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A power sector analysis of draft NECPs

Rapid decarbonisation of the power sector is central to Europe's decarbonisation and climate goals. This paper analyses 15 draft NECPs (submitted as of 13 October), exploring what they mean for progress towards a clean power sector in Europe.

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About Ember

Ember is an independent, not-for-profit energy think tank that aims to shift the world to clean electricity using data. It gathers, curates and analyses data on the global power sector and its impact on the climate, using cutting edge technologies and making data and research as open as possible. It uses data-driven insights to shift the conversation towards high impact policies and empower other advocates to do the same. Founded in 2008 as Sandbag, it formerly focused on analysing, monitoring and reforming the EU carbon market, before rebranding as Ember in 2020. Its team of electricity analysts and other support staff are based around the world in the EU, UK, Turkey, India, China and Indonesia.

Summary

Europe's power system is rapidly evolving, with renewable growth beating all expectations despite a persisting energy crisis and sky-high inflation. In this context, the updated national energy and climate plans (NECPs) of EU Member States have an important role in sending long-term signals to industry and describing an ambitious vision for the future energy system. The plans submitted to date show that countries are aiming higher for wind and solar power, but lack details on key flexibility solutions to take full advantage of this new clean energy.

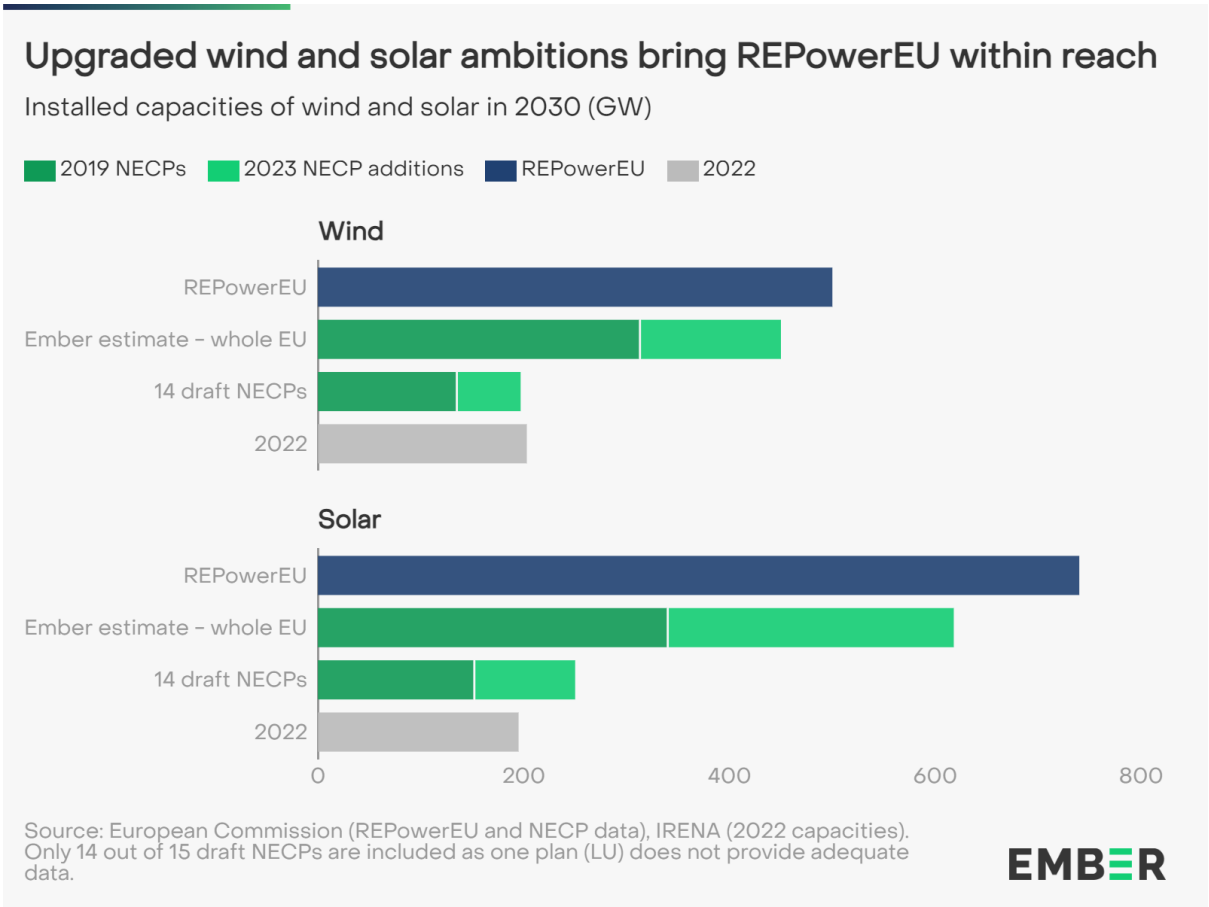
This paper presents an interim analysis of 15 draft NECPs with a focus on the power sector transition. The analysis explores what updated wind and solar targets mean for the anticipated share of renewables in each country's electricity mix and whether they are fit for achieving a clean power system in the 2030s - a central pillar for Europe's net zero goal. A spotlight is put on clean flexibility, particularly electricity storage as a key solution that could address several emerging challenges. The key findings of this analysis are:

- **Wind and solar ambition is dramatically increased but still falls short of REPowerEU goals.** The EU solar fleet is set to triple by 2030 and the wind fleet is set to double. Targets have markedly increased since 2019, by an average of 64% for solar and 49% for wind, bringing within reach a power sector aligned with REPowerEU. There is potential to accelerate further this decade, which must be maximised in order to slash fossil fuel dependence and achieve a clean power system in the 2030s.
- **More detailed plans and targets for electricity storage and flexibility are needed to ensure delivery on the targets and EU competitive advantage**. There is a paucity of detail around plans to scale clean flexibility, with only six plans providing quantified targets to grow electricity storage. This is a missed opportunity to signal a strong political commitment, boosting confidence in a sector that could be at the forefront of European innovation and competitiveness.
- **Data availability and quality in available plans is generally very poor and must be improved**. Participation in the process, as well as accountability and effectiveness of the plans, will suffer if the coverage and accessibility of data is not improved.

Further data and analysis can be viewed in our live NECP tracker tool.

1. Soaring capacity targets

Wind and solar targets have been dramatically elevated in the past four years as growth has defied expectations. Current ambitions, if delivered, would see the solar fleet triple and the wind fleet double by 2030. A power sector compatible with the REPowerEU plan is within reach, and studies show that higher deployment levels are feasible. Member states must be bolder in order to further cut dependence on fossil fuels in the power sector.



1.1 Solar targets up 64%

Out of the 15 drafts analysed, 14 provide data on expected solar capacity by 2030. Solar ambition in these countries has increased from 152 GW to 248 GW[1] (+98 GW), or 64% higher than in 2019 NECPs. This trend is expected to strengthen as more drafts are submitted, considering some of the missing member states (MS) have significantly raised their solar ambition since 2019 (e.g., Germany, Greece, Ireland, Bulgaria, Poland). Two countries have already exceeded their previous 2030 target (Poland and Latvia), demonstrating the unforeseen momentum behind solar power.

1.1.1 Consequences for EU energy targets

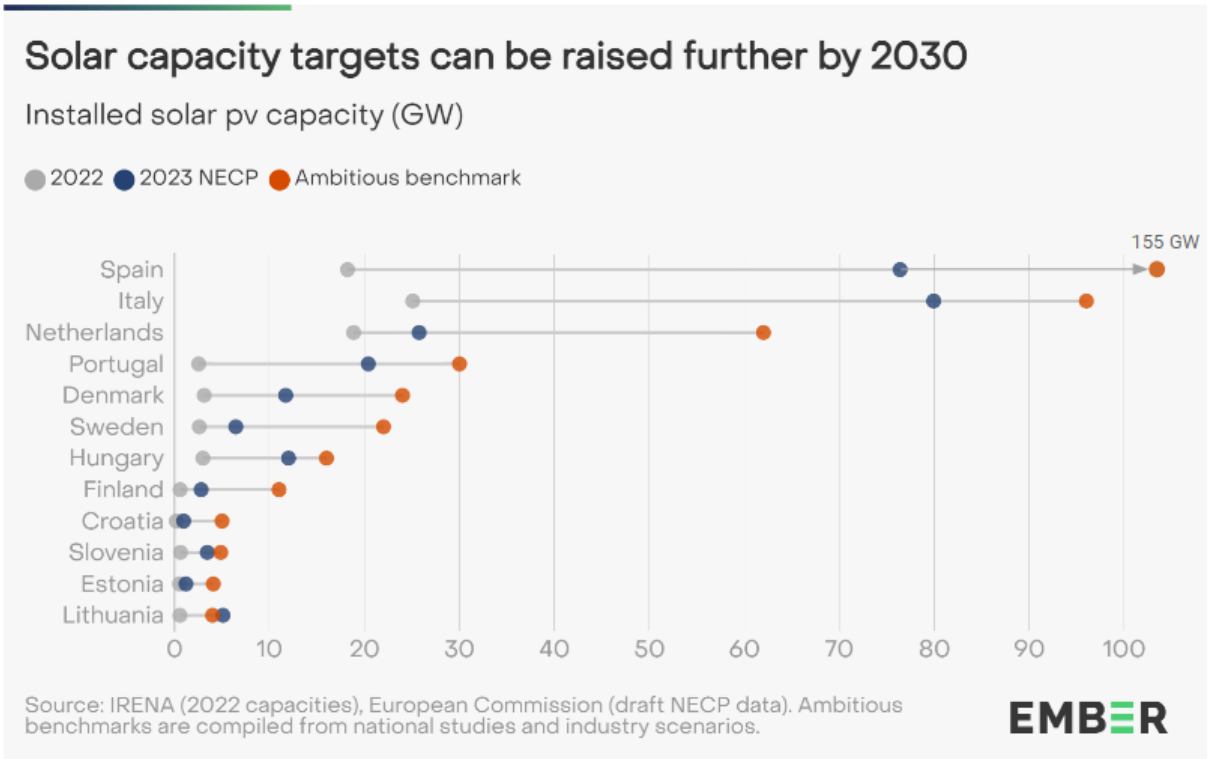
These draft NECPs combined with the most recent announcements from other MS mean that - according to our estimates - a total EU solar fleet of 617 GW[2] is planned for 2030. This is 81% higher than the collective target set in 2019. In the context of the EU's support for a COP28 pledge to triple renewables globally by 2030, the planned level would deliver a factor of 3.2 increase on the current fleet (195 GW in 2022).

The planned deployment is still, however, 123 GW short of what is proposed in the REPowerEU plan, which states a need for 740 GW of solar in order to achieve a 69% renewable electricity supply by 2030. This is similar to the level in Ember's pathways towards a >95% clean power in Europe by 2035[3], which show that at least 750 GW are required by 2030, and as much as 1.2 TW if faster decarbonisation via electrification can be achieved and coal is entirely phased out[4].

Comparison of draft NECPs with industry outlooks and independent studies shows that higher deployment is feasible in the 14 countries considered, and in many cases is expected by the market by 2030. Solar Power Europe estimates that on current market trends alone an

[1] All care has been taken in this report to present solar capacity consistently in units of GW-DC (i.e., in terms of direct current output).
[2] It is rarely stated whether solar capacity figures are reported in units of alternating current (net output) or direct current (DC, gross output). This total figure assumes that all solar capacities are reported in units of direct current (DC, gross power). However, the total figure could be as high as 672 GW in the extreme case where all uncertain reporting is in AC not DC.
[3] Decarbonising the European power sector by 2035 has been identified as a critical milestone on the path to net zero by the IEA, and is a strong feature of pathways consistent with 1.5C used by the IPCC.
[4] The largest solar fleet is required in Ember's 'System Change' scenario (aligned with CAN Europe's Paris Agreement Compatible Scenario), in which net zero is achieved in the EU by 2040, with coal power phased-out by 2030 and gas power by 2035.

additional 191 GW will be delivered on top of the levels announced. This means that upgraded targets in these countries alone could put the EU fleet on course for approximately 800 GW, more than enough to close the gap with REPowerEU. We have gathered ambitious yet feasible deployment benchmarks for each MS analysed here. These are presented in the figure below and provided in a Data Annex.



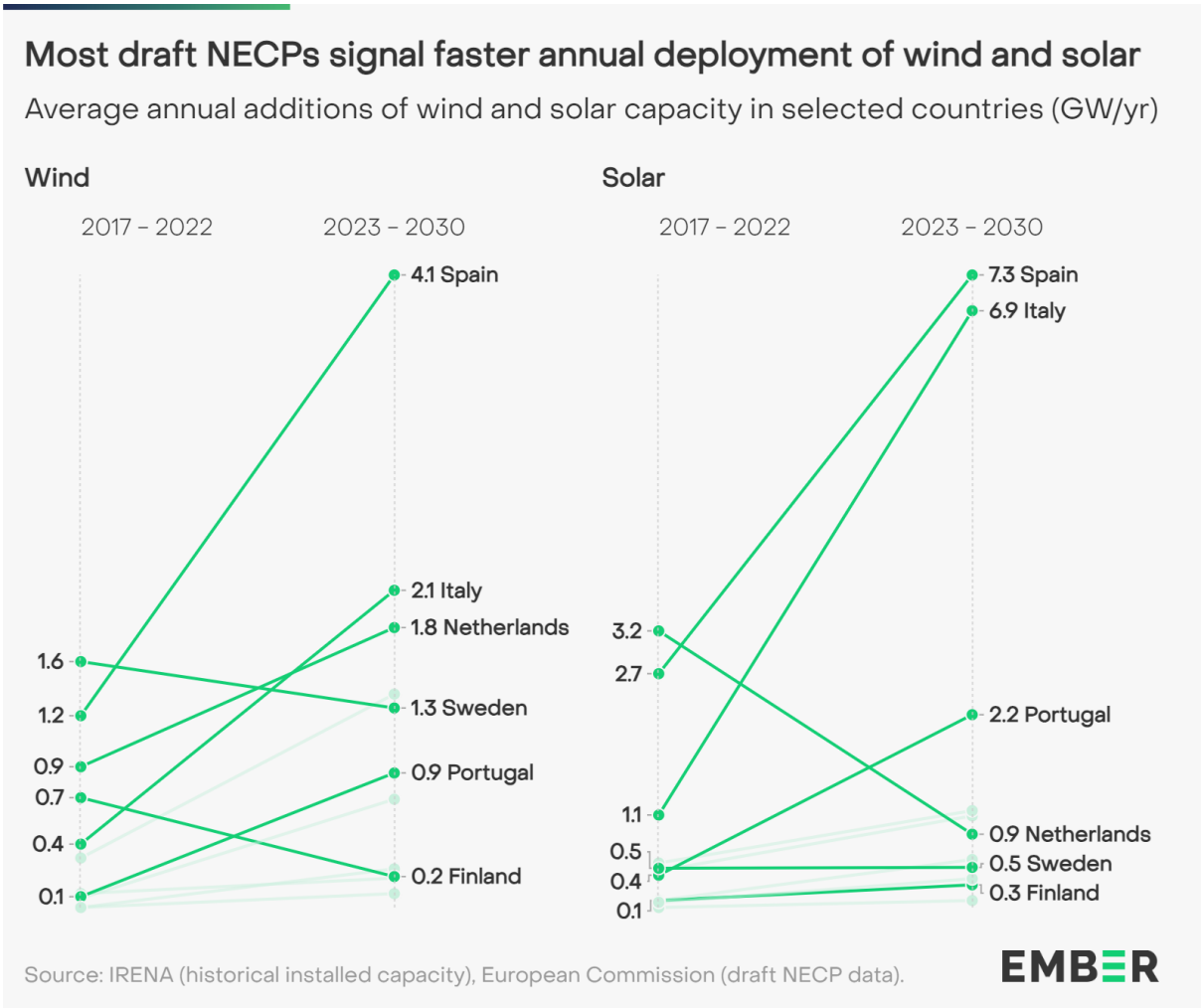
1.1.2 Leaders and laggards

Of the 14 MS with data, Spain has delivered the largest absolute increase in its target, from 39 GW to 76.4 GW. To achieve this target, Spain will need to nearly triple its average annual deployment rate in the next eight years compared with the previous five years. Italy shows the greatest acceleration, with average annual deployment increasing from 1.1 GW/yr to 6.9GW/yr, but the Italian market is emerging from a period of slow growth.

Lithuania has increased its target five-fold, from 0.9 GW to 5.1 GW, the largest relative uplift in any plan so far. Achieving this target would increase Lithuania's total installed capacity eight-fold. Other countries noteworthy for their solar ambitions are Portugal, Slovenia, and Hungary, all of which have at least doubled their targets since 2019 and will more than quadruple their solar fleets by 2030. The same can be said for Finland, but the increase is from a low base, and comparison to benchmarks indicates there remains a large untapped potential for expansion this decade.

On the other hand, some MS have set underwhelming solar targets. The Netherlands is the only MS not to increase its solar target compared with 2019. The country has been a solar leader in Europe, achieving the highest capacity per capita on the continent, yet the anticipated slow-down is a consequence of insufficient grid capacity and system flexibility. This is a stark demonstration of the need for grid build-out and flexibility to keep pace with renewable development. There is a real risk of this being repeated across Europe, as many solar targets in draft NECPs appear to underestimate momentum in the market. Weak renewables targets will fail to trigger the required expansion of grids and flexibility, the development of which often involve longer lead times than solar and wind.

Cyprus and Estonia, like the Netherlands, have set targets which imply a slower annual deployment rate over the next eight years than in the previous five. Sweden's target implies a constant growth rate, despite the country effectively achieving its 2030 target 8 years early. To emphasise how these targets are unrealistically low, Solar Power Europe expects the Netherlands to reach its new 2030 target by 2024, with Cyprus and Sweden following in 2025.



1.2 Wind targets up 49%

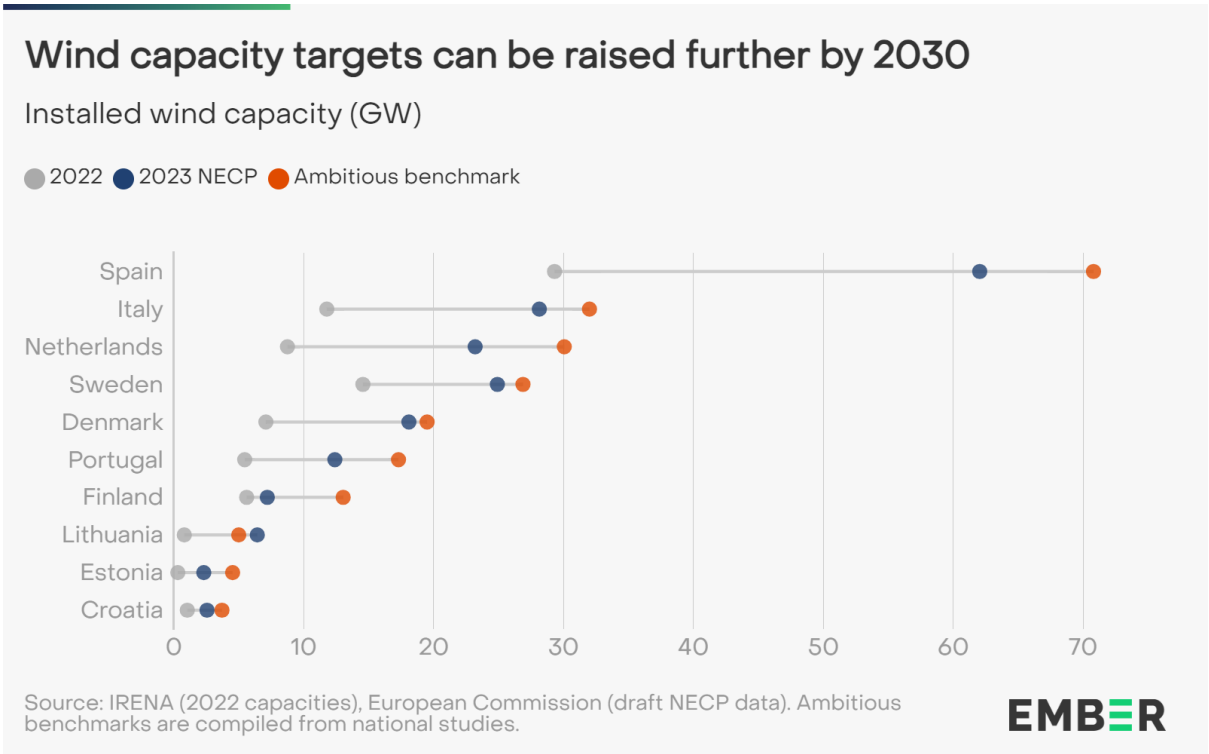
Out of the 15 drafts analysed, 14 provide data on expected wind capacity by 2030. Wind ambition in these countries increased from 127 GW to 186 GW, or 49% higher than in 2019 NECPs. Two countries (Sweden and Finland) have already exceeded their previous 2030 target.

1.2.1 Consequences for EU energy targets

The REPowerEU plan proposed increasing the EU wind fleet to 510 GW by 2030. The recent Wind Power Action Plan from the European Commission repeats the need for more than 500

GW wind to achieve the goals of the European Green Deal. WindEurope have explained that due to foreseen turbine improvements the same objectives could be achieved with a lower installed capacity. Nevertheless, much more ambition is needed than the 313 GW in 2019 NECPs. The latest plans, combined with recent MS announcements, indicate total ambition for the EU wind fleet has reached 445 GW by 2030. This is short of the claimed 500 GW, but the gap may be smaller than it appears depending on the progress of turbine improvements.

Ember modelling of pathways towards >95% clean power in Europe by 2035 show that between 475-500 GW would be required by 2030, even after accounting for turbine improvements. This suggests that, while updated wind ambition may be sufficient for the EU Green Deal, it still falls short of what is required to decarbonise Europe's power system quickly enough to align with global climate goals. Recent studies, however, show that it is feasible to increase the announced targets. A survey of modelling studies and other research reveals space for an additional 42 GW by 2030 in the 14 countries considered. These are presented in the figure below and provided in a Data Annex.



1.2.2 Leaders and laggards

Spain and Sweden have delivered the largest absolute increases in their wind ambitions, by 12 GW and 13 GW respectively, although Sweden's previous 2030 target was under-ambitious and has already been achieved. Other significant upgrades in ambition are seen in Estonia and Lithuania, who both plan to increase their fleets eight-fold by 2030 from less than 1 GW today to 2.3 GW and 6.4 GW respectively. Lithuania is the only country to match or exceed the ambitious benchmark we identify for wind deployment. Lithuania and Portugal show the fastest acceleration in average annual deployment rate, with both over a factor of ten higher in the next eight years compared to the past five. Italy (5x) and Denmark (4x) are also meaningfully picking up the pace.

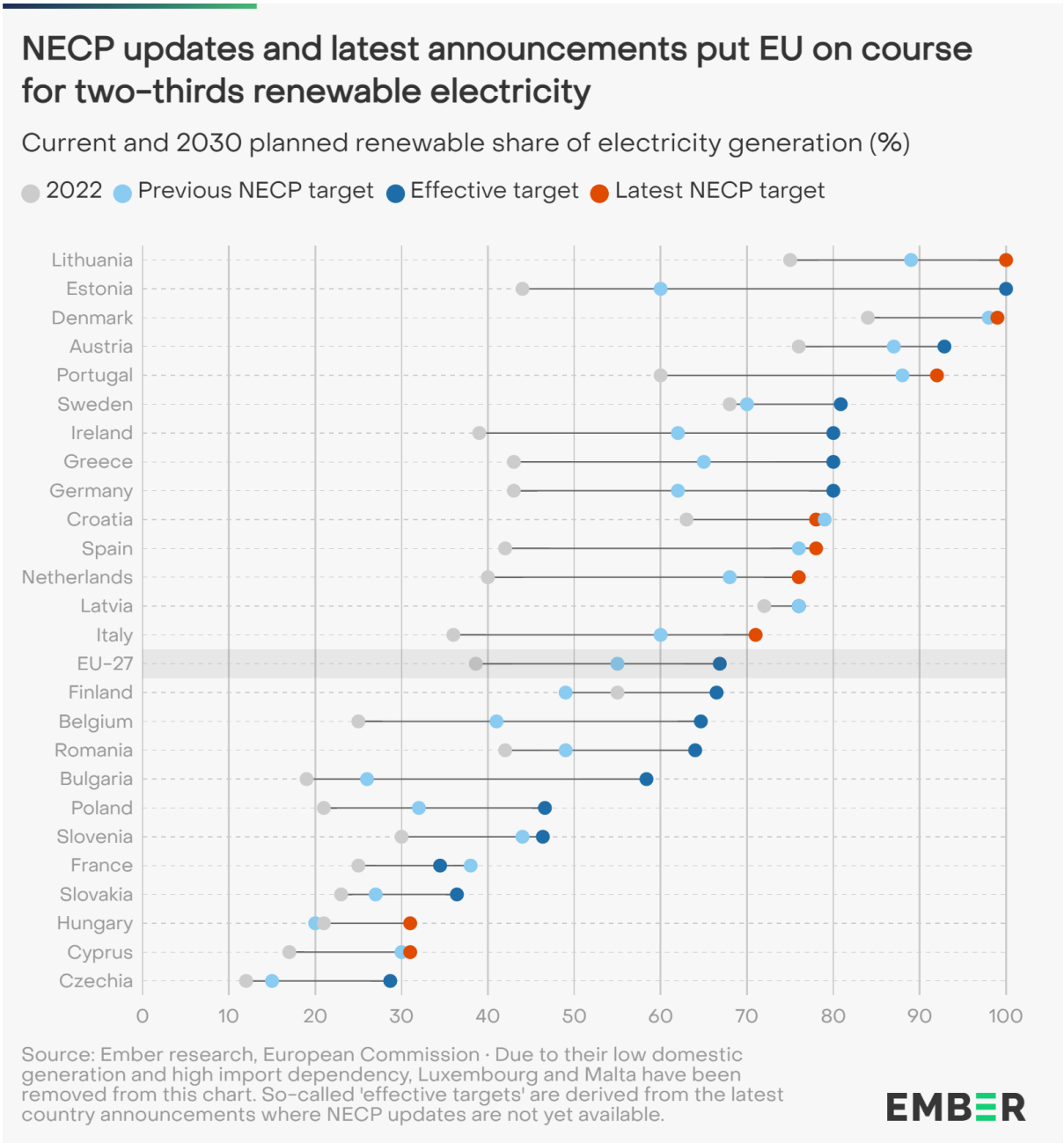
On the other hand, two countries have not increased wind targets since 2019 (Slovenia and Cyprus). Finland's target, although increased from 5.5 GW to 7.2 GW, implies a dramatic slowing of the deployment rate, from 0.7 GW/yr between 2017-2022 to just 0.2 GW/yr between 2023-2030. The only other country to plan a slower deployment rate is Sweden, but this is only moderate, and it should be noted that both of these MS have experienced some of the fastest wind growth in the EU in recent years.

2. Two thirds renewable by 2030

Renewable electricity is set to dominate the EU power sector by 2030. Based on the updated targets and other national announcements, we estimate that renewables could generate 66-67% of EU electricity by 2030. At least 23 out of 27 MS see an expanded role for renewable power compared to targets set in 2019. However, more ambitious targets are needed to put the EU on track for a predominantly decarbonised power system in the mid 2030s, as required by global climate commitments.

2.1 Steps towards clean power

Of the 15 draft NECPs analysed, 10 provide sufficient data to estimate the share of renewables in the power mix by 2030. Only Croatia has submitted a draft plan that sees a smaller share of power generated by renewables in 2030 than in the 2019 version.



2.1.1 The renewables pace-setters

Updated drafts show that three MS (Denmark, Lithuania, Portugal) will exceed 90% renewable electricity by 2030, joining two other MS (Estonia and Austria) who are also on course to exceed this level according to previous announcements. The most significant increases in ambition in new plans compared to 2019 versions are seen in Italy, Hungary, and Lithuania (all 11 percentage point increases), followed by the Netherlands (+9pp). Other MS yet to submit plans (or provide adequate data) are known to be planning even higher increases in renewable power targets.

In May 2023, the G7 re-affirmed their pledge to achieve fully or predominantly decarbonised power sectors by 2035. In EU members, we see varying degrees of progress towards this goal by 2030. Spain and France (draft NECP pending) are expected to reach 89% and 95% clean electricity already by 2030. Italy, however, is on course for just 71% by 2030 (up from 60% in the previous NECP), increasing to around 80% by 2040.

2.1.2 Acceleration is possible

Recent studies using detailed power system modelling show how it is feasible for some of the analysed countries to achieve a higher penetration of renewables in the power mix by 2030 while ensuring security of supply.

Table: renewable share of electricity supply in draft NECPs versus selected modelling studies.

Region	Current target	Ambitious target	Comments
Hungary	31%	43%	Recent Ember modelling showed that if countries in the CEE region removed barriers to wind and solar and increased targets (to higher but still feasible levels), benefits would be delivered including lower electricity prices and lower dependence on power imports.
Slovenia	46%	56%	
Italy	71%	77%	Detailed modelling has shown how Italy - in order to fulfil its G7 pledge of a fully or predominantly decarbonised system by 2035 - can reach 77% renewable penetration by 2030. Most of the gap would be accounted for by solar power.
Spain	78%	89-95%	While undoubtedly a wind and solar leader, Ember modelling for clean power by 2035 showed that Spain can go further than its stated target. With around 70 GW of wind (8 GW more than currently planned) and 70-115 GW solar (76 GW is currently planned), a renewable penetration of 89-95% could be achieved while maintaining security of supply.
Portugal	92%	99%	The same modelling study as above showed how Portugal can achieve 99% renewable penetration with similar wind and solar capacities to those announced. Unlocking these final percentages would require activating clean sources of flexibility to displace gas generation.

2.2 Ambiguity around fossil power

Despite a much stronger commitment to renewables compared to four years ago, more action is needed to reduce reliance on fossil sources of power. Reducing consumption of fossil fuels in all sectors this decade should be a firm priority for Europe's energy security, as well as being critical for climate action. The power sector is in a unique position given that mature technologies already exist, and are already taking significant market share away from fossil fuels. For this reason, the remaining fossil power in 2030 deserves closer attention.

Both the IPCC and the IEA concur that coal power should be phased-out in advanced economies (including all of Europe) by 2030, in pathways consistent with the Paris Agreement. After initially declaring a phase-out date of 2030, Spain's draft NECP now shows no active coal capacity from 2025. In contrast, Hungary previously committed to close its last lignite power plant by 2025, but uses its plan to indicate the phase-out will now take place by 2030 'at the latest'. Similarly, Italy previously committed to a 2025 phase-out, but citing the disruption caused by the gas crisis now claims this is only achievable by 2026 on the mainland (and 2028 when including Sardinia). While generation volumes are expected to remain marginal in both cases, these developments potentially undermine Europe's climate credibility.

Perhaps of greater importance and long-term significance are the trends in fossil gas capacity observed in draft plans. There will continue to be a need for dispatchable generation capacity for decades to come, but it has been shown that the EU's existing fleet of thermal generation can be safely downsized while maintaining security of supply, even in high electrification scenarios. Eventually the remaining, smaller, fleet will need to be replaced by clean dispatchable sources. The extent of this replacement / conversion will depend on how successfully other (more cost-effective) sources of flexibility are unlocked, especially on the demand-side. These findings apply to the whole European system, but the same holds true for most national systems. We would therefore expect to see decreasing gas generation and a limited - if any - net increase in gas capacity across the plans.

Gas generation and capacity data are available in 7 of the 15 plans analysed (some provide one but not the other). The plans of Spain, Portugal, and the Netherlands all evolve as described above; a net decrease in capacity combined with a faster decline in generation (more than half by 2030). Hungary plans 1.5 GW of new gas CCGT and to close some

existing capacity. Sweden appears to be the clearest outlier, with a planned 3-4 GW increase in gas capacity (With Existing Measures, WEM), despite plans for an almost entirely clean power supply by 2030. Our own modelling finds that security of supply can be achieved without such an increase, with flexibility provided by alternative clean sources, particularly interconnection. This suggests unnecessary costs and a risk of stranded assets.

3. Missing: plans for clean flexibility

Renewable electricity is experiencing a period of rapid growth in Europe. Increased system flexibility will be essential in order to bring the benefits of this low cost energy to consumers. However, the draft NECPs fail to present a plan to scale clean flexibility alongside renewables. Quantified targets for electricity storage, in particular, are conspicuously absent in most cases. NECPs are an opportunity to demonstrate political commitment to growing clean flexibility and storage, boosting confidence in a sector that could be at the forefront of European innovation and competitiveness.

3.1 The importance of electricity storage in NECPs

In order to increase energy security, affordability, and resilience in the Energy Union, the NECP guidance invites MS to "*describe in their updated NECPs how they intend to bring the benefits of lower cost renewables and low carbon technologies to consumers*". To do this, among other things, they should "*investigate investment incentives in flexibility … and firm capacity*". In addition, the Governance regulation states that NECPs should include "*National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage*"[5]. Further expectations are set by the European Commission's recommendations on energy storage, which encourages MS to use NECPs to "*strengthen the objectives and related policies and measures that aim to cost effectively promote the deployment of energy storage*"[6].

[5] Governance regulation, Annex 1, article 2.3 (iv) (dimension energy security)
[6] Paragraph 2 of the European Commission's recommendations on energy storage, March 2023

These extracts make it clear that electricity storage - both grid and consumer scale - should feature strongly in updated draft plans. Moreover, in order to improve accountability and serve as a useful signal to industry, objectives should be quantified.

3.2 Supportive words but few numbers for storage

Out of the 15 draft NECPs, all except Denmark, Sweden, and Luxembourg explicitly express an objective to increase electricity storage capacity. These three member states may have such objectives, but they are not expressed clearly in their draft plans. While the presence of these objectives is encouraging, only six countries provide quantified electricity storage levels in 2030. These are summarised in the table below. Where numbers are available, a breakdown in technology is often not provided, which undermines the strength of these targets as an investment signal.

Table: overview of quantified storage targets in draft NECPs.

Country	Target	Additional information in the draft NECP
Spain	22 GW by 2030 30 GW by 2050	The 22 GW target represents a small increase on the pre-existing national strategy (20 GW). The target comprises “daily, weekly, and seasonal” storage technologies, but an indicative breakdown is not provided. A number of recent reforms aim to support storage in combination with renewable production.
Italy	22.5 GW by 2030	Expected storage figures for 2030 are broken down by region and technology. All growth (from 7.9 GW today) comes from battery sources.
Cyprus	10 MW V2G, 50 MW battery storage, and 80 MW PHS by 2030.	Support schemes (one or two-way CfDs) are being prepared for hybrid (RES plus storage) projects.
Hungary	Up to 1 GW by 2030	Regulatory reforms and financial incentives are planned to boost the storage market. A National Battery Strategy aims to build a battery value chain in Hungary.
Lithuania	20 GWh of household storage by 2030	The plan describes investment support for batteries at the household and community level. Also, an existing pumped hydro plant will be upgraded.
Portugal	1 GW batteries and 3.9 GW pumped hydro by 2030.	Previous legal reforms are credited with opening market access to storage, and a national storage plan is promised which will be updated at least every 5 years. Hydrogen is also frequently mentioned, including as long-duration storage for the power system.

Several MS highlight recent market reforms implemented with the intention of opening markets or improving conditions (e.g., grid charges) for flexibility and storage (ES, IT, CY, DK, NL, FI, PT, SK). The Netherlands and Denmark claim to already operate electricity markets sufficiently open to storage and demand flexibility. Other MS signal an intent to further reform markets and remove regulatory barriers to storage in the future (HU, EE, FI, LT, SI, IT). While these are moves in the right direction, analysis by SmartEn claims there is further to go, as no country achieves full marks in their market monitor for demand side flexibility.

The absence of detailed storage objectives indicates incomplete or lacking assessment of system needs including all flexibility options. MS do not have long to improve this situation, as the proposed electricity market design reform would require a Flexibility needs assessment for each MS due by 1 January 2025[7]. Considering the tremendous synergies that electricity storage would have in the energy system - from easing grid congestion to lowering consumer energy bills - this process of thoroughly assessing needs and setting out a long-term strategy cannot start soon enough.

3.2.1. A long way to 200 GW

Electricity storage in the EU today stands at around 60 GW, the vast majority of which is pumped hydropower. Lithium-ion battery capacity stands at around 10 GW[8], approximately half of which is utility scale. Eurelectric's Decarbonisation Speedways study sees the need for 190 GW storage by 2030, including 60 GW each of utility-scale and prosumer-scale batteries. EASE recommends a similar number, estimating that the EU will require about 200 GW of energy storage by 2030 and 600 GW by 2050. Aurora forecast that Europe's utility-scale battery fleet (including GB) is likely to reach 45 GW by 2030 on current trends, a significant expansion from today but falling short of the indicated needs.

The lack of details around electricity storage in plans is particularly concerning in the context of rapid increases in renewable deployment and ambitions for 2030. While thoroughly assessing system needs is complicated, the growing need for storage is indicated by the growing number of MS who plan for a high penetration of renewables in their power systems. Out of the 15 plans analysed, we estimate six will cross the threshold of 60% penetration of renewables this decade (ES, IT, NL, PT, EE, FI), and five are already above this level (DK, HR, LV, LT, SE). We estimate a further five are likely to indicate crossing 60% in their plans (BE, DE, GR, IE, RO). Studies suggest this is approximately the level where storage needs begin to quickly escalate.

3.2.2 Targets are needed to drive market development

Fully implementing the Clean Energy for all Package is a necessary step to incentivise storage and other clean flexibility by opening up energy markets to their participation. However, more commitment and clarity is needed to ensure strong market-based mechanisms and a European industry fit to deliver this critical infrastructure. Market reforms may improve the conditions for investment, but strategies and targets add urgency and drive, and provide a long term signal of political commitment. All of these will be necessary to motivate the required levels of investment.

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[7] *Art. 19c in the European Commission's Electricity Market Design reform proposal published in March 2023.*

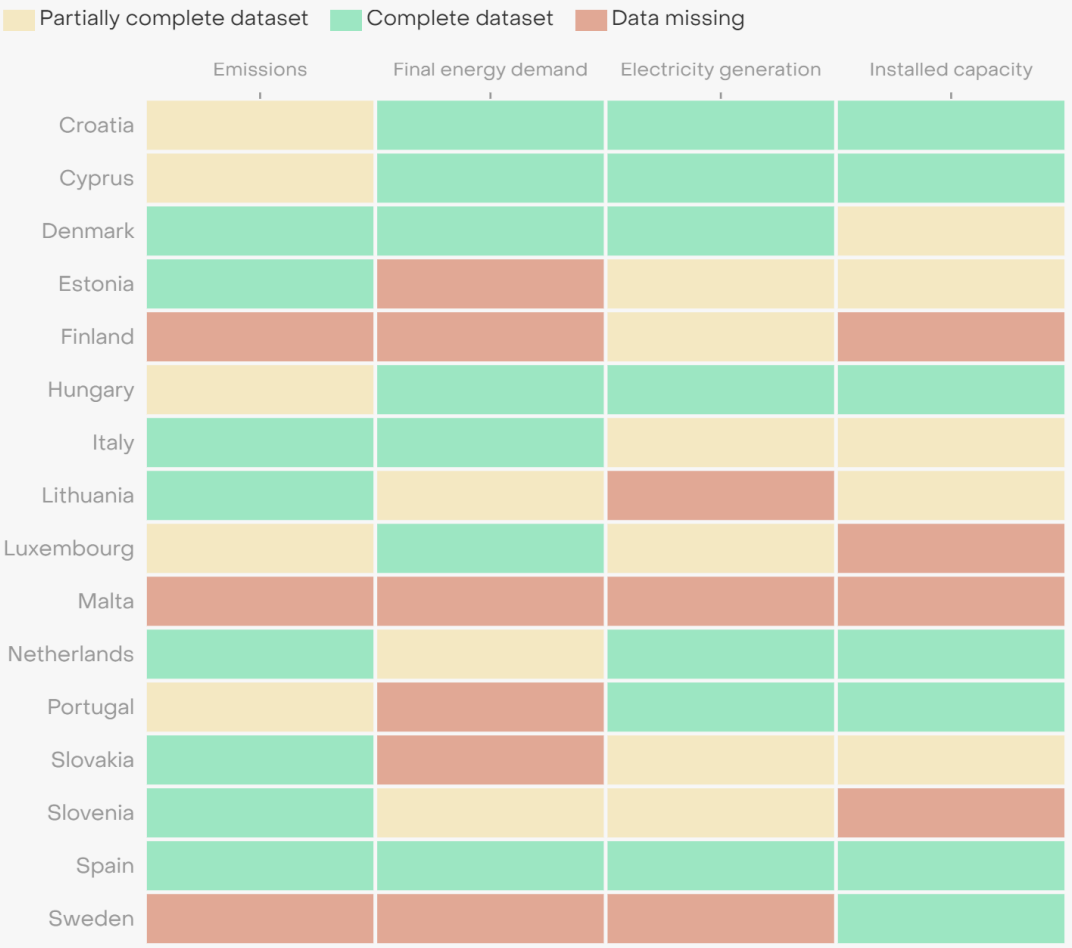
[8] EASE estimate.

4. Poor data quality

Of the 15 plans analysed, only Spain provides sufficiently comprehensive data to track key metrics related to the power sector transition. These are, namely: GHG emissions, final energy demand, electricity generation, and installed generation capacity. This demonstrates the poor overall quality of the NECPs submitted so far, particularly regarding data transparency.

While none of the four data elements listed above is consistently available across all 15 plans, the most frequently omitted are electricity generation and installed capacity. Where these data are available, they are commonly only provided for renewable sources. While understanding the trajectory of renewables is essential, complete reporting across fuel types is necessary to ensure a phase-out of fossil fuels is happening in parallel. As a consequence of this incomplete reporting, there are five plans for which the basic metrics of renewable and fossil shares of power generation cannot be calculated directly. Even when plans do provide sufficient electricity data, it is often presented in inaccessible or inconsistent forms, often only in graphical format, making analysis difficult.

Data quality of NECP 2030 targets



Source: European Commission, Ember analysis

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4.1 The importance of data transparency

Data transparency is essential to the NECP process for three key reasons:

1. **Tracking progress towards common goals**. Robust, complete and comparable data are required to track progress towards the bloc's common energy and climate goals.
2. **Signals to investors and industry**. NECPs provide crucial insight into Europe's future energy landscape. They should provide clarity on the size of the investment and infrastructure challenges, such that measures can be taken to ensure delivery of critical infrastructure for the energy transition. Failing to provide comprehensive data and information is a missed opportunity to reinforce confidence in the key clean technology industries of tomorrow.
3. **Enabling public scrutiny and establishing buy-in**. The creation of NECPs needs to be participative, and data is central to enabling this. Measurable pledges ensure accountability in plans, and accessible data enable informed scrutiny; two things that are essential to build broad consent for the final plans. Amid a growing backlash against green policy across Europe, participation has never been more important, and it starts with transparent data and information.

5. Conclusions and recommendations

This paper has analysed 15 draft NECPs with a focus on the power sector transition. These plans have been supplemented with the latest announcement from MS yet to submit updated drafts, particularly their wind and solar capacity objectives. The analysis reveals that wind and solar power targets for 2030 have been significantly increased since previous NECPs in 2019 and as a result a power sector aligned with REPowerEU is within reach.

As a number of countries plan swift transitions to renewable power, detailed accompanying objectives to expand clean flexibility are missing. Targets to support the development of electricity storage would signal political commitment to a critical sector but are largely absent in the available plans. Another common and severe problem with draft plans is the poor quality and limited coverage of fundamental energy data.

Ember recommends that the European Commission, in its December assessment of draft NECPs, strongly encourages Member States to:

- Maximise the feasible potential to deploy wind and solar power this decade, emphasising its role as the most cost-effective measure to lower emissions, reduce electricity prices, and slash dependence on fossil fuels.
- Include indicative electricity storage targets for 2030 in their final NECPs.
- Provide more concrete measures for how they intend to deliver increased system flexibility from clean sources, or how they intend to assess the needs and potential for clean flexibility where such assessments have not been done.
- Improve data coverage and avoid obscuring information in their NECPs. Improve the clarity with which information and data is presented, enabling higher quality participation and better informed scrutiny.

Supporting Information

Detail of inquiry

The paper was submitted to the European Commission on 31 October 2023, in advance of their assessment of draft NECPs, due in December 2023.

Methodology

Estimates of the EU-27 generation mix in 2030

The share of renewables, fossil fuels, and clean sources are calculated as a weighted average of national power mixes, weighted by total generation in 2030.

Where possible, renewable and fossil shares in each MS's power mix in 2030 were calculated using generation data from the 2023 draft NECPs. Where an updated NECP was unavailable or did not provide adequate generation data, alternative sources were used in the following order of preference: National announcements regarding the power mix since 2019, Ember's own power system modelling (taking into account the most recent power sector announcements), or as a last resort 2019 final NECPs.

NB. 'Other' generation shares are found as the difference between total power generation and the sum of renewable and fossil generation.

Below is a list of each member state and the source of generation data used to calculate their shares of generation:

AT	2023 Draft NECP for public consultation	Source
BE	Elia Group - Plan de développement fédéral 2024-2034	Source
BG	Ember PyPSA model	Ember
CZ	2023 Draft NECP for public consultation	Source
CY	2023 Draft NECP	Source
DE	German Federal Ministry for Economic Affairs and Climate Action - The Easter Package	Source
DK	2023 Draft NECP	Source

EE	2023 Draft NECP	Source
ES	2023 Draft NECP	Source
FI	Ember PyPSA model	Ember
FR	Government of France - Ecological Planning in Energy 2023	Source
GR	Ember 2030 target tracker	Ember
HR	2023 Draft NECP	Source
HU	2023 Draft NECP	Source
IE	Ember 2030 target tracker	Ember
IT	2023 Draft NECP	Source
LT	Ember PyPSA model	Ember
LU	2019 Final NECP	Source
LV	2019 Final NECP	Source
MT	2019 Final NECP	Source
NL	2023 Draft NECP	Source
PL	Polish Ministry of Climate and Environment - Scenario 3 Pre-consultations on updating strategic documents – KPEiK/PEP2040	Source
PT	2023 Draft NECP	Source
RO	Ember 2030 target tracker	Ember
SE	Ember PyPSA model	Ember
SI	Ember PyPSA model	Ember
SK	Ember PyPSA model	Ember

Data Annex

Ambitious benchmarks for wind and solar capacity deployment by 2030. These are sourced from national studies or ambitious industry scenarios, and hence can be interpreted as ambitious yet feasible levels that can be achieved with additional policy support. Benchmarks are only provided for MS that have submitted draft NECPs.

Country	Wind (GW)			Solar (GW)		
	2023 NECP	Ambitious	Source	2023 NECP	Ambitious	Source
Spain	62.04	70.80	1	76.39	155.00	1
Italy	28.14	32.00	2	79.92	96.00	2
Sweden	24.91	26.88	3	20.40	30.00	8
Netherlands	23.20	30.06	3 (onshore) 4 (offshore)	11.70	24.00	8
Denmark	18.10	19.50	5	1.40	2.26	8
Portugal	12.40	17.30	3 (onshore) 6 (offshore)	12.00	16.00	8
Finland	7.20	13.04	3 (onshore) 7 (offshore)	25.75	62.00	8
Lithuania	6.43	5.00	7	5.10	4.00	8
Croatia	2.56	3.71	7	0.89	3.00	7
Estonia	2.31	4.53	7	6.45	22.00	7
Hungary	1.08	1.50	7	1.20	4.08	7
Slovakia	0.75	1.68	7	2.80	11.00	7
Cyprus	0.17	0.17	5	3.45	4.86	8
Slovenia	0.15	0.56	7	0.96	5.00	7

Sources:

1) Ember power system modelling of Europe for the New Generation study
2) ECCO modelling of a pathway towards clean power by 2035 in Italy
3) Wind Europe market outlook 2023-2027, extrapolated to 2030 using average 2025-2027 deployment rates
4) Netherlands offshore wind plan, May 2023, assuming all targets for 2030/31 are achieved by 2030
5) 2023 NECP (In the case of Denmark, assuming additional offshore projects in the NECP can be delivered in addition to committed by 2030)
6) Latest offshore wind announcement (if all 10GW of projects with capacity allocated by 2030 can also be constructed by this date)
7) Ember power system modelling of the CEE region for the In it Together study
8) Solar Power Europe, '2030 Direction', NECP Analysis