in investment is needed to avoid bottlenecks and maintain reliability. Transmission grids also require extensive reinforcement. If we fail to act, a lack of grid capacity will undermine both our climate targets and economic ambitions.

A Critical European Priority

Recognising the urgency, the outgoing Commission published its *Grid Action Plan* in November 2023. This was a welcome step, but plans alone are not enough—swift and decisive implementation is needed.

Public understanding is also crucial, and we must do a better job in engaging with citizens on the vital importance of grid expansion, and ensuring the public is well-informed about why grid expansion is necessary. Without broad support for building grid, progress will stall. The EU must also prioritise cross-border infrastructure to build a fully integrated Energy Union. The *Letta Report* rightly calls for a dedicated cross-border infrastructure fund to finance new interconnector projects, blending public and private investment.

Flexibility and Storage: The Missing Pieces

Building new grids is vital, but maximising the efficiency of existing infrastructure is equally important to minimise consumer costs.

This means investing in energy storage—from short-duration batteries to cutting-edge 100-hour storage technologies—to reduce grid congestion and better match renewable supply with demand. It also requires deploying smart grid technologies and real-time energy management tools to maximise efficiency.

Crucially, we must address our major *dispatch-down* problem—when our renewable generators are unable to sell the electricity they are able to produce due to our grid being unable to accommodate them at a given time. This waste of valuable renewable energy undermines competitiveness and climate goals. The new Commission should introduce an *EU Strategy on Dispatch Down* to prevent these losses.

With the right investment and policies, Ireland can lead the way in achieving 100% renewables. EirGrid has already demonstrated world-leading integration of renewable electricity, strengthening our energy independence in the process; and we are only getting started.

Permitting: The Elephant in the Room

Of all barriers to grid expansion, our slow planning process is perhaps the most frustrating. We have the technology, the capital, and the clear need—yet bureaucracy keeps projects in limbo. The *REPowerEU* plan includes binding measures to speed up approvals, yet some Member States, including Ireland, have thus far failed to enforce them rigorously.

A system where transmission lines take over a decade to approve is unfit for a world that must decarbonise now.

The *North-South Interconnector* is a prime example of our failing planning system. This is an utterly essential project, crucial for energy security and grid capacity, has been delayed for decades due to planning hurdles and objections.

At this point, I think we need to be honest: those blocking such projects are, by definition, obstructing Ireland's economic growth, energy security, and climate ambitions.

The same principle applies across Europe. Major grid projects must be deemed to be *overriding public interest* and fast-tracked through the planning system accordingly.

The Time for Action is Now

Europe's economic competitiveness depends on a modern electricity grid. Without immediate action to expand and strengthen it, we risk missing climate targets, making ourselves less energy-secure, and stalling economic growth.

The solutions are clear: prioritise investment, accelerate planning, enhance interconnection, deploy cutting-edge technologies, and reinforce supply chains. However, none of this will happen without strong political will.

We must wake up to the urgency of grid development. The next decade will determine whether we build a competitive, net-zero Ireland and Europe, or fall behind global competitors.

The choice is clear: *Grid, baby, grid.*

Strengthening hydrogen infrastructure to support the green energy transition

PHILIPPE **BOUCLY**

President of France Hydrogène

The growing frequency and intensity of climate change-related events highlight the urgent need for decarbonisation. Electrification is a key tool in this transition, with electricity projected, according to all prospective models, to account for 50 - 60% of the final energy consumption by 2050. So, to achieve full decarbonisation, renewable heat and renewable gases (including hydrogen) must be mobilised to address the remaining 40 - 50%. Hydrogen is expected to play a critical role, contributing to 10 - 20% of the final energy consumption by 2050.

In that respect renewable and low carbon hydrogen is a cornerstone of the EU's Net Zero Strategy.

Hydrogen will serve two primary functions: To decarbonise "hard to abate" sectors i.e. sectors where electrification of processes is difficult or impossible, for instance sectors using hydrogen as a feedstock: production of ammonia, chemical industry or steel industry where hydrogen could replace coke to produce iron. Hydrogen is also necessary to decarbonise transport sector, intensive or heavy-duty mobility (where there is a need for large autonomy or short refuelling time) and for maritime and aviation mobility with hydrogen or hydrogen derivatives such as ammonia, methanol or e-kerosene.

Another very important role of hydrogen will be to contribute to integrate renewable energies within energy systems. Hydrogen can provide flexibility to address the variability of wind and solar energies. So, beyond the historical role of hydrogen as a chemical product, the role of hydrogen as an energy vector either to transport or to store energy will be more and more confirmed.

Hydrogen will progressively acquire the status of a commodity and similarly to electricity or natural gas today, a market for renewable or low carbon hydrogen will emerge.

The need for a robust hydrogen infrastructure

For hydrogen to establish itself as a viable market, infrastructure development at national, European and world scale is paramount (as today for electricity or natural gas markets).

Regulation 2022/869 on guidelines for trans-European energy infrastructure (May 30, 2022) defines hydrogen infrastructure as encompassing pipelines, storage facilities, reception, storage and delivery terminals for hydrogen and hydrogen derivatives (ammonia, methanol, LOHC, etc...) and transport-related installations such as hydrogen refuelling stations.

In the field of pipeline system, significant progress has already been made by natural gas TSO (Transmission System Operators). The European Hydrogen Backbone (EHB) Initiative spearheaded by 33 European gas TSO, envisions a 58,000 kilometres network by 2040 connecting H2 production sites, storage facilities, terminals and consumers. 60% will come from repurposed natural gas pipelines alongside with new constructions (40%), offering cost-effective hydrogen transport (0,10 up to 0,25 €/kg per 1,000 km depending on pipe size and type - repurposed or new). This vision is already turning into action. The Netherlands has initiated a national backbone. Through a specific law, Wasserstoffbeschleunigungsgesetz, the German government is providing support to a core network, the "Kernnetz", of roughly 9,000 kilometres by 2032.

Enagas, the Spanish TSO, has recently committed €3,13 billion by 2030 for 2,700 kilometres of pipe and two underground storage facilities as a first step of the Spanish hydrogen backbone.

France's NaTran (ex GRTgaz) is developing interconnections with neighbouring countries including the MosaHYc Project (100 km) between France and Germany, RHYn project (100 km) in Alsace with connections with Germany and Switzerland, HY-FEN between Fos-Marseille and the German border and HYnframed, a H2 network in the South region.

By 15. February 2024 the EU Commission has approved a third Important Project of Common European Interest (IPCEI) to support H2 infrastructure (Hy2Infra) [1]. This IPCEI is expected to boost the development of an H2 infrastructure by supporting development of new or repurposed hydrogen transmission and distribution pipelines, large-scale storage facilities, construction of handling terminals and deployment of 3.2 GW of large-scale electrolysers.

On 30. January 2025, the EU Commission allocated almost €1,25 billion in grants from the Connecting Europe Facility (CEF)[2]. Part of this amount (€250 million) will be allocated to 21 development studies for projects in many European countries, for backbone projects in Italy, Portugal and Spain and for the BarMar-H2MED Project (€28 million).

On 10. February 2025 the H2-MED Alliance (Enagas, NaTran, OGE, REN and TeReGa) received expression of interest from 168 companies covering 528 projects. By 2030 1,6 million tonnes of hydrogen are expected to be exported from Spain to Germany via BarMar and HY-FEN pipes, increasing to 2.4 Mt by 2040. The partners are now developing the feasibility study. In parallel many challenges have to be overcome: contracting i.e. long term booking agreements, funding especially public financial support and a clear regulatory framework in order to de-risk the project.

In the field of storage some projects are being developed in France (Hypster project), in Spain, in Austria and in Germany. 13 storage

1 https://ec.europa.eu/commission/presscorner/detail/en/ip_24_789

2 https://ec.europa.eu/commission/presscorner/detail/en/ip_25_377

operators coordinate within the "H2eart for Europe" Alliance (www.h2eart.eu). At the European level the FrHyGe project involves 17 partners (Storengy, Enagas, Geostock and many others). With a total budget of €43 million, 20 of which are funded by CHP (Clean Hydrogen Partnership), FrHyGe is dedicated to validating large scale underground hydrogen storage in salt caverns (Manosque in France and Harsefeld in Germany). As an order of magnitude, a salt cavern (in Manosque, Etrez or Harsefeld for instance) can store 5000 up to 6000 tonnes of hydrogen which represents approximately 250 GWh (to be compared to battery storages presently developed: 200 up to 400 MWh).

In the field of transport, the "chicken and egg" dilemma should be solved by developing a refuelling infrastructure. The Alternative Fuel Infrastructure Facility (AFIF) is an effective and efficient instrument to support the rollout of such infrastructure. Beyond this minimal infrastructure it will be necessary to build a sufficient number of hydrogen refuelling stations in order to accompany the ramp-up of the heavy duty and intensive mobility and to give a necessary comfort to the users. It is one of the preconditions for the uptake of hydrogen vehicles.

As far as storage and delivery facilities for hydrogen and hydrogen derivatives are concerned, some projects are already ongoing: Air Liquide project Enhance in Antwerp (an ammonia cracking facility with a subsidy of €110 million from the EU), Air Products in Le Havre, Hamburg and Rotterdam for receiving and cracking ammonia, studies for ammonia reception facility terminals in Brunsbüttel and in Antwerp (financed by CEF).

A January 2025 study[3] by Trinomics, ARTELYS and LBST for the EU Commission estimated the investment needs until 2040 for a pan-European energy infrastructure: almost €170 billion between 2024 and 2040. Majority of these investments are dedicated to H2 pipelines (€105 billion) while storage facilities amounting to €27 billion, import terminals to €20 billion and electrolysers to €16 billion. 53% of these investments would develop in Germany, France and the Netherlands.

To foster the development of such infrastructure, a favourable framework must be established, and some conditions need to be set up to give visibility to all players.

Regulatory Certainty and Streamlined Permitting

- To ensure a real technological neutrality in clean hydrogen production: from renewable and nuclear electricity, from fossil fuels with CCS and from biomass.
- As implementation of hydrogen infrastructure require a lot of time, speeding up the permitting processes will help to reduce the overall project timelines and costs.
- To implement the "Hydrogen and Gas Directive" in respective national legislations: to define the body in charge of regulating the H2 infrastructure, to certify specific operators as H2 Transmission Network Operators in order them to be member of the ENNOH (***European Network of Network Operators for Hydrogen***), to define rules for storage and reception terminal operators.

Financing and investment de-risking

Some steps were already achieved through IPCEI (Hy2Infra) and through the Connecting Europe Facility. As explained before an appropriate H2 infrastructure is a prerequisite for the development of the hydrogen market. This requires an immediate and robust support and strong contributions from public bodies such as European Investment Bank (EIB) and the future Industrial Decarbonisation Bank and tools to de-risk investment. Such de-risking mechanisms are already in place in Germany and Netherlands.

To accelerate the hydrogen ecosystem take-off and to unlock large scale projects, mobilizing private funds is necessary. One of the largest funds, "Clean H2 Infra Fund" is managed by Hy24 a 50/50 JV between ARDIAN and FiveTHydrogen and has already invested in Hy2Gen AG, in Green Steel (Sweden), in Elyse Energy and in HySetCo the company enabling hydrogen mobility with taxis and refuelling stations in Paris' region.

Conclusion, a critical pivotal moment.

Implementation of hydrogen technologies is progressing at slower pace than most of the analysts, companies and governments predicted it five years ago. To fight climate change there is no time to stop but rather to accelerate and to scale up. In that respect a well-developed hydrogen infrastructure is crucial for setting up a hydrogen market. It is necessary to decarbonise "hard-to-electrify" sectors in the economy, to balance the variability of renewable energy and to ensure energy security and supply diversification and then contribute to independence and sovereignty. Given the long lead times for infrastructure deployment, immediate and coordinated planning involving all stakeholders is essential. Establishing a clear regulatory framework, securing robust financial support, and accelerating project execution will be key to unlocking hydrogen's full potential in the green energy transition.

Refuelling station HySetCo - Porte de Saint Cloud – Paris

3 https://op.europa.eu/en/publication-detail/-/publication/864c619c-e386-11ef-be2a-01aa75ed71a1/language-en

Moving from weakness to **competitive advantage**: high energy prices paving the way to the era of **European electrification** (2025-2030)

SUZANA CARP

Dep. Executive Director, CleanTech For Europe, Co-Founder Cleantech for CEE

All around the world, the electrical grid is a reflection of political-economic centers and historical priority routes, since the late 19th century. The European Union is no different, the state of our electrical grids carries with it our various stories of integration, the most recent syncing of the Baltic states to the European continental grid and away from the Russian one in February 2025 being a real-time example of that. But the grid is certainly not about the past only. In fact, it is very much about the future and the visions for political-economic power underpinning it. In fact, one could say it reflects past visions of the future.

Europe needs a new vision for its economic future and it actually starts from electrification and grids. Currently, our electric grids are a good indication of where European integration: congested, rigid, slow-moving when it comes to adoption of innovation and not properly connecting European Member States with each other or European regions for that matter (thinking of Iberia's far below 2.8% interconnection to the rest of continental Europe). Managing these congestions have been estimated to have cost billions of Euros in 2023 alone[1].

Southeastern Europe is a region in the spotlight of this debate and it was mentioned in the recently launched Action Plan for Affordable Energy for its skyrocketing energy prices reached in the summer of 2024, of above 250E/MWh, resulting from the lack of cross-border capacity and flexibility[2]. It is imperative that such issues are dealt with as a matter of urgent priority, not least because of the 46 million Europeans affected by energy poverty, many of whom are in this very region.

To show the direct connection between interconnectivity and lowered energy prices, one needs to look no further than the example of Ireland and the UK. The moment the East-West interconnector went live in 2014, electricity prices dropped instantaneously. Equally so, following Brexit, the reduced electricity traded created higher price spikes on both sides. Now, with the help of certain innovative technologies, for example in the space of cables, one could even envision connecting clean electricity production in Romania to it's end use in the Czech Republic.

According to the Grids Action Plan from 2023, 584bn Euros would be needed for investments in grids this decade alone. At the same time, a report by CurrENT estimates that a steady annual deployment of innovative grid technologies (such as Dynamic Line Rating, Advanced Power Flow Control, high-capacity conductors could save us700 billion Euros by 2040 [3]. If we were to massively build up smart grid applications available for deployment within 3-6 months, in addition to fast-forwarding interconnectors build-out, long-distance cables and investing in innovative high-capacity and high-efficiency conductors, amplifying the capacity of the grids and their operations, one can safely assume this would lower prices across regions in the EU.

It is important to note that the existing grid congestion is further exacerbated by the exponentially growing projects waiting to go online and the long waiting times they are usually faced with (several years). This model of European infrastructural loose interconnection is clearly outdated, yielding a disconnect are felt in the political-economic situation across Europe, including in our huge re-think of what continental wide European competitiveness is. The Draghi report went heavy on this topic, identifying grids and electrification as huge levers of necessary change and enablers for competitiveness. Beyond this rethink, the disconnect is felt in the electricity prices paid by citizens and industry alike across the continent. These costs come on top of the already high energy prices, therefore affecting the competitiveness of European businesses and impacting directly citizens.

Electrification should in fact have emerged as the shining star of the Clean Industrial Deal. While it is of course across the various documents and it is mentioned in the competitiveness compass as a key enabler, it is not quite given the center stage that it requires. A 32% by 2030 only target for electrification is showing a modest, if not even shy vision for our future. Half of the 2020s are behind us but half of this decade is still ahead. Is it truly realistic to assume that we will focus on other things first and then catch-up with massive electrification in the 2030s? No, this part of the transition to a net-zero competitive economy is now. A more relevant target for electrification would have been 40% by 2030.

If we are to move to visions of the future, the vision for our European grids is a pretty good indication of what Europe's vision for its own future is. A European SuperGrid for an European Electrified Union is a long overdue idea and it is needed for Europe to be a SuperPower in the 21st century and while this idea has been around for more than a decade, it's time has come. Only through Electrification, supported by innovative grids and the move towards a SuperGrid can we move beyond this weakness and harness our really competitive advantage in European cleantech, which has its strongest foothold in electrified technologies. We'd be supporting both demand creation and supply creation for the solutions to a more resilient, a smarter and cleaner European future.

1 https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_2024_MMR_Crosszonal_electricity_trade_capacities.pdf

2 https://energy.ec.europa.eu/publications/action-plan-affordable-energy-unlocking-true-value-our-energy-union-secure-affordable-efficient-and_en

3 https://www.currenteurope.eu/wp-content/uploads/2024/06/CL-CurrENT-BE-Prospects-for-Innovative-Grid-Technologies-final-report-20240617-2.pdf

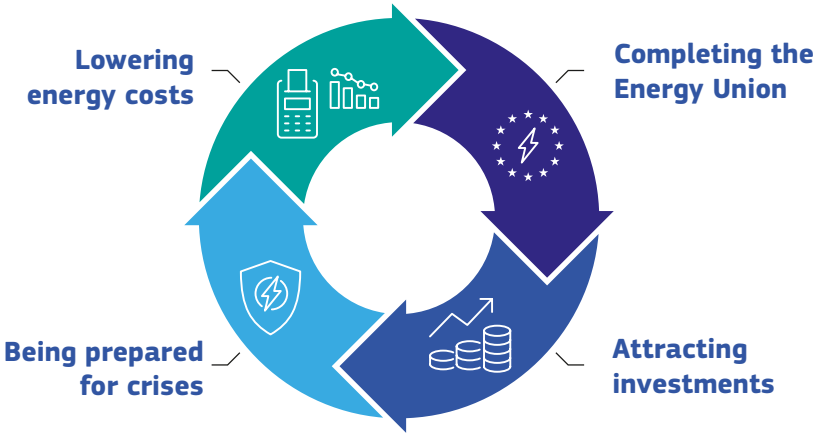
European Commission

An Action Plan to ensure all Europeans have access to affordable energy

February 2025

The EU is at a critical turning point for its competitiveness, decarbonisation and energy security. High energy costs put Europe at a real risk of deindustrialisation and threaten our economic growth. They are hurting our citizens, with **energy poverty affecting more than 46 million Europeans**. Retail electricity prices have almost doubled for industries. This situation undermines the EU's global standing and international competitiveness.

The challenges are clear. We need to strengthen the Energy Union to address them. The Commission is therefore putting forward **an Action Plan with immediate actions to lower energy costs, complete the Energy Union, attract investments and be ready for potential energy crises**.



€40 billion

A fully integrated energy market could bring **benefits of up to €40 billion per year by 2030**.

€260 billion

A greener, smarter and more flexible energy system will help **save €45 billion in 2025, going up to €260 billion annually as of 2040**, representing 1.2% of the EU's GDP.

A unique network of public affairs professionals

The Brussels Sustainability Club is a unique network gathering over 150 public affairs professionals representing leading organisations including multinational companies and trade associations from across sectors as well as environmental NGOs who share a common interest in sustainability policies.

Our platform aims to foster networking, sharing of information, and a constructive dialogue with policymakers and business leaders on sustainability issues. Our club brings together a diverse group of professionals from all seniority levels working in Brussels.

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