



## Can the EU become energy independent?

**As presented in many papers and articles, the so called EU Green Deal is a major cooperation project aimed at reducing carbon emissions levels, with the goal of the European Union becoming the first climate neutral continent by 2050. Reaching the so called 'Net Zero' level implies drastically reducing the use of fossil fuel based energy supplies in favor of renewable energy sources (solar, wind, hydropower and bioenergy), and during the transition period, moving towards 2050, maintaining nuclear power to a decent level, and ultimately to make nuclear fusion a reality. European energy consumption is significantly dependent on the importation of coal, gas and oil. Reducing this consumption, especially in today's troubled situation where we are facing supply shortages from one of our largest suppliers, is a complex but nonetheless interesting area of discussion.**

### **High speed to Hydrogen deployment**

As electronics engineers we are used to focusing on electricity, how to convert power with high levels of efficiency, how to optimize its utilization by implementing artificial intelligence, and how to use the latest technology. Reaching 2050 Net Zero will put a lot of pressure on power designers but it will also create jobs to install, operate and maintain equipment.

Based on International Energy Agency (IEA) research, energy sources used to produce electricity today (Figure 01 - next page) are expected to drastically reduce the use of fossil fuels in the future, and in 2050 to be composed of almost 90% from renewable sources, with wind and solar PV together accounting for almost 70%, and the remaining 30% from nuclear power. That means a lot of power electronics solutions at different levels to efficiently convert, store, restore and distribute energy to the grid and end users.

Transitioning to a high level of electrification will require major transformations in our industries, but many are unable to switch from gas to electricity. If replacing a domestic gas heater by a heat-pump is conceivable, then replacing gas by electricity in the production of fertilizers, glass and bottle manufacturing, iron and many

other industries, is just not feasible. However, in many cases natural gas can be replaced by hydrogen and we are already seeing many examples of efficient transitions within industry. For sure the production, storage and distribution of hydrogen remains a challenge, but all over the world a lot of very positive research and activities are taking place in this area.

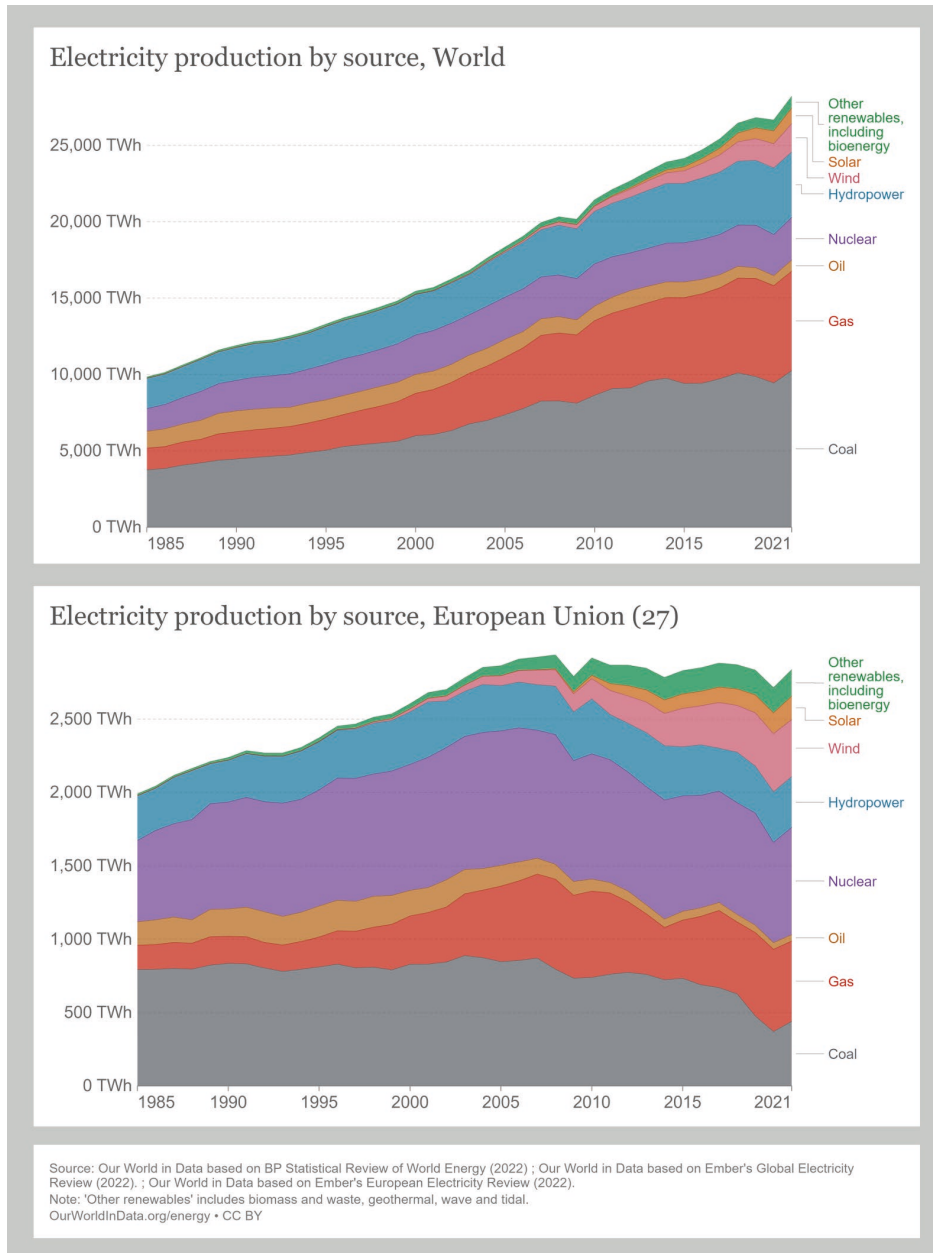


Figure 01: Worldwide and Europe electricity production 1985-2021 (Source PRBX/Our World in Data)

It is a fact that hydrogen is an important part of overall EU strategy for energy system integration. The dedicated strategy on hydrogen in the EU was adopted in 2020, and a vision was put forwards for the creation of a European hydrogen ecosystem based on research and innovation to scale up production and infrastructure to an international dimension. The strategy explored how producing and using renewable hydrogen can help decarbonize the EU economy in a cost-effective way, in line with the European Green Deal, and contribute to the post-COVID-19 economic recovery.

As was presented, in my Keynote, at the Green Engineering Summit in response to the hardships and global energy market disruption caused by Russia's invasion of Ukraine, the European Commission presented the REPowerEU Plan based on three pillars: Saving energy ; Producing clean energy ; Diversifying our energy supplies (Figure 02 - next page). Part of this plan is hydrogen and on September 14 in a speech to the State of the Union, President von der Leyen announced the creation of the European Hydrogen Bank with a budget of three billion euros to help build the future market for hydrogen.



The original project included a large array of solar panels to power electrolyzers generating hydrogen for an autonomous refueling station for cars and utility vehicles. Exploring the large range of possibilities offered by this technology, the station could also use the stored hydrogen to supply a fuel cell to generate electricity. The oxygen resulting from the split process in the electrolyzers is captured and stored for medical, industrial or farming applications. This autonomous station is a good example of what could be deployed at a larger scale and even to generate hydrogen for other vehicles such as local trains as Alstom demonstrated in August 2021 with the first passenger train in the world powered by hydrogen, the Coradia iLint which made its debut at Östersund in Sweden. Since then the Coradia iLint began regular operations in Germany, and in September 2022 travelled 1,175 kilometers without stopping to refill its hydrogen tank (Figure 04).



Figure 04: Alstom Coradia iLint. (Source: PRBX / Alstom)

### Germany – Wesseling EU Largest PEM electrolyzers

As part of the REFHYNE European consortium and with EU funding through the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), July 2021, the largest European polymer electrolyte membrane (PEM) water electrolyzers began operating at Shell's Energy and Chemicals Park in Rhineland near Cologne. The Rhineland electrolyzers will use renewable electricity to produce up to 1,300 tons of green hydrogen a year, and plans are underway to expand capacity of the electrolyzers from 10 megawatts to 100 megawatts (Figure 05).

These two examples reflect the scale of hydrogen initiatives in Europe and especially when one considers the large number of projects, place Europe as a leading player in energy transition and industry decarbonization.



Figure 05: Shell's Energy and Chemicals Park near Cologne (Germany. (Source: PRBX / SHELL)

### Conclusion

Electrification and Hydrogen are the masterpieces in the reduction of carbon emissions, opening a new era in our methods to produce and use energy. We should also consider the longer term and 'a solution' to power a 10 billion inhabitants planet with affordable energy. Both electricity and massive hydrogen production will benefit an almost infinite power level delivered by the promising nuclear fusion. We are at the beginning of a new industrial era and power electronics engineers will play a very important role in developing sustainable energy systems for today and tomorrow's generations. →

**Note:**

This paper was first presented, in 2022, at the ASPENCORE Green Engineering Summit and published by EE Times Europe.  
<https://www.eetimes.eu/>

**References:**

Powerbox (PRBX):  
<https://www.prbx.com/>

Our World in Data  
<https://ourworldindata.org/>

International Energy Agency (IEA) Net Zero Emissions  
<https://www.iea.org/topics/net-zero-emissions>

EU Hydrogen strategy  
[https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen\\_en#eu-hydrogen-strategy](https://energy.ec.europa.eu/topics/energy-systems-integration/hydrogen_en#eu-hydrogen-strategy)

REPowerEU  
[https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en)

ElectriVillage Mariestad  
<https://mariestad.se/>

The REFHYNE project is at the forefront of the effort to supply Clean Refinery Hydrogen for Europe  
<https://refhyne.eu/>

Alstom Coradia iLint  
<https://www.alstom.com/solutions/rolling-stock/alstom-coradia-ilint-worlds-1st-hydrogen-powered-train>

**Illustrations:**

Note: When publishing, please add owner's credits/thanks to the illustrations.

**About Powerbox**

Founded in 1974, with headquarters in Sweden and operations in 15 countries across four continents, Powerbox serves customers all around the globe. The company focuses on four major markets - industrial, medical, transportation/railway and defense - for which it designs and markets premium quality power conversion systems for demanding applications. Powerbox's mission is to use its expertise to increase customers' competitiveness by meeting all of their power needs. Every aspect of the company's business is focused on that goal, from the design of advanced components that go into products, through to high levels of customer service. Powerbox is recognized for technical innovations that reduce energy consumption and its ability to manage full product lifecycles while minimizing environmental impact. Powerbox a Cosel Group Company.



**Patrick Le Fèvre**  
Powerbox Chief Marketing  
& Communication Officer

**About the author**

Chief Marketing and Communications Officer for Powerbox, Patrick Le Fèvre is an experienced, senior marketer and degree-qualified engineer with a 40-year track record of success in power electronics. He has pioneered the marketing of new technologies such as digital power and technical initiatives to reduce energy consumption. Le Fèvre has written and presented numerous white papers and

articles at the world's leading international power electronics conferences. These have been published over 450 times in media throughout the world. He is also involved in several environmental forums, sharing his expertise and knowledge of clean energy.

**For more information**

Visit [www.prbx.com](http://www.prbx.com)  
Please contact Patrick Le Fèvre, Chief Marketing and Communications Officer  
+46 (0)158 703 00

PRBX white paper 035 EN Rev A  
2023-04-18