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The EU's Plan to Scale Up Renewables by 2030
Implications for the Power System

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Key Takeaways

- Scaling up renewable energy (REN) is paramount for climate protection and energy security, but it is also a major industrial challenge for the European Union (EU). The REPowerEU plan requires multiplying the installed capacity for solar photovoltaic (PV) power by a factor of 3 and raising wind capacity by a factor of 2.5 in less than 8 years from now.

- To achieve such ambitious targets, permit-granting and administrative processes need to be streamlined, while greater consistency between environmental and climate legislation is required for both REN and related infrastructure.

- The precondition for massive REN deployment is an efficient and flexible energy system. The latter needs to be enforced throughout the Fit for 55 Package, and through European and national energy "system" development plans.

- The EU's REN ambitions – those related to offshore wind in particular – are disruptive in terms of technology needs, investments, as well as governance. Interim steps as well as regional and national strategies must be developed accordingly.

Introduction

On July 14, 2021, the European Commission (EC) launched its Fit for 55 Package, which encompasses a wide set of legislative proposals aimed at achieving a net decrease of the EU's greenhouse gas emissions (GHG) of at least 55% below 1990 levels, by 2030. Revamping the Renewable Energy Directive (RED) forms part of this set of interconnected proposals. The whole package is expected to be adopted and enter into force by 2023, leaving only seven years for its implementation.

Yet in the middle of negotiations on the package, Russia's war against Ukraine has forced the EU to prioritize short term security of supply. National reactions include the extension of the lifetime of two nuclear reactors in Belgium or the decision to keep several coal-powered plants operational in Germany. The European Council has also committed to phasing out the EU's dependency on Russian gas, oil and coal imports as soon as possible, and the European Commission (EC) is now given the task of elaborating a detailed implementation plan by the end of May 2022. The challenge is twofold: taking immediate measures for next winter and the following 2-3 years (saving energy in a hurry, diversifying gas supplies, etc.) and taking structural measures through a revision of the 2030 strategy, with a strong focus on reducing energy consumption and investing in low-carbon alternatives, including REN.

What are the implications for the power sector? Can the ambitious roadmap for rolling out at least 40% – or even 45% – REN in Europe be successful? How will the challenges of grid integration and the security of the electricity system at times of high-speed change in supply and demand be met? This *Briefing* looks at these challenging questions.

Renewables in Europe: From Research & Development to Mainstream Use

At the European level, renewable energy policy started with the EC's White Paper on renewable sources in 1997, setting a first common, yet indicative target of 12% REN in primary energy consumption by 2010. The first two Renewable Energy Directives were adopted in 2001, focusing separately on REN for electricity (REN-E) and for transport. At some point, it became obvious that the initial REN-E directive lacked teeth and that Member States were lagging behind targets. The landmark European Council in March 2007 (under the German presidency) saw the adoption of the so-called 20-20-20 targets, including a mandatory REN target of 20% to be achieved in 2020. Shortly after the adoption of RED I (2009), the cost of REN support schemes started to trigger concerns in many Member States. Consequently, State Aid Guidelines were updated in 2014 to ensure that these schemes are properly framed, and system obligations applied to these new sources of energy.

In 2014, the Council adopted an unambitious and purely indicative target of a 27% reduction in GHG emissions by 2030. Five years later, with the Clean Energy Package for all Europeans, a new binding Renewables target of 32% for 2030 was put into the revised RED (RED II). While 32% still means that the carbon neutrality target as per the Paris agreement will not be met, its mandatory nature should be seen as a step forward. The Clean Energy Package (CEP) also introduced streamlined governance through setting a single reporting tool called the National Energy and Climate Plans (NECPs). The new target for 2030 is different from the nationally set REN targets of RED I, as Member States' commitments are outlined in their respective NECPs. Moreover, should the combined effort not deliver the EU target, then the EC will provide further guidance on how to achieve it.

The ink was not even dry on the Clean Energy Package when the incoming von der Leyen Commission (2019) proposed its European Green Deal, with the goal of climate neutrality for the EU by 2050 and a tightened net emission reduction target of at least 55% (up from 40% as enshrined in the CEP) for 2030. As the energy sector accounts for more than 75% of all emissions, the fast-paced replacement of fossil fuels in electricity, heating, cooling and transport has now become a clear climate imperative. Therefore, the EC's proposal of July 2021 is to reach a REN share of at least 40% by 2030 in final energy demand.

The Big Leap in Capacities by 2030

RED I was a success in that the EU collectively exceeded the 20% target by 1.3 percentage points (pp) according to latest (2021) European Environment Agency (EEA) data. Only five member states failed to achieve their national target in gross energy consumption: Belgium, Romania, and Slovenia by less than 1 pp, and France and Poland by over 2 pp. The five leading countries on REN share in the final energy consumption are Sweden, Finland, Latvia, Denmark, and Austria.

REN electricity set to reach 65% in 2030

It should be stressed that REN is mainly used for generating electricity. With the new 40% REN target, the share of renewables in the electricity mix in the EU is set to grow from 37.3% in 2020 to at least 65% in 2030. In parallel, the share of electricity in the energy mix will grow from about 20-25% to about 40% in 2030 and reach about 60% by 2050.[1] Electrification means an increase in power consumption that must be addressed through low carbon energy sources. For example, in the recent coalition agreement, the new German government recognized that its national power consumption will increase by about 50%: from 488 terawatt-hours (TWh) today to about 680-750 TWh in 2030. Since Germany

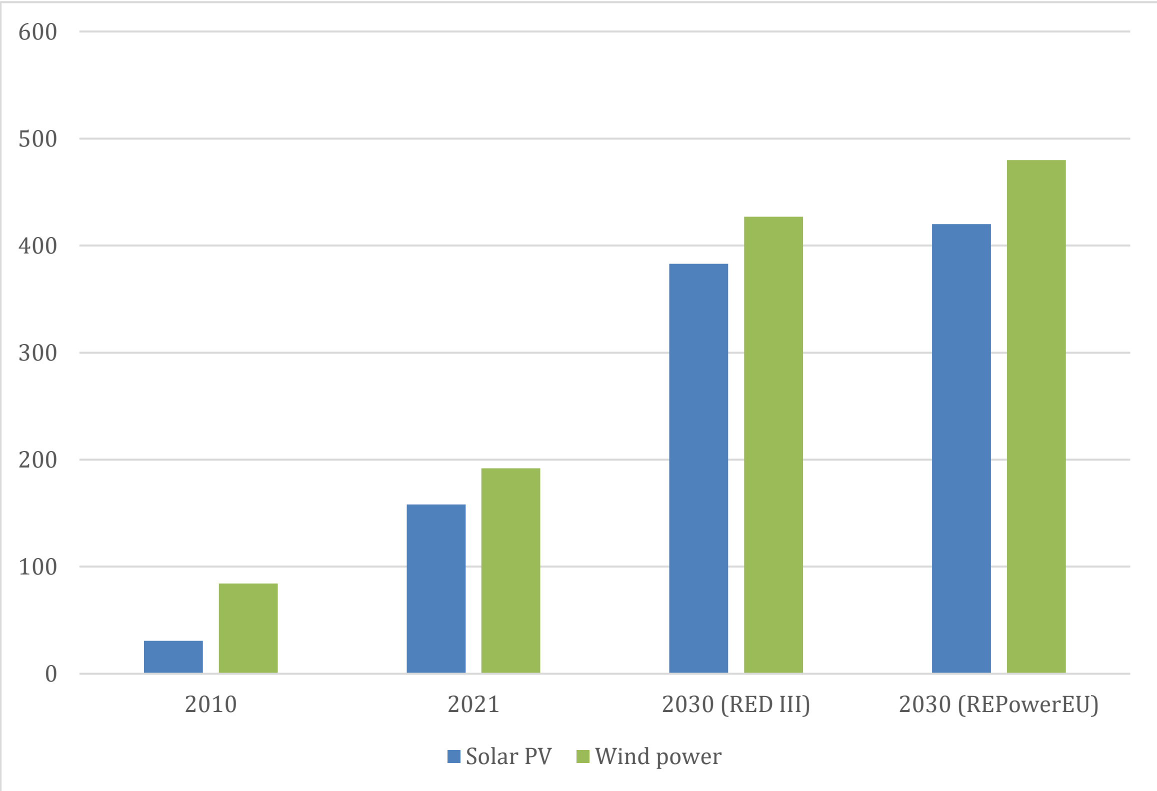
1. Energy Brainpool, "EU Energy Outlook 2050 – How Will Europe Evolve over the Next 30 Years?", June 29, 2021, available at: https://blog.energybrainpool.com.

wants REN to account for 80% of its electricity supply in 2030, it means producing 544-600 TWh of REN-E in 2030, up from merely 200 TWh in 2021.

The total installed European power capacity was of 930 GW in 2021.[2] Wind power accounted for 192 gigawatts (GW), solar power for 158 GW.[3] By way of comparison, France's total installed power capacity equaled 130 GW in 2021, and Germany's was 230 GW. Yet, it should be remembered that variable generation sources require much more installed capacity than so-called baseload ones, like nuclear, gas or coal.

The table below shows the expansion of installed capacities of the main REN sources – solar PV and wind power – between 2010 and 2021, as well as the more than ambitious projections and targets for 2030, as derived from the current RED III proposal and the preliminary REPowerEU plan.[4]

Installed Capacities of the Main REN-E Sources



Source: author based on IRENA, Ember Climate, Agora Energiewende, REPowerEU plan.

2. ENTSO-E, Transparency Platform, availabe at: https://transparency.entsoe.eu.
3. Ember Climate, "European Electricity Review 2022", February 2022, available at: https://ember-climate.org.
4. European Commission, "REPowerEU: Joint European Action for More Affordable, Secure and Sustainable Energy", Communication, March 8, 2022, available at: https://eur-lex.europa.eu.

This represents a massive investment and implementation challenge for REN-E in the EU. The new targets as outlined require no less than multiplying installed capacities for solar PV by a factor 3 and wind power by a factor of 2.5. Are these targets achievable considering local acceptance issues, supply chains disruption, inflation, and the need for a full system to be in place? A huge ramp up of REN-E is required to meet higher electricity demand, replace coal and part of the ageing nuclear reactors and gas fired power plants. It is a major challenge and there is a risk that little REN-E is left for electrolysers in support of the EU's high ambitions for green hydrogen production. Hence why discussions on hydrogen/ammonia imports have already started.

Key Changes Introduced by RED III and Main Points Being Discussed

The current French presidency of the Council of the EU will seek to broker a general approach by June 2022, with trilogues to follow as of September, under the upcoming Czech presidency. The adoption of the revised RED III is to be expected in early 2023, followed by the first drafts of NECPs by Member States in March 2023.

Given the tough controversies around RED I and RED II, it is interesting to note that RED III enjoys a high level of acceptance among various stakeholders, interest groups and Member States. No one is calling for the target to be reduced, which is a major change as the adoption of the 32% for CEP led to fierce discussions. In having endorsed the 55% target in June 2021, Member States implicitly accepted the revised REN target of 40% by 2030. Yet, organizations like the World Wildlife Fund (WWF), Climate Action Network (CAN) Europe, SolarPower Europe as well as a growing share of the EU Parliament[5] believe the target should be raised to at least 45%.

RED III enjoys a high level of acceptance

In addition to an ambitious overall share, RED III introduces for the first time specific indicative sectoral targets for heating, cooling, transport, buildings, and industry (Art. 15a on buildings, Art. 22a on industry and Art. 25 on transport). This is because progress has been slow in these sectors. Member States will be required to propose contributions towards the overarching target through their NECP by March 2023, including on the indicative sector specific targets. The Council Revision proposal (December 2021) shows that the indicative sectorial sub-targets are not yet agreed. But it does not suggest any alternative targets or mechanisms. Another legacy of the past is the controversy over bioenergy sustainability criteria (Art. 4). A group of 10 Member States, led by Sweden, wrote to the French presidency in January 2022 stating that bioenergy sustainability criteria should

5. F. Simon and K. Taylor, "Widespread Support in EU Parliament for 45% Renewable Energy Target", Euractiv, March 15, 2022, available at: www.euractiv.com.

not be amended for now, given that the last revision only occurred in 2018 and was not fully implemented.

In line with the climate emergency, RED III includes a strong reference to the need to speed up the implementation of projects and shorten the time for administrative processes (Art. 10). To facilitate meeting deadlines, one-stop-shops form part of what needs to be reinforced. A separate communication by the EC on permit granting and power purchase agreements will be released in June 2022 and is currently under consultation. Concerning the roadblock on permits, the Council (December 2021) came out with even tougher wording: it suggested that REN projects and related infrastructure are labeled of public interest, and it is important to swiftly remove legal barriers. It also stated that "this is without prejudice to EU and national laws on environmental protection". The EC has also been asked to review the implementation of REN projects one year after the adoption of RED III, and to suggest solutions should implementation be too slow. The apparent conflict between environmental protection and climate objectives is to be addressed in resolving inconsistencies between the Fit for 55 package and the Habitats and Bird Directive. This means that the important rules on the protection of biodiversity need to be interpreted differently (instead of insisting on habitats on a narrowed location, its presence in a wider area needs to be ensured). Proposals to this end were made at the Council in December 2021 by Dan Jorgensen (Denmark), and supported by Claude Turmes (Luxembourg), as well as by the new German government that has just come up with a proposal in that sense, ensuring that wind onshore can be speeded up while protecting the environment as well.

Conflict between environmental and climate protection

Another controversial point relates to storage. The EC's proposal highlights the need for using decentralized storage and batteries (Art. 18 and 19), while centralized storage is not referred to. Several associations including WindEurope and Solarpower Europe call for an inclusion of centralized storage and not only distributed storage, on the grounds that its contribution to energy systems needs to be enhanced in the regulation.

Building an Electricity System Fit for Large Amounts of REN

Despite the focus on generation, RED III also stresses the need to "have a secure and adequate electricity system fit for a high level of renewable energy sources" and to develop the related framework for electrification (Introduction, 5). Yet, such a system has to be enforced throughout the Fit for 55 Package.

The transition of the European energy system already started a decade ago, when baseload capacities using coal, gas and nuclear power started to diminish and as variable REN expanded. The traditional supply-consumption chain from large-scale generators to passive consumers is now progressively transformed into multidirectional interactions, with decentralized generation, a new role for Distribution System Operators, for Transmission System Operators, as well as new opportunities for citizens and market participants such as aggregators. What governance, regulation and technologies are now required to implement RED III targets?

Crucially, the electricity grid itself is either an enabler or a barrier to the take-off of REN. This follows from the characteristics of electricity, which is network-bound, difficult to store, is transmitted at near to the speed of light (297.000 kilometers per second) and thus requires perfect management. Furthermore, the EU now has a large integrated alternating current (AC) power system, which stretches across 28 countries of the continent, including Turkey, Ukraine, Moldova and soon the Baltics. Meanwhile, the reduction of baseload plants has diminished also so-called inertia: essentially system stabilizers that are big spinning machines and make sure that the 50 hertz frequency is maintained. New rules and technologies need to be applied to overcome the difficulty of inertia reduction. It should be recalled that all types of electricity generation, including REN electricity production units, are responsible for the provision of system and balancing services, in order to contribute to the stability of the power system.

Congestion redispatch costs have reached very important levels

The electricity grid is not a simple copper plate but an imperfect extensive network that largely reflects past energy needs and conditions. Therefore, the new boundary conditions of supply, and of a more variable system have increased congestion but also the curtailment of REN when renewables are not needed or when their output cannot be transported. The Electricity Regulation of the Clean Energy Package has foreseen that such curtailment should not exceed 5% of the annual electricity generation by REN. Congestion redispatch costs have reached very important levels that citizens, or state budgets, have to shoulder through their electricity bills: they have reached around €2 billion a year in Germany.

Overall, there is a clear mismatch between the high speed of change required by policymakers to meet climate objectives on the one hand, and long times needed to build more networks, connecting more REN, and getting the system transformation right and optimized on the other hand. Building massively more REN requires a huge amount of hardware: many more substations between transmission and distribution grids, inverters, cables, meters and so on. This means addressing local acceptance issues, lengthy permitting requirements, a public planning procedure for better anticipation of REN location, but also supply chain risks as visible in the Covid crisis and amplified by the war in Ukraine.

It is also widely recognized that so-called power electronics represent a meaningful solution to optimize grid usage. Integrating powerful high-voltage direct current (HVDC) lines into the densely meshed AC system, as Germany plans with its HVDC North-South connection or with increasing offshore hybrid connections, not only adds large capacity to North-South power flows but also represents significant digital technology investments. A more digital system will enable REN to contribute to so-called ancillary markets and provide frequency stability.

ENTSO-E has listed 65 available technologies in its Technopedia, describing them using existing cases and the Technology Readiness Level.[6] Yet mature technologies such as dynamic line rating or modular power flow control are not yet used sufficiently, as regulatory frameworks and lack of incentives favor traditional tools and approaches. An innovation mindset is required to implement the flexibility solutions that are already at hand, new skill-labor has to be trained, while power engineering classes in universities need to be updated so as to include new solutions and how these can be managed.

It is time to implement the EU Energy System Integration Strategy

Storage in big and small formats will also be useful if operated as an important flexibility provider and as part of a system, in combination with other innovative technologies and developed in conjunction with REN. The socio-economic potential of storage still needs to be assessed by European policymakers. So-called hybrid projects can contribute here too: technologies and generation, storage including from e-mobility and generation, but also green gas and electricity can be intelligently combined in a system approach.

To meet the new RED III ambitions and handle the challenge of grid integration, the EC and Member States should introduce system development plans (at both national and EU levels) that would investigate all possible solutions together, rather than in isolation. In other words, it is time to implement the EU Energy System Integration Strategy of 2020 at full speed.

Why Offshore Wind Ambitions Are Disruptive and How to Remedy This

The ambitious offshore agenda is set out in a separate Offshore Renewable Energies Strategy (2020): 300 GW of offshore are envisaged for 2050. The strategy details needed actions and describes future technologies such as floating offshore installations. The RED III Directive refers to this separate strategy and requires Member States bordering a

6. ENTSO-E Technopedia, available at: www.entsoe.eu.

sea basin to cooperate on the amount of energy they want to produce there by 2050. This requirement is the same in the revised TEN-E Regulation (Art. 14).

Offshore has a huge economic and technological potential for the EU, as it is today a global leader. Yet, offshore is disruptive with respect to technology needs, investments, as well as governance. It requires new connections, platforms at sea, along with continued efforts on further developing offshore generators and making maintenance easier under challenging conditions. It is no surprise that companies such as Supernode are looking into the potential of superconductors for offshore power after 2030.

In terms of investments, reaching 300 GW of offshore wind and 40 GW of bioenergy by 2050, up from today 12 GW offshore and no bioenergy today, will require a "total change of approach," to quote the EC: the industry needs to be scaled up by factor 30, with an investment of €800 billion to be carried out by 2050 on offshore, with 2/3 going to grids, and 1/3 to generators. So far, in the last decade, €30 billion has been invested in offshore power. The EC sees a need for a further €60 billion in this decade, and further up-scaling thereafter. If there is no step change and current policies are continued, then only 90 GW of offshore power will be installed by 2050 according to the EC. It goes without saying that massive research and development (R&D) is needed to foster offshore deployment in all its technical dimensions, and to build up the required skills and supply chains.

Build up the required skills and supply chains

In terms of governance, offshore power requires a common regional approach in the North and Baltic Seas. For the other EU maritime facades (Atlantic, Mediterranean and Black Sea), the need for a regional approach is less obvious as the potentials are very different from one country to the other, as well as the distances. In the North Sea, initial bilateral agreements of transmission system operators (TSOs), such as 50Hertz Germany with Energinet Denmark, are very promising steps. The offshore regions may also become separate bidding zones, with hybrid and multi-terminal arrangements. While the 2050 target is set, interim steps need to be developed and each Member State should set up a sound strategy, to be included in the 2023 NECPs.

How to Make REN a Solution to the Climate and Geopolitical Crises

REN development is a European success story and RED I and II have proven to be robust and efficient frameworks for developing REN across Europe. Yet the new target for 2030 is not an incremental step, but disruptive. It requires a system fit for REN that has started to emerge but is far from completion. Electricity networks are at the very heart of this system. This revamp requires strong public support, a sense of urgency from policymakers, companies, and citizens alike, and openness to doing things differently.

There are four imperatives for a successful implementation of RED III in the electricity sector:

- **First,** rising electricity consumption requires rapid implementation of the Energy Efficiency First principle. As for road transport where just replacing diesel cars by electric cars 1:1 is not the way forward, policy makers should emphasize the Energy Efficiency First principle throughout the Fit for 55 Package, and chiefly also in RED III.
- **Second,** labeling REN and related infrastructure as being of public interest is a step in the right direction and a powerful symbol at once. Yet a conflict between environmental and climate imperatives risks emerging and needs to be properly addressed through policy consistency, as it will otherwise continue to delay and lead to controversy. Overly complex administrative processes need to be simplified, and slow permit granting to be overcome. Ways forward are one-stop-shops and timelines, as well as the increase of staff levels in the relevant public agencies. Anticipating REN grid connection needs will also help speed up network development.
- **Third,** upscaling REN to at least 40% without updating and digitizing the overall system will cost citizens a lot. As REN expand in the electricity system, their involvement in the provision of system and balancing services must be developed further. Beyond RED III, a one-system approach must be enshrined in system development plans, at the European and national levels and this one-system approach should be applied across the whole Fit for 55 Package.
- **Fourth,** policymakers and regulators need to recognize the costs of delay and the benefits of timeliness more broadly (e.g., saving high redispatch and congestion costs and keeping curtailment of REN below 5%), not only when it comes to building REN and new grids, but also when it comes to using existing networks better and more efficiently. A toolbox approach is required that looks at the interaction of enabling technologies including storage, both centralized and decentralized. This toolbox has to become part of national and pan-European system development plans.

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