AQUILA GROUP

EUROPEAN POWER SOVEREIGNTY THROUGH RENEWABLES BY 2030

Executive Summary

Summary of the Meta-Analysis Commissioned by

AQUILA GROUP

Main Authors

Leonard Göke, Christian von Hirschhausen, Siddharth Joshi, Claudia Kemfert, Jürgen P. Kropp, Hans-Joachim Schellnhuber, Eicke R. Weber, Christos Zerefos

Contributing Authors

Lukas Barner, Luis Costa, Mario Kendziorski, Fabian Reitemeyer, Stavros Solomos, Björn Steigerwald, Behnam Zakeri

Executive Summary

RENEWABLES CAN DELIVER EUROPEAN POWER SOVEREIGNTY BY 2030

Introduction

Europe has the potential to become self-sufficient in energy by 2040 with the renewable energy technologies we already have at hand, a new report based on a meta-study and led by researchers from the Potsdam Institute for Climate Impact Research (PIK) has found. This energy system based on 100% renewable energies would come with a drop in energy costs for consumers, reduced vulnerability in times of geopolitical tensions, and would boost European competitiveness on the world stage.

It urges politicians across the continent to develop a 'common will' and achieve power sovereignty by utilising existing technologies and spearheading a massive but affordable expansion of renewable energy – particularly wind and solar.

The report states that by using complementary European energy resources led by the sun in the South of the continent and wind in the colder North, together with a consolidated power grid, the European energy system could free itself from imports of gas and oil and from reliance on volatile nations such as Russia.

It found that Europe could achieve power sovereignty and electricity generation free of fossil fuel resources by 2030, although it cautions that the entire energy system will not be free of fossil fuels until 2040.

This would lead to some of the cheapest energy prices in the world, strengthen Europe's competitiveness, and help deliver climate change targets such as net-zero. Indeed, Europe could become the first climate-neutral continent.

Governments have the existing cash reserves to meet these ambitions, the report added. The researchers found that it would cost EUR 140 billion a year until 2030 and EUR 100 billion a year until 2040 to achieve energy independence. To put this into context, we have spent EUR 792 billion to protect consumers from the effects of Russia's invasion of Ukraine in 2022 which led to fears over energy security and a spike in prices. In the EU27 around a third of the cost could be met by diverting yearly subsidies from other sources.

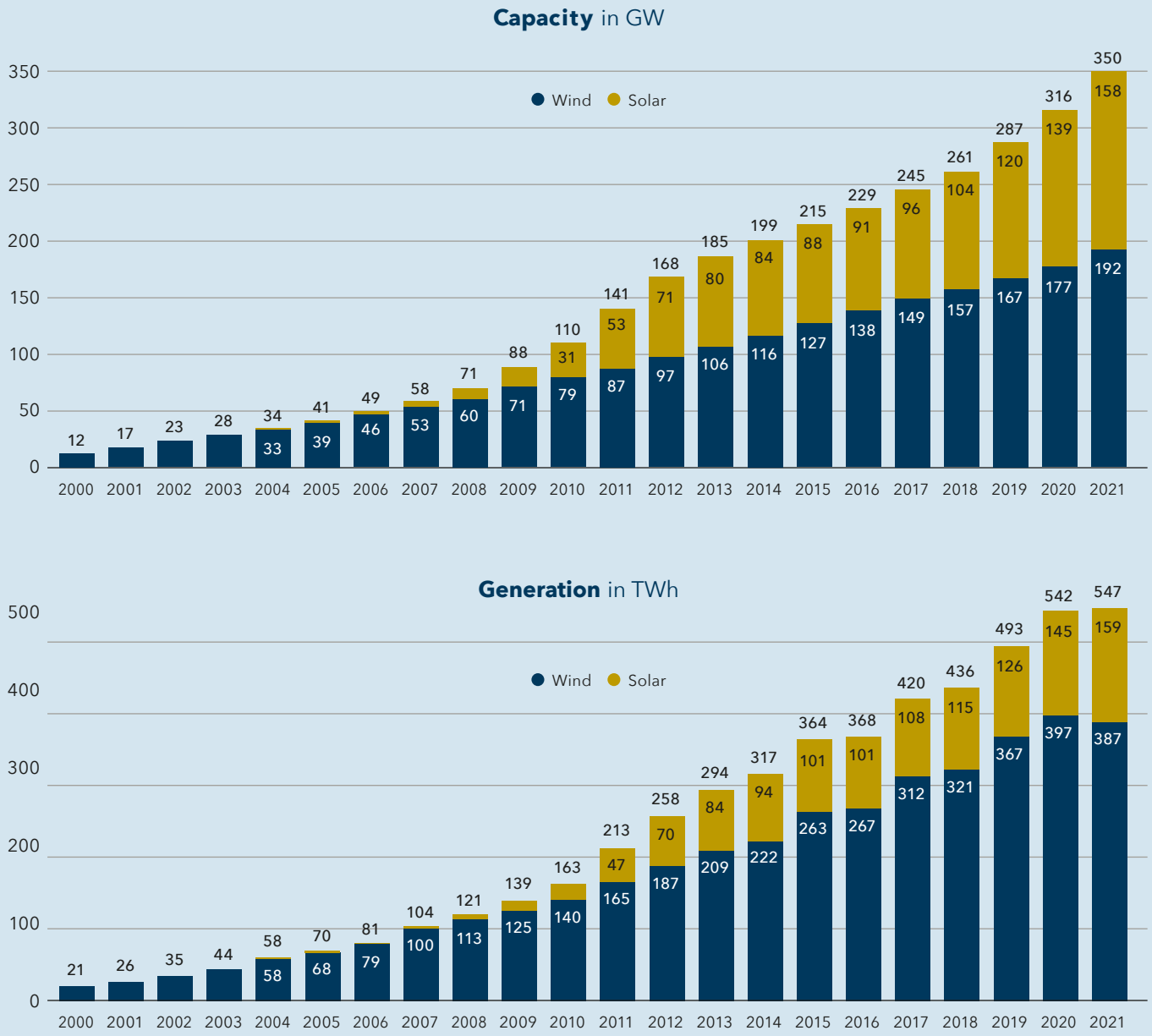
The report urges politicians to take decisive action in other areas, such as ensuring that future electricity market design favours capital-intensive investment in renewables and that policies prioritise renewable energy and grid expansion. Furthermore, the political awareness on the financing side is crucial when looking at increased costs and interest rates, and thus capital expenditures for renewable energy assets.

The report based on a meta-study was commissioned by Aquila Group, which develops and operates solar PV, wind, and hydroelectric power plants and battery storage facilities capable of delivering 21 gigawatts of electricity to Europe. Aquila Group worries that the opportunity to create an integrated green energy system based on complementary European renewable resources could slip away if we don't act now.

The study was coordinated by the Potsdam Institute for Climate Impact Research. Their researchers were joined by academics from six more reputable institutes: Atmospheric Research Centre for Atmospheric Physics and Climatology, Bauhaus Earth, Fraunhofer Institute for Solar Energy Systems, German Institute for Economic Research, International Institute for Applied Systems Analysis (IIASA), Research Center for Atmospheric Physics and Climatology and Technical University of Berlin. All figures included in this document are based on the study.

Figure 1

INSTALLED CAPACITY FOR WIND AND SOLAR POWER IN THE EU AND GENERATED ELECTRICITY



The energy system today

The researchers believe that Europe can power itself entirely from its own renewable energy sources from 2030 onwards. This 'sovereignty' means no importing of electricity or energy resources for conversion into power from outside the continent. While power sovereignty would be possible by 2030, preliminary research suggests that independence for the entire energy sector (including sectors such as heating, mobility, etc.) could be achieved by 2040 if appropriate targets are set.

They found that 38 % of the electricity sector in Europe was based on renewable energy sources in 2022. Wind and solar reached a new record in electricity production in 2021 and for the first time more electricity was produced from wind and solar than from gas in the EU27 (623 v 557 TWh). Figures from 2020 also show the important role of hydroelectric power, which made up 33 % of renewable electricity.

But much more needs to be done. For example, other renewable resources have not yet been used or only used to a small extent, such as heating buildings from shallow geo-thermal energy or solar thermal systems. That is despite it being available almost everywhere in Europe on a large scale.

Slightly more than 40 % of electricity in Europe is still produced using fossil fuels – mainly gas imported from Russia until 2022. In 2021, a further 22 % was produced by nuclear plants, which the report says is unsustainable because of the unresolved issues around handling waste and because the current reactor technology is not competitive.

The European Commission proposes to increase the current renewable energy target for 2030 from 40 % to 45 % but again this will not be sufficient to achieve self-sufficiency in the power sector by 2030, particularly with demand set to rocket. For Europe as a whole, electricity demand will increase from about 4,000 TWh in 2020 to about 8,000 in 2050. This increase is mainly driven by the electrification of heat production and electric vehicles, with an expected 16 million on the road by 2030 compared to 618,460 in 2022 in Germany alone.

The production of renewable energy, however, is only part of the answer. Energy storage capacities to compensate for fluctuations in renewable power, and the necessary network infrastructure, are still insufficient. Flexible solutions are needed to ensure that energy is available at the right time, including a consolidated energy grid, battery technology, the development of hydrogen infrastructure and even alternative sources of gas in the near term.

Digital technologies will also play an essential role in delivering energy independence. The use of technology such as artificial intelligence can help plan, store and deliver energy where and when it is needed. However, this does give rise to cyber security risk in the European energy system which will need to be tackled.

Overall, the report says strategies are urgently needed to reduce the fossil fuel share of European energy both quickly and efficiently. The European energy system and strategic planning must be much more integrated to help make this happen.

Figure 2

EXPECTED DEVELOPMENT OF POWER DEMAND IN GERMANY

between 2018 and 2030

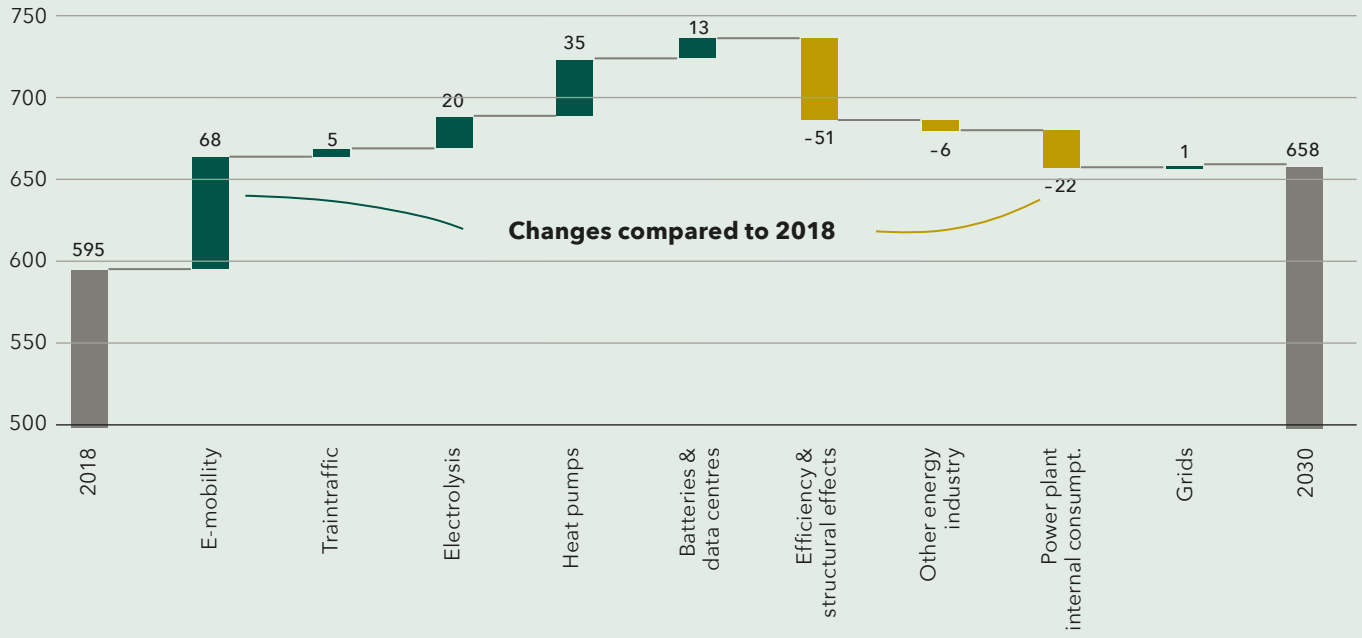
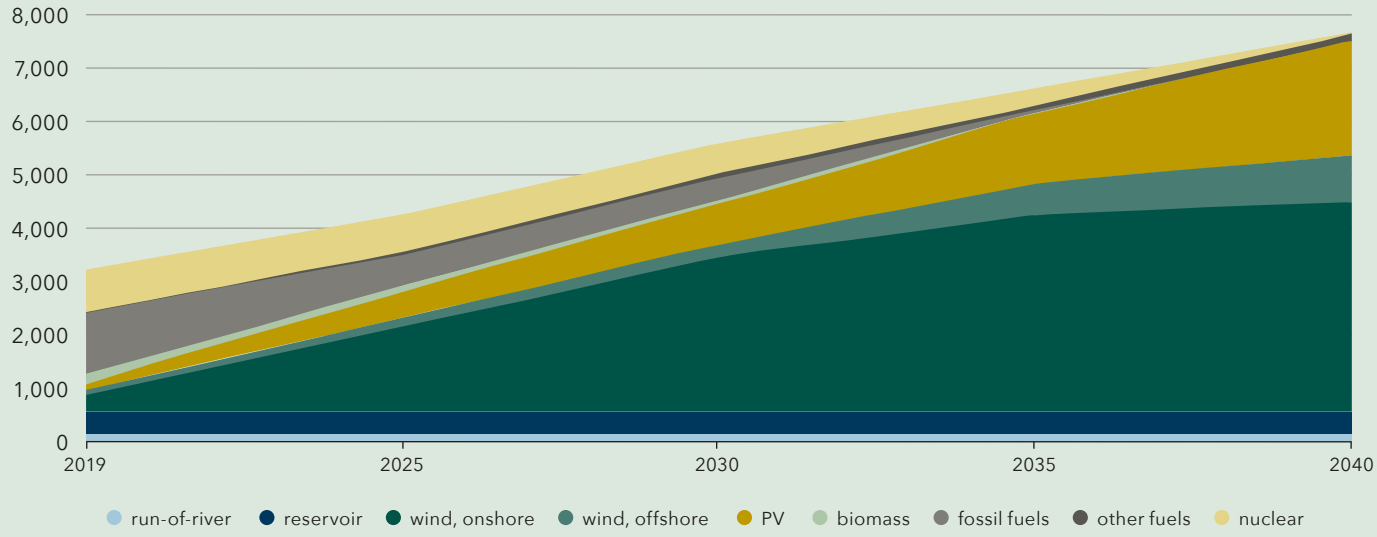


Figure 3

DEVELOPMENT OF EUROPEAN POWER GENERATION FOR THE MODELLED SCENARIO

in TWh



Powering the future

The energy transition towards sustainable power is inevitable as we fight to tackle climate change and it can be achieved quickly without new technological breakthroughs. We can rely on existing technology and improve things when new technology becomes available. But the focus on what is possible with existing tech is often pushed into the background.

Wind and solar – the majority of new renewable power is expected to come from wind and solar with new or expanded farms. The report says that the potential for wind and solar alone amounts to around 200,000 TWh/yr. If competing land uses are considered, the available area drops to less than 10 %, but it can still generate about 15,000 TWh of electricity. That's equivalent to the European energy demand in 2021. If solar modules were installed on existing rooftops in Europe around 4,000 TWh could be produced, which is approximately equivalent to the power demand of the EU27 in 2030. While the potential is high, the cost of renewable energy continues to fall. Electricity from solar photovoltaic is already cheaper than electricity from fossil gas.[1] These two factors combined make it an absolute priority to enable the fast expansion of solar capacities across Europe.

But there are challenges. The supply of wind energy in Europe drops in the summer but this could be compensated by building more onshore and offshore plants in regions where there are strong wind patterns during that time. There is also potential for the construction of nearshore solar farms around several Mediterranean Islands. Wave energy can also be exploited, the report states, particularly off the western coast of Europe.

Hydroelectric power – the last hydroelectric potential in Europe should be developed, because it provides one of the best ways to store energy and stabilise the grids. To fully exploit its potential, grid connections to hydroelectric core regions (e.g. northern Europe) should be expanded. There is, however, limited additional capacity in the continent at present.

Geothermal resources – these have the potential to provide heat for a quarter of all citizens in Europe, but there is only 3 GW of installed capacity in Europe today. Geothermal energy is also interesting from the perspective of supply flexibility as it fluctuates less than both wind and solar. Heat pumps, in particular, are an important technology.

Hydrogen – is also expected to become increasingly important after 2030 to replace fossil fuels that cannot be directly electrified, such as those used in aeroplanes, boats and back-up solutions.

Biomass – the report found that forest-based biomass should not play a role in large-scale power transformation. It may be too valuable to be used at large scale because wood is needed for construction and over-exploitation could have an impact on biodiversity.

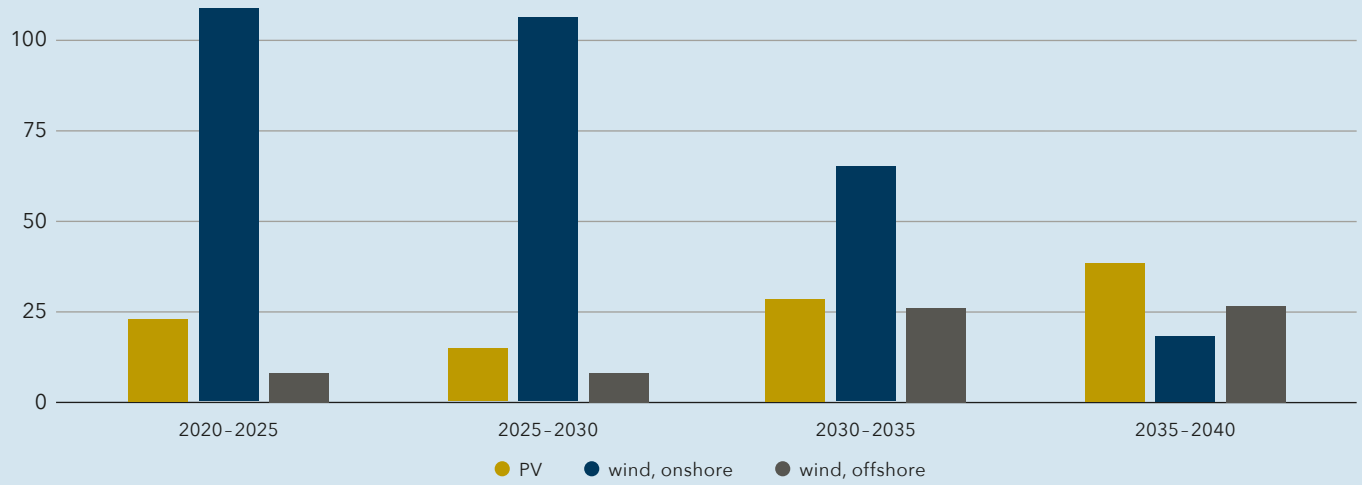
Overall, to achieve a fully renewable power system in 2040 the report says that the period until 2030 is critical and must have the highest relative growth of renewable generation. Compared to 2019, generation from onshore wind must increase by a factor of eight to 2,900 TWh, PV generation by a factor of six to 750 TWh,

1 Aquila Capital, "European energy crisis: The problem is not the design of the electricity market, but bureaucratic obstacles", (October 2022), Available at: https://www.aquila-capital.de/fileadmin/user_upload/PDF_Files_Whitepaper-Insights/2022-10-14_Opinion_article_European_Energy_Crisis_EN.pdf

Figure 4

ANNUAL INVESTMENTS NEEDED FOR RENEWABLE EXPANSION IN THE POWER SECTOR

in billion EUR per year



and offshore wind generation by a factor of four to 250 TWh. After 2030, growth will then slow in relative terms, but must still increase substantially. In this period, solar PV generation should triple to 2,100 TWh. Offshore generation should triple as well, increasing to 870 TWh, while onshore wind may only increase by 36 % to 4,000 TWh.

This is ambitious but not astronomical in terms of size and cost. Policymakers should be encouraged by not just the great energy potential of wind and solar but the fact that they are set to get cheaper.

As said, until 2030 European countries must spend about €140 billion per year for the expansion of wind and photovoltaic, but this value decreases to an average of €100 billion per year for the decade from 2030 to 2040.

Policy action

Energy vulnerability

It is clear, particularly in light of the Russian invasion of Ukraine, that the efficient and sustainable use of our own resources will reduce our vulnerability to political blackmail over energy supply.

- Norway and the UK are the biggest European producers of oil providing 1,000 TWh and 570 TWh respectively. The supply from other countries only amounts to 220 TWh in total. Europe imported about 2,300 TWh of oil from Russia before 2022.
- Independence from gas imports, again primarily from Russia, requires halving gas consumption for instance by replacing gas boilers with heat pumps in our homes and buildings. Europe also has a clear dependence on imports for our nuclear industry such as yellowcake and enriched uranium. In fact, the report says, 21 EU nuclear reactors rely on fuel elements and technical support from Russia.
- Decentralised energy generation – relatively smaller power generation facilities such as wind parks that are located closer to consumers – can lead to the more efficient use of renewable energy production and consumption. It allows for multiple sources of energy to be used, preventing blackouts or power outages in the event of a failure at a single plant. This boosts reliability and reduces the dependence on energy imports.
- Policymakers also need to tackle the dependence on imports when it comes to solar cell production. Europe must build a competitive mechanical engineering infrastructure to regain technological leadership and to make Europe truly self-sufficient and independent. This is particularly necessary to strengthen European markets and avoid the risk of deindustrialisation.

Strategic moves

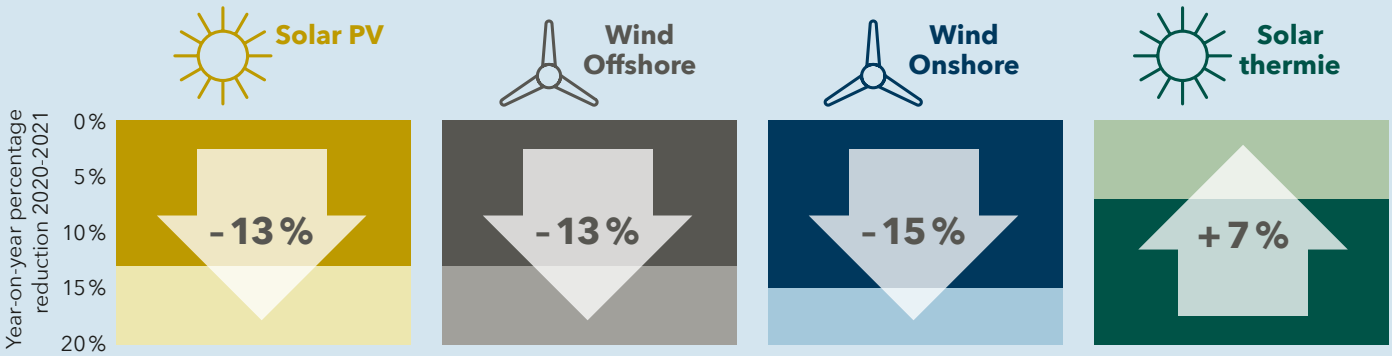
The report says that Europe needs to start making strategic moves to develop renewable energy infrastructure, technology and skills and avoid leaving everything up to market forces. As such the US Inflation Reduction Act and its commitment to spend a possible $800 billion over the next 10 years on climate protection should be seen as worthy competition and not a matter for confrontation.

The Act brings the US closer to the goals of the Paris Agreement and certainly announces that it is back on the climate stage after

Figure 5

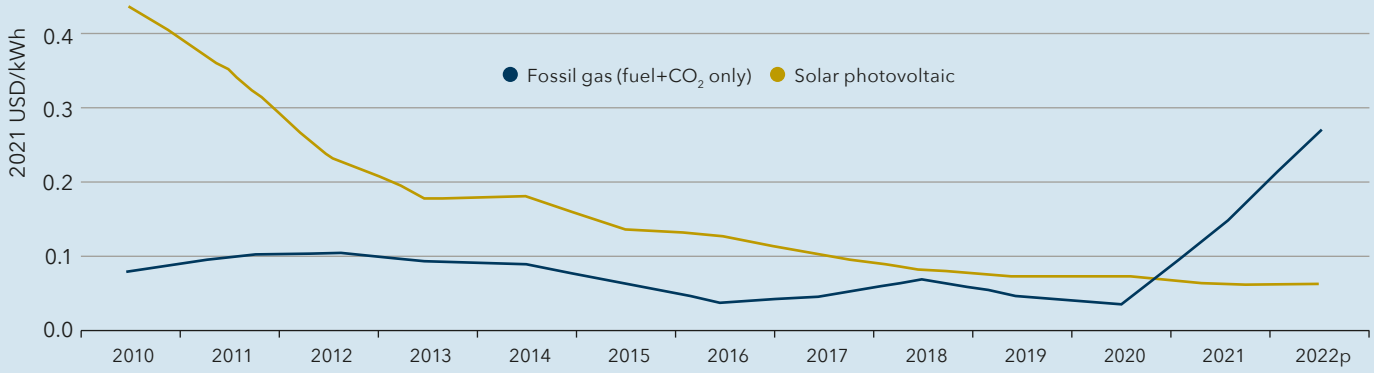
CHANGE IN GLOBAL WEIGHTED LEVELIZED COST OF ELECTRICITY

by technology, 2020-2021



THE WEIGHTED AVERAGE LCOE OF UTILITY SCALE SOLAR PV COMPARED TO FUEL AND CO_2 COST ONLY FOR FOSSIL GAS IN EUROPE

2010-2022



the Trump years. Tax credits to energy producers there will have a significant impact on the price of green fuels and could see Europe becoming an importer of green hydrogen. This should spark Europe into thinking how investments here can help its hydrogen strategy remain competitive. This might involve less bureaucracy and tax-free/tax-reduced market frameworks but too much competition on subsidies must be avoided.

Europe can only succeed if legislative frameworks and national targets and strategies are aligned and an integrated European energy system is built, with strong interconnection at all levels of the value chain. While Europe-wide strategic decisions need to be made some regions are already showing the way. Andalusia Energy Strategy 2030 was approved on 7 June 2022. It will guide policy on the promotion of renewable energies, savings, energy efficiency, and energy infrastructure in Andalusia over the next 10 years. It aims to position Andalusia as a benchmark region in the energy transition.

Public incentives

There remains strong public support for rapid action on renewable energy to tackle global warming. As such the right incentives from Government may bring about vital behavioural changes which could reduce energy demand by up to 20 %. This public support must be leveraged by establishing framework legislation and incentives, that prioritize renewable energy expansion and public participation.

Changes to our everyday habits to reduce energy consumption need to be accompanied by significant infrastructure and materials investment in areas such as construction and transport. This includes investing in electric vehicle charging infrastructure, substituting concrete and steel for timber and the promotion of 'deep energy' building renovations.

Politicians must grasp the nettle. This is their time. If energy investments are misdirected in the next few months and years, there is a significant risk of the world's green transition coming at the expense of higher levels of conflict and suffering.

Recommendations

- Policymakers should drive a massive expansion of electricity generation based on renewable resources until 2030 and beyond. An annual production growth rate of about 20 % is required.
- Policies must be adopted to ramp up this expansion through capital-intensive investments. Transaction costs for participants such as developers should be reduced through measures such as feed-in-tariffs which are more effective than auctions. Overall, more capital must be directed into renewable energies by making these asset classes even more attractive for private capital. Opening up clean energy assets for a wider group of investors and funds is crucial.
- In order to speed up the construction of projects such as wind farms, Governments should simplify licensing procedures which prioritise renewable energy and grid expansion. Such mechanisms urgently need to be simplified, if necessary, through further EU framework directives.
- Network development plans by European Transmission System Operators (TSOs) need to be streamlined and coordinated to make implementation easier. The expansion of an electricity grid that maintains a self-sufficient European electricity system can only be organised locally to a very limited extent, because all RES are distributed across the European continent. This requires European initiatives for grid expansion and a better connection of the Iberian Peninsula into European power and hydrogen grids is desirable.
- European Governments should introduce an Industrial Policy to manufacture key components, such as solar PV technology, needed to support this expansion of renewable energy. If we want to enable energy independence today, this means rebuilding an industrial basis in the respective sectors.
- There is a strong argument for building domestic (European) production capacities for solar PV and wind power plant construction instead of resorting, if necessary, to some-what cheaper producers on the world market who may not be able or willing to ensure supply.
- More training is needed to upskill workers in the renewable energy sector or else installation will suffer because of labour shortages.
- When it comes to new technologies, we must look to innovate, but politicians should not wait until the optimal solution has been found. We do need to further invest in innovation but at the same time we must utilise the existing technology – it is more than enough to leverage our potential for a greener and more independent Europe.
- Behavioural changes can contribute to energy savings but there is still a need for widespread adoption of electrification technologies such as electric heat pumps and electric vehicles.
- A significant rise in electricity demand from the transport sector over the current decade seems unavoidable. That carries the risk of a sharp increase in electricity demand and market pressure on rare earths, cobalt, nickel and lithium for battery production. It is therefore important to couple the unavoidable rise in demand with policies such as incentives for less private car ownership.
- Because of the import dependence of key elements and technology, costs, and safety, nuclear energy is not a sustainable option. Existing nuclear power plants should remain operational until the end of their technical lifetime, but no new plants should be constructed.
- European Network Development Planning needs to be restructured. A sovereign energy Europe working towards 100 % renewable energy supply needs a new approach to planning. This includes having a ‘bias’ towards renewables rather than other sources of energy, such as nuclear. Integrated network planning is required, instead of the current independent optimisation of electricity (by ENTSO-E), natural gas (by ENTSO-G), and hydrogen network planning.

List of Authors

M.Sc. Lukas Barner
Technical University of Berlin
Germany

Dr. Luis Costa
Potsdam Institute for Climate Impact Research
Germany

Dr. Leonard Göke
Technical University of Berlin
Germany

Prof. Dr. Christian von Hirschhausen
Technical University of Berlin
Germany

Dr. Siddharth Joshi
International Institute for Applied Systems Analysis
Laxenburg, Austria

Prof. Dr. Claudia Kemfert
German Institute for Economic Research
Berlin, Germany

M.Sc. Mario Kendziorski
Technical University of Berlin
Germany

Prof. Dr. Jürgen P. Kropp
Potsdam Institute for Climate Impact Research
Germany
and
Bauhaus Earth
Berlin, Germany

M.Sc. Fabian Reitemeyer
Potsdam Institute for Climate Impact Research
Germany

Prof- Dr. mult Hans-Joachim Schellnhuber
Potsdam Institute for Climate Impact Research, Germany
and
Bauhaus Earth
Berlin, Germany

Dr. Stavros Solomos
Atmospheric Research Centre for Atmospheric Physics and Climatology
Academy of Athens, Greece

M.Sc. Björn Steigerwald
Technical University of Berlin
Germany

Prof. Dr. Eicke R. Weber
Fraunhofer Institute for Solar Energy Systems
Freiburg, Germany

Dr. Behnam Zakeri
International Institute for Applied Systems Analysis
Laxenburg, Austria

Prof. Dr. Christos Zerefos
Research Center for Atmospheric Physics and Climatology
Academy of Athens
Athens, Greece

For more information please contact:

Aquila Group
Valentinskamp 70, 20355 Hamburg, Germany

P +49 40 87 50 50-100
info@aquila-capital.com

Hamburg · Athens · Frankfurt · Invercargill · Lisbon · London · Luxembourg
Madrid · Milan · Oslo · Prague · Schiphol · Seoul · Singapore · Taipei · Tokyo · Zurich

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