CARBON-FREE EUROPE
AN INCLUSIVE CLIMATE INITIATIVE

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NEW MODELLING FINDS USING MIX OF EVERY LOW-CARBON TECHNOLOGY COULD SAVE THE EU APPROXIMATELY €80 BILLION COMPARED TO RENEWABLES-ONLY IN QUEST TO ELIMINATE RUSSIAN NATURAL GAS, GET TO NET-ZERO

CARBON-FREE EUROPE
Press Team
@CFEurope2050

EU CITIZENS WILL FACE MORE ENERGY PRICE VOLATILITY UNLESS MEMBER STATES MOVE FASTER AND EMBRACE A DIVERSE MIX OF TECHNOLOGIES BY 2030

BRUSSELS—New first-of-its-kind modelling commissioned by Carbon-Free Europe shows the European Union's most feasible, cost-effective pathway to net-zero by 2050 must retain existing carbon-free energy sources including nuclear and bring all available low-carbon technologies online. This analysis shows crucial steps Europe and individual Member States must take over the next three decades to ensure credible trajectories to net-zero.

To reduce dependence on Russian gas in the next 12 months the EU must maximise its existing clean energy from nuclear power plants, increase ambition around energy efficiency and electrification of buildings and transport, and build an unprecedented amount of renewable energy.

The analysis reinforces that the chances of reaching emissions goals for individual countries and the EU increase as more clean technology and fuel options, such as carbon capture, direct air capture, hydrogen, and nuclear power, are included as viable mitigation options. Increased optionality reduces risk and makes it more likely that clean energy will be cost-effective and net-zero goals can actually be achieved.

The optimal energy mix to achieve these goals would require the EU to make the investments and scale infrastructure to generate 20% of its electricity from nuclear, 18% from offshore wind, 27% from onshore wind, and 27% from solar, and 8% other resources like biomass, geothermal, and hydro by 2050. Pursuing a 100% renewable energy strategy would cost the EU at least €80 billion more a year by 2050 and require the EU to quadruple its electricity generation compared to a tripling in other net-zero pathways. Using every low- and zero-carbon resource to get to net-zero would also help the EU insulate itself from persistently high natural gas prices and significantly increase its energy sovereignty.

KEY TAKEAWAYS INCLUDE:

- **Electricity Generation:** The EU needs to add over 2000 GW of clean energy by 2050. That's like building the equivalent of two new Europe's worth of power.
    - The EU will need to build on average between 27-79 GWs of solar annually, 6-25 GWs of onshore wind annually, and 11-22 GWs of offshore wind annually out to 2050. In comparison, historically (2011-2020) the entire EU has built on average 23 gigawatts of renewables a year.
    - Attempting 100% renewables would require a quadrupling of electricity generation to support additional hydrogen demand, making the buildout challenge even more unrealistic. That would require the EU to add 126 GW every year, 2.6 times more than what Germany built over seven years from 2013 to 2019 during the scale up of the Energiewende.
- **Electrification:** The EU's goal to accelerate electrification of buildings, transportation, and parts of industry is a crucial strategy to meet carbon neutrality but, combined with increasing electricity demand to produce hydrogen, will result in more than a 250% increase in the EU's electricity demand by 2050 compared to today - a significant factor in the buildout challenge outlined above.
    - New passenger vehicle sales would need to be fully electric by around 2035 to have a fully electrified passenger vehicle fleet by 2050.
- **Industry:** Around 50% of the industrial sector is decarbonised by electrifying process heat, and remaining industrial emissions are eliminated using a combination of clean hydrogen and carbon capture.

- Clean hydrogen will develop as an entirely new industry, becoming the backbone of decarbonising industry, freight, shipping, and aviation. By 2050, Europe will need to produce around 31 million metric tons of hydrogen.
- Carbon capture is required in all net-zero pathways in order to decarbonise cement and create negative emissions with bioenergy with carbon capture and storage (BECCS) and direct air capture (DAC).

- **Land Use:** Our land use constraint analysis suggests the EU and UK have sufficient land for siting renewables, around 8,274 GW of renewables potential if only considering available land and not factoring in economic constraints. After factoring in resource quality and cost of transmission to load centres, the model chooses to deploy 1,900 GW of renewables by 2050 in the Core scenario. Conversations around wind and solar resource potential must consider these economic factors in addition to land use limitations.

THOUGHTS FROM CARBON-FREE EUROPE CO-FOUNDERS

> *"If policymakers take urgent action to deliver on Europe's net-zero ambitions, the EU can move away from Russian gas, reduce price volatility for citizens and industry, and enable lower household energy bills in the medium-long term."*
>
> **—Josh Freed, co-founder of the Carbon-Free Europe initiative**

> *"Our modelling shows the EU can still meet its energy requirements without a regressive turn back to fossil fuels like coal. By sticking to its decarbonisation plan and using a diversity of clean energy technologies, the EU also ensures its energy sovereignty and future leadership in sustainable technologies."*
>
> **—Lindsey Walter, co-founder of the Carbon-Free Europe initiative**

THOUGHTS FROM EXTERNAL EXPERTS

> *"The CFE study confirms that deep decarbonization of Europe's electricity sector is feasible, but neither easy nor cheap. Their analyses suggest that a diverse portfolio of clean energy technologies, including a large share of nuclear energy, is key to success. In my opinion this finding becomes even more compelling when carbon emissions are targeted in hard-to-electrify sectors such as chemical processes, steel-making, and air transportation."*
>
> **—Jacopo Buongiorno, Director of the Center for Advanced Nuclear Energy Systems (CANES), Massachusetts Institute of Technology (MIT)**

> *"To develop a robust, long-term strategy to reach climate neutrality, keeping multiple pathways open to reach Europe's climate goals is essential for each region to tailor the transition to their economic needs. Technology optionality means that we need to focus on volumes rather than colors for low-carbon hydrogen supply, and on commercializing carbon capture and storage technologies for harder-to-abate sectors as soon as possible."*
>
> **—Lee Beck, International Director, Carbon Capture at Clean Air Task Force (CATF)**

NOTES TO EDITORS:

For further information, technical details on the modelling, or interviews with Lindsey Walter, please contact Kreab at + 44 (0)7766990075 or soyama@kreab.com.

CARBON-FREE EUROPE

Carbon-Free Europe is working to galvanise support across Europe for an ambitious decarbonisation agenda and is driving efforts to innovate and modernise European energy systems. Through a combination of cutting-edge research and advocacy, the organisation seeks to encourage national governments to deploy every clean energy technology necessary for the world to achieve net-zero emissions by 2050 at the latest.

The modelling demonstrates how Europe can decarbonize its entire economy, not just the power sector, showing how different sectors interact as they work together to reduce emissions.

More information about Carbon-Free Europe can be found on their website: http://www.carbonfreeeurope.org/