ENERGY TRANSITION READINESS INDEX 2024

AN REA PUBLICATION:

REA

WWW.R-E-A.NET

SPONSORED BY:

joint radio company jrc

Contents

This report has been prepared for the Association of Renewable Energy and Clean Technology (REA) by Robert Hull, Director of Riverswan Energy Advisory (roberthull@riverswan.co.uk). Bob is an independent consultant with over 30 years of experience in the power and utility industry in the UK and worldwide, formerly holding senior leadership roles with Ofgem, National Grid, and KPMG.

Foreword

Welcome to this 2024 addition to the REA's Energy Transition Readiness Index (ETRI) series. Since 2019, the REA has monitored European countries' progress in delivering the energy transition by surveying investors and developers of renewable technologies in different markets. This tracking has highlighted evolving investment interests and national achievements in renewable energy growth, offering crucial insights as Europe's energy transition accelerates.

This year's shorter ETRI summary edition reflects on historical trends and new challenges across European energy markets. Two macro trends shape this report.

Firstly, many European markets have successfully expanded the prevalence of variable renewable generation, particularly solar and wind capacity, driven by ambitious decarbonisation goals. However, as this positive and essential change is realised, the report highlights how all markets must now address challenges in scaling the infrastructure and flexibility services needed to ensure reliable, affordable, low-carbon power systems.

Secondly, over the last 18 months we have also seen significant levels of political change in many European states featured in ETRI, with energy and climate change policies being key debating points. National elections in France, UK, Finland, Netherlands, Spain, Greece, Switzerland and Poland, were also accompanied by the 2024 European Parliamentary Elections. The European Commission itself, in the last year, has also raised EU ambitions for decarbonisation within the European Green Deal.

The nature of the energy transition is therefore coming into sharp focus, just as new Governments start to take on the challenge of its delivery. Rather than conducting a new survey, this year's ETRI review evaluates known challenges and new trends, helping investors and developers navigate existing markets, while allowing them time to get better acquainted with these evolving realities.

By looking back on progress to date, we especially identify the importance of flexibility services. Important global trends, such as the growing demand from both increasing electrification and the growth of data centres and giga factories, means more responsive renewable generation being required. While growing volumes of battery storage are also delivering demand side response services, there is also increasing demand for longer duration energy storage options.

We are especially pleased to have this year's report sponsored by the Joint Radio Company - responsible for the radio spectrum used by the UK energy industry. Their involvement underscores how these flexibility systems rely on smart grid communication systems. As variable renewable generation and increasing levels of flexibility are required, the importance of enhanced operational grid control systems becomes ever more critical.

This year's report exhibits how far different European energy markets have come. It celebrates the leaders, as well as highlighting specific localised market realities. It also points to the future. Smart, decentralised and flexible energy systems are being delivered across Europe. This brings with it both opportunities and challenges, that all investors, developers and Governments must now face head on. Having identified these trends, now is the time to ensure we are redoubling efforts by delivering affordable, secure and decarbonised energy systems that are fit for the future. Net Zero and a clean energy system remain the investment opportunity of the 21st Century.

Trevor Hutchings FIEMA, DiploD, CertIoD
Chief Executive, REA

1. Executive Summary

Countries across Europe are accelerating already ambitious renewable electricity targets for 2030 and beyond, both to meet decarbonisation goals and in response to the recent energy crisis. Renewable electricity is becoming increasingly important for energy resilience as well as lowering energy costs for consumers and businesses.

Most renewable electricity growth will be met through rapid deployment in new wind and solar. But this will need to be matched by growth in flexible low carbon electricity resources e.g., flexible demand or storage, to ensure security of supply when variable renewables are not available. The transition to a decarbonised energy system depends on successfully attracting investment to grow flexibility resources alongside renewables and is the focus of this report.

Since 2019 the REA have been monitoring European countries' progress on delivering flexibility through our Energy Transition Readiness Index reports. This year's report provides an update on European electricity markets for fourteen selected European countries (ETRI14). Together they make up 85% of electricity production and demand across the European Union (EU27) plus Norway, Switzerland and the UK.

Over the last ten years, output from renewables have increased by 140% to reach a total of 750TWh per annum in 2023, representing 27% of all electricity production across the ETRI14. But to reach the latest estimated 2030 targets, this output will need to reach 1,400TWh by 2030, representing 47% of total annual production. Not only must fossil fuel generation be replaced but additional demand from heat pumps, electric vehicles and data centres must be met.

The flexibility challenge is increasing. This report highlights that several countries in the ETRI14 (Denmark, UK, Ireland, Germany, Greece and Netherlands) may have over 60% of electricity production supplied by solar and wind in 2030. The need for low carbon flexibility and an agile energy system alongside these variable renewable resources is becoming increasingly evident.

As a result, opportunities for investment in low carbon flexibility are also expected to accelerate. The benefits to customers are significant – across the EU, consumer savings are estimated at €71 billion per annum from 2030 and, in the UK, consumer savings of more than £40 billion are estimated by 2050.

But many barriers to participation and investment remain, both in terms of technology enablers and accessibility to markets. These barriers include:

- **Ill-defined strategies or targets for low carbon flexibility resource**
- **Grid connection queues and lack of grid capacity**
- **Inadequate policies to incentivise investment in flexibility assets**
- **Planning restrictions and delays in realising consents**
- **Restricted access to, and availability of, flexibility markets**
- **Competition from fossil-fuel flexibility assets with sunk costs**
- **Inadequate metering, data and communications technologies, including suitable smart grid communication systems to enable agile and responsive electricity network**
- **The challenges in addressing increasing cybersecurity risks**

Progress across the ETRI14 in addressing these issues is mixed. In many countries, coordinated policies and actions are still needed. This will encourage and enable investment in flexibility resources and achieve clean power targets for 2030 and beyond.

Transition factors

Market access
- Regulation enables fair access for all providers
- Trading - markets are open and effective
- Transaction costs are fair for flexibility

Socio-political support
- Flexibility needs are recognised
- Supportive political and public consensus
- Public policy and regulation aligned

Technology potential
- Grid accessibility
- EV Infrastructure deployment enabled
- Digitisation enabled
- Innovation enabled

Previous ETRI reports used the above assessment framework, scoring countries against the three columns, in order to determine progress in delivering the energy transition.

2. Introduction

The 2024 ETRI Report

The energy transition requires an increasingly large capacity of variable renewable energy i.e., solar and wind, to be added to electricity systems to replace fossil-fuel generators. This also requires increasing volumes of flexible generation or demand resources to compensate for this variability. New providers of flexibility services are emerging, offering resources including distributed generation, energy storage, demand response, and interconnection.

Since 2019, the Association for Renewable Energy & Clean Technology (REA) has published its Energy Transition Readiness Index (ETRI). The report assesses the readiness of fourteen selected European electricity markets for the energy transition, from the perspective of private investors in the flexibility services and technologies that support the deployment of renewable power and decarbonisation.

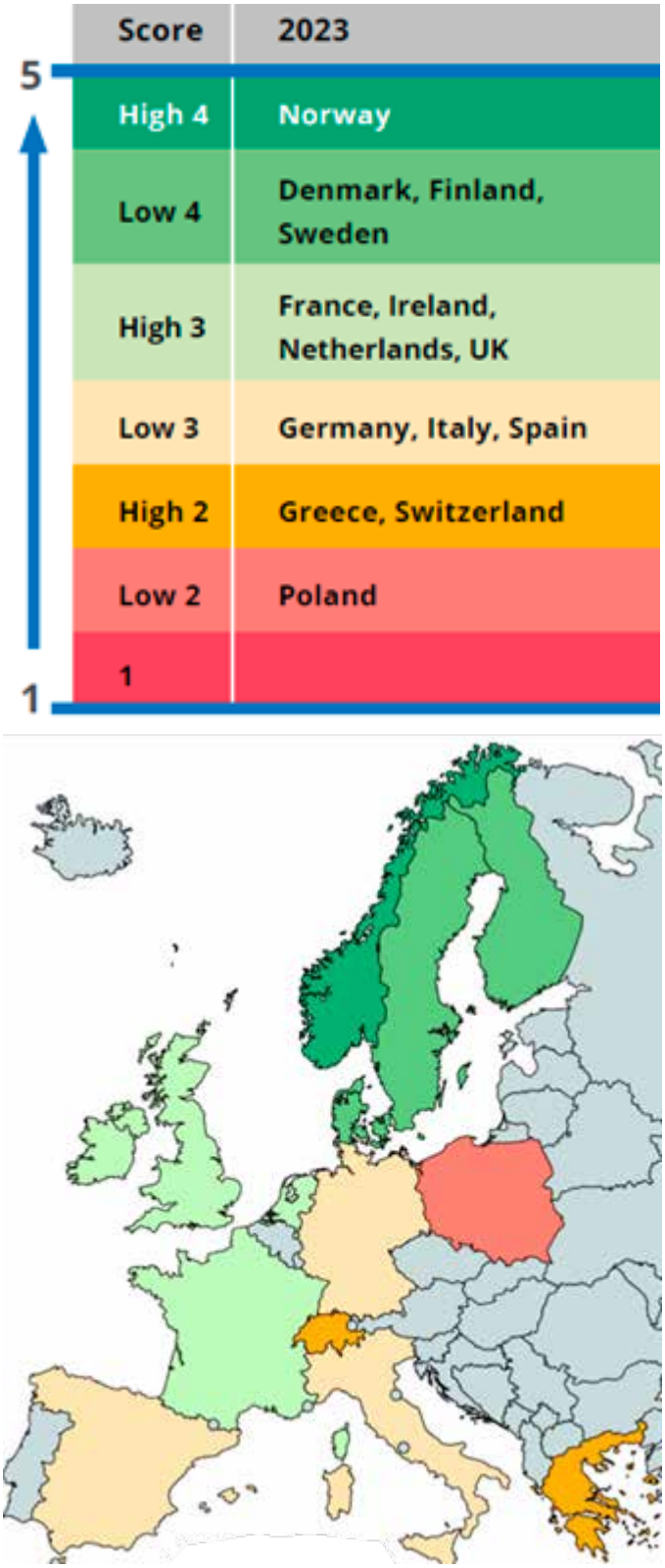
The last ETRI report was produced in 2023, assessing investor views on the impact of factors such as socio-political support, technology potential, and market access, alongside progress being made to deliver clean power in each of the countries.

The 2023 report ranked progress of the fourteen countries towards their energy transition objectives between low and high, as shown in Figure 1. From an investment attractiveness perspective, all countries showed strong ambition towards these objectives, but higher scoring ones had more transparent and accessible markets for flexibility resources.

The 2023 report also highlighted the decarbonisation and renewable electricity targets for 2030, and the challenging 'flexibility gap' that must be addressed if these targets were to be realised. Recommendations in the report to boost investor confidence in flexibility markets were:

- **Clear flexibility targets should be set for 2030, showing the contributions from grid-scale storage, demand-side flexibility, interconnectors, and low carbon generation**
- **Co-ordinate plans to meet flexibility targets, also removing barriers to flexibility**
- **Devise policy interventions to incentivise flexibility where and when needed**

Figure 1: 2023 Energy Transition Readiness Index ranking of 14 European countries



2024 Update Report

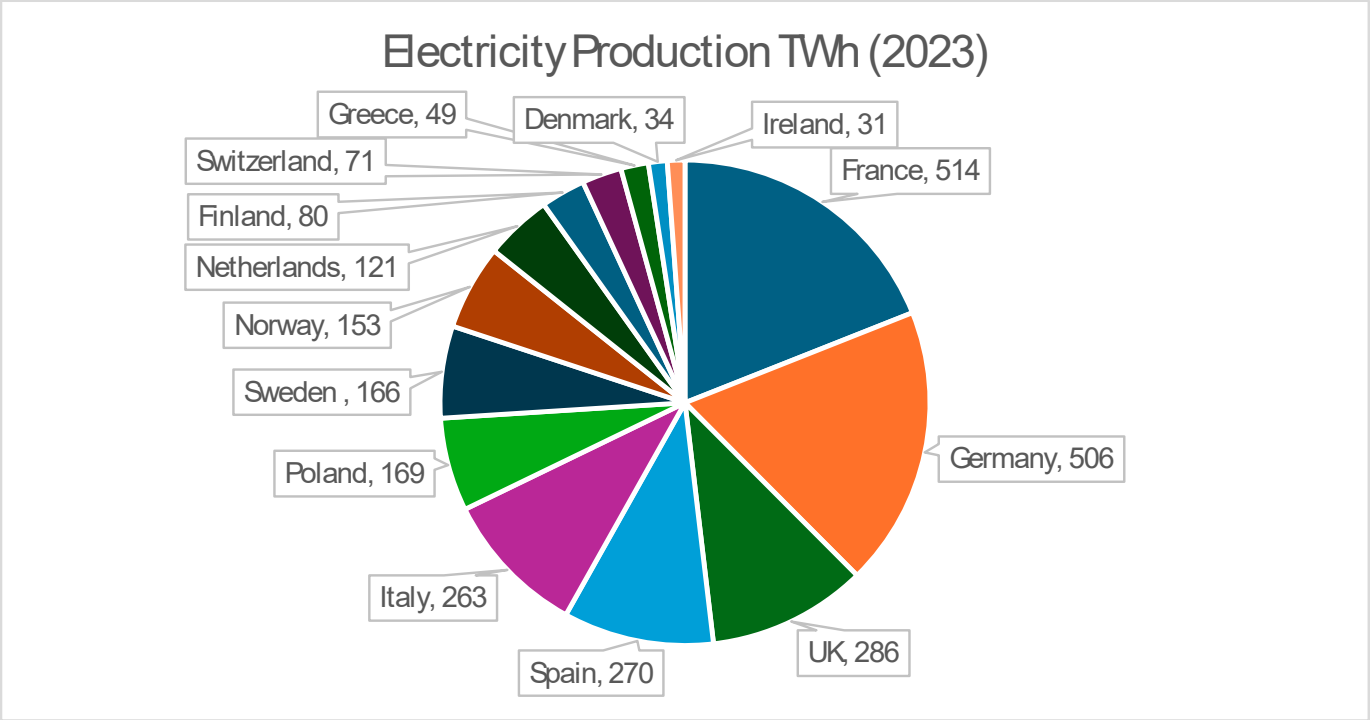
Much has happened since the 2023 ETRI report. European electricity markets are still impacted by the energy crisis. Governments have acted to accelerate the energy transition across the EU and the UK. Ambitions for 2030 have grown and the 2030 flexibility challenge is becoming more critical. At the same time several European elections, including the UK, have taken place, with new administrations taking on the challenge of flexibility and the energy transition.

This year's report provides an update on European electricity markets, prior to aiming to complete a further investor survey next year, once new Governments have settled in. The report highlights the key generation market dynamics over the last year and how they have changed over the last ten years. Progress of demand-side flexibility resources and enablers are also assessed as they start to play a bigger role in the energy transition. The latest flexibility gap to 2030 is estimated, highlighting the barriers and the measures still needed to enable private sector investment in flexibility resources.

3. Electricity Market Update

This report provides an update on the energy transition in the 14 countries included in the ETRI analysis (ETRI14). These countries represent 85% of the total electricity production across the 27 countries of the European Union, plus Norway, Switzerland and the UK. In 2023, total electricity production across the ETRI14 countries was 2,713TWh, broken down as follows:

Figure 2: 2023 Electricity production (TWh) by ETRI14 country[1]



Energy Transition Progress Over The Last 10 Years

Across the ETRI14, clean power output (including hydro, nuclear and biomass as well as wind and solar) has increased by 10% over the last 10 years, reaching 69% of total electricity production in 2023. This increase has occurred despite major reductions in nuclear output in Germany over that period. The following table shows the change in clean power production by country over the last 10 years.

Driving this change has been a dramatic growth in renewable electricity output. Across the

ETRI14, there has been a 140% increase in solar and wind output since 2014, a total increase of over 400TWh. Solar and wind output now represents 27% of all electricity produced across the ETRI14, compared to 11% in 2014.

Figure 3: Clean power as % of electricity production (2014 to 2023)

Country	2014	2023	% Change (10 years)
Netherlands	15%	51%	35%
Denmark	56%	88%	31%
Greece	25%	50%	26%
UK	38%	62%	24%
Finland	73%	94%	21%
Ireland	25%	45%	20%
Poland	13%	27%	15%
Germany	42%	54%	12%
Spain	61%	71%	10%
France	91%	92%	1%
Norway	98%	99%	1%
Switzerland	97%	98%	0%
Sweden	98%	98%	0%
Italy	44%	44%	0%

Focus on 2023

During 2023, the impact of the Russia/Ukraine war, the energy crisis, and policy responses by Governments to the energy crisis were still evident. Key electricity market developments during the year were:

- **output from wind and solar reached record levels in 2023 - some 27% of ETRI14 electricity production. Other clean power technologies (hydro, nuclear and biomass) contributed to a 69% total of clean power. Fossil fuel output continued to fall.**

- **electricity demand continued to fall as gas and electricity prices remained above pre-crisis levels. Electricity demand in the ETRI14 group fell 3% between 2022 and 2023.**

The following chart shows the overall percentage of clean power in each of the ETRI14 countries during 2023, together with the proportion of which is provided by solar and wind combined. The associated table shows the percentage increase in clean power between 2022 and 2023

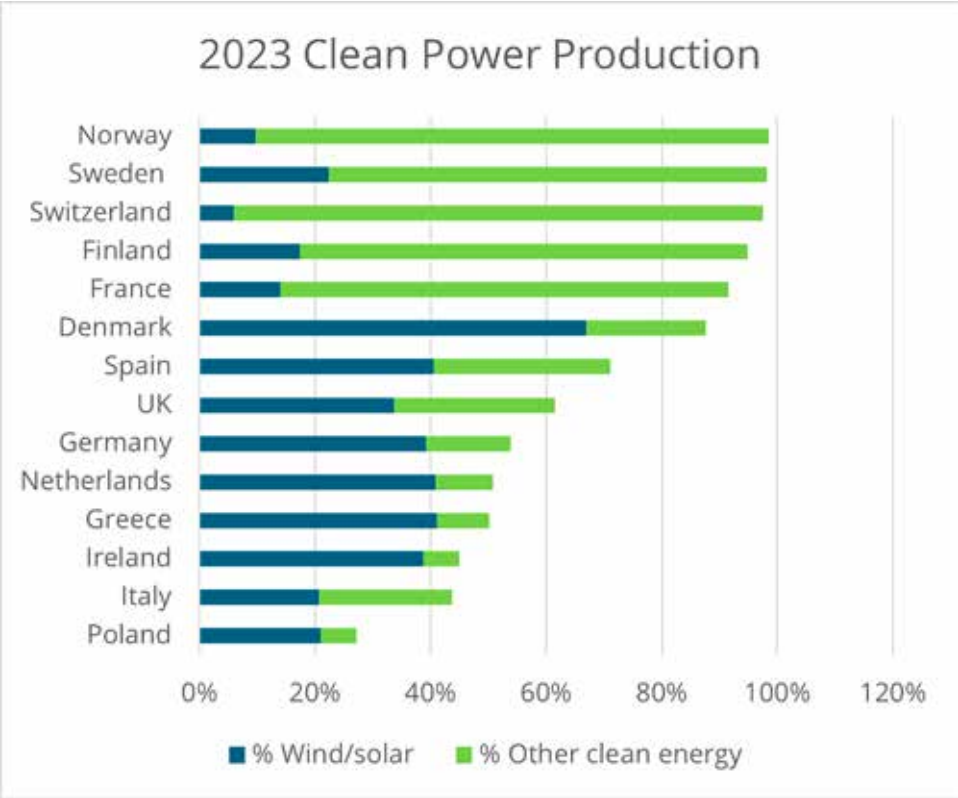
.

The upper part of the chart shows countries are currently delivering nearly 100% of their electricity from clean energy resources i.e. wind, solar, hydro, nuclear, and biomass. Norway, Sweden, Finland and Switzerland have large hydro resources, and France a large nuclear output. The lower part of the chart shows the countries (e.g., Poland, Italy, Ireland) that generated a significant proportion of their electricity from fossil fuels (gas, coal).

Many countries show a significant increase in clean power output between 2022 and 2023, including growth in wind and solar output. Across the ETRI14, solar and wind output grew by 75TWh (or 11%) between 2022 and 2023.

Variable solar and wind generation will be less able to provide flexibility to the electricity system, and other flexible resources will be needed to maintain security of supply. The above chart highlights that Denmark has reached a 67% penetration level for solar and wind, with Ireland, Greece, Netherlands, Germany, UK and Spain all currently around the 40% level.

Figure 4: Clean power as % of electricity production (2023) and change from 2022[1]



Country	% Change (22-23)
Norway	0%
Sweden	0%
Switzerland	0%
Finland	6%
France	4%
Denmark	6%
Spain	8%
UK	5%
Germany	3%
Netherlands	7%
Greece	7%
Ireland	6%
Italy	8%
Poland	6%

Demand Side Flexibility

Flexible electricity resources are increasingly being located 'behind the meter' (BTM) allowing energy 'prosumers' (those who both produce and consume electricity) to be better engaged with wholesale electricity and flexibility markets. These distributed energy resources can be many and varied. But they all need the communications, control, and data necessary to interact with flexibility and wholesale markets.

Demand-side or distributed flexibility is hugely valuable: electric vehicles, heat pumps and batteries can provide significant future volumes of flexible demand at a local level. Smart meters and resilient communications systems are key enablers for the commercial and physical use of these assets. The following table presents a status update for 2023 and compares some key distributed energy resources and enablers across the ETRI14 countries.

Figure 5: 2023 Demand-side flexibility resources and enablers

	Electric vehicles			Heat Pumps			Enabling Technologies	
	BEV Total ('000's)	BEV % of total fleet	BEV % of new registrations	Total ('000's)	HP % of total homes	HP % increase in 2023	Battery Storage (GW)	Smart Meter penetration
Denmark	243	4%	41%	665	23%	9%	n/a	100%
Finland	103	1%	24%	1452	52%	8%	0.2	100%
France	1,097	2%	15%	4544	15%	14%	0.9	92%
Germany	1,696	2%	12%	2082	5%	26%	8.0	14%
Greece	18	0%	4%	n/a	n/a	n/a	0.1	4%
Ireland	72	1%	12%	87	5%	39%	0.8	57%
Italy	303	0%	4%	3519	14%	10%	3.9	100%
Netherlands	524	3%	26%	622	7%	46%	0.4	88%
Norway	782	18%	73%	1728	72%	6%	0.0	98%
Poland	61	0%	3%	693	5%	23%	0.0	29%
Spain	213	0%	5%	1466	8%	16%	0.2	100%
Sweden	358	4%	31%	2547	46%	6%	0.1	100%
Switzerland	192	2%	16%	492	13%	13%	0.3	20%
UK	1,152	2%	15%	442	1%	16%	4.0	61%

The analysis shows:

- **Electric vehicles -** Norway continues to lead on BEV uptake with 18% market penetration and 73% of new registrations. Greece, Poland, Spain, and Italy continue to show both the lowest fleet numbers and new registrations.
- **Heat pumps -** Norway, Sweden and Finland continue to lead on heat pump uptake and the UK has the lowest. The Netherland and Ireland lead on new installations.
- **Battery storage -** Germany, the UK and Italy are leading on battery storage deployment, with the UK leading on grid scale batteries, and Germany and Italy on BTM batteries.
- **Smart meters -** rollout is high in many countries, but Germany and Greece have relatively low levels of penetration, with mandatory rollouts yet to take effect.

Demand Side Flexibility - Some Emerging Issues

Achieving the energy transition will require a substantial increase in the use of demand-side flexibility resources. This will require significant investment in the growth of these resources and technologies, and the opening of markets to realise revenues. This is a sector where a wide range of opportunities and challenges are emerging - some examples include:

Data centres - power demand for data centres is rapidly increasing due to the impact of Artificial Intelligence (AI) on the industry. According to research by Savills[2], European data centre power capacity is expected to increase to around 13GW by 2027, an increase of around 3GW from 2024. Many of these data centres are expected to be based in FLAPD markets (Frankfurt, London, Amsterdam, Paris and Dublin). However, continued rapid expansion of AI applications means that this level of demand could more than double by 2030. This presents a challenge in that more renewable generation and flexibility resources will be required to supply this power, but also opportunities for data centres to participate in flexibility markets.

Electricity storage - as illustrated in the Figure 5, battery storage capacity is expanding across Europe. According to research by LCP Delta[3], a total of 21GW of lithium-ion battery capacity is installed across Europe in 2023, and they forecast this capacity will increase to 120GW by 2030, a six-fold increase.

In 2023, there was a major increase in BTM residential (and subsidised) battery systems in Germany and Italy, contributing to over 1 million BTM battery installations. Auctions for grid scale battery projects took place in Greece and Spain, while grid scale battery growth in the UK developed under a merchant model.

The output duration of lithium-ion batteries is increasing, with projects beginning to move towards 4-hour durations. But other storage technologies e.g., pumped storage hydro, liquid/compressed air, flow batteries, etc., will be increasingly needed to provide longer duration storage capacity. The UK Government has recently decided to introduce a cap and floor regulatory regime to support large scale long duration storage investment. This regime is similar to that successfully used to realise major interconnector investments.

Smart grid communications - as the volume of distributed flexibility resources grows, it will be essential that resilient communication systems are in place in the electricity network to enhance the availability and contribution of these flexibility assets. This is especially the case for countries (as illustrated in Figure 4) which require a large increase in the volume of variable solar and wind renewables to displace fossil fuel-based generation and reach 2030 clean power targets. The importance of enhanced operational control increases for these countries.

Many countries in Europe are adopting a private wireless-based communications approach using a long-term evolution (LTE) standard (with 410-470MHz spectrum dedicated for this purpose). Dedicated or shared spectrum access has been awarded for smart grid capabilities in Denmark, Finland, Germany and Norway. While countries like Greece, Italy and UK currently only allow limited access for legacy systems[4]. This communications solution is considered more reliable and capable than public mobile networks [5,6,7] and cheaper than public mobile and private fibre networks[8].

In the UK, where an enhanced private wireless approach has yet to be adopted, it has been successfully trialled[9] in an electricity distribution area, delivering resilient operational communications connectivity for real time monitoring and control. In addition, the UK National Infrastructure Commission[10] has recommended that the communication needs for the energy sector be identified and infrastructure be delivered by 2030.

Case Study: Germany - Enhanced Electricity Network Control Via Smart Grids

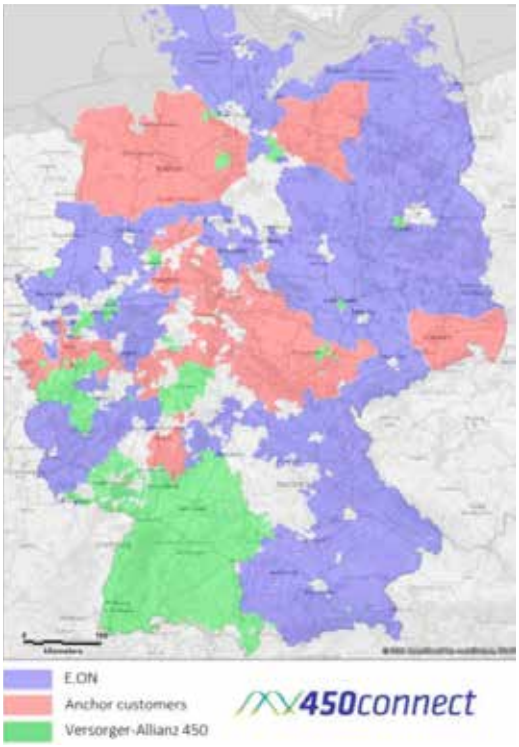
Representatives of the energy and water industries in Germany have agreed on a common industry model for construction and operation of a nationwide 450 MHz (Band 72) radio network. As operators of critical national infrastructure, the Federal Network Agency (BNetzA) awarded the joint use of the 450MHz band beyond 2020[11] to enable smart grid capability and address;

- **"The provision of the spectrum can make a significant contribution to the energy transition".**
- **"The functioning of critical infrastructures is an essential part of society and the economy. Degradation or failure of these infrastructures together with supply shortages can bring society in Germany to a standstill, endanger public safety and order and even put lives at risk".**
- **"Important to be able to respond adequately to future events in the supply networks and for the telecommunications infrastructure to be "blackout-resilient" in these circumstances.**

The four equal partners in the 450connect GmbH joint venture each own 25%

- **the previous owner of 450connect, Alliander AG,**
- **a consortium of municipal regional Distribution System Operators (DSOs),**
- **regional DSOs belonging to E.ON SE / Innogy SE and**
- **Versorger-Allianz 450, an association of municipal energy and water utilities, with participation of EnBW.**

Together, the companies provide energy and water supply to 90 percent of Germany's area. This smart grid capability will facilitate the digitisation of millions of network elements (including photovoltaic, wind turbines, heat pumps, charging stations for electromobility and smart meters), together with black-start resilient communications for their control. Network roll-out began in 2021 post spectrum award and the smart grid capability will be fully available by mid-2025.



4. Flexibility Needs In 2030

Each of the ETRI14 countries has set emission reductions targets for 2030, often together with associated targets for clean or renewable electricity. These targets have been derived from the latest National Energy Climate Plans for EU countries, or other national plans. Some of the targets are explicitly defined and some are implicit and depend on other assumptions. For this report, electricity demand assumptions for 2030 have been derived from these plans or estimated if assumptions for 2030 are not available[12].

By 2030, electricity production (and demand) across the ETRI14 countries is estimated to increase by around 10% from 2023, with demand growth expected from roll out of heat pumps and electric vehicles, and from data centres, with growth also being offset by efficiency savings.

Most plans and associated targets assume that new renewable electricity will be from variable wind and solar, which in turn will drive an increased need for flexible electricity resources to enable decarbonisation and security of supply. This is illustrated in the below chart, showing the percentage of clean power (and the proportion of variable wind/solar) anticipated in 2030.

Most countries have increased their 2030 renewable and/or clean electricity targets in response to the energy crisis and a greater need for energy resilience. This chart shows Norway, Sweden, Switzerland, Finland, France and Denmark, all at 100% clean power by 2030, and the UK with an expected target of 95% (in line with the 2030 Clean Power Mission). Germany, Spain, Greece and Ireland at 80%. Poland has also increased its target to 50% from 32%. Across the ETRI14, this shows that almost 50% of electricity will be generated by solar and wind by 2030.

The following chart, Figure 7, shows actual solar and wind output in 2023 together with their potential growth to meet 2030 national renewable targets, assuming all growth is delivered by these technologies. It highlights the scale of the flexibility gap if solar and wind output variations are to be met by other flexible technologies while still meeting clean power targets.

Figure 6: 2030 Clean power and renewable targets

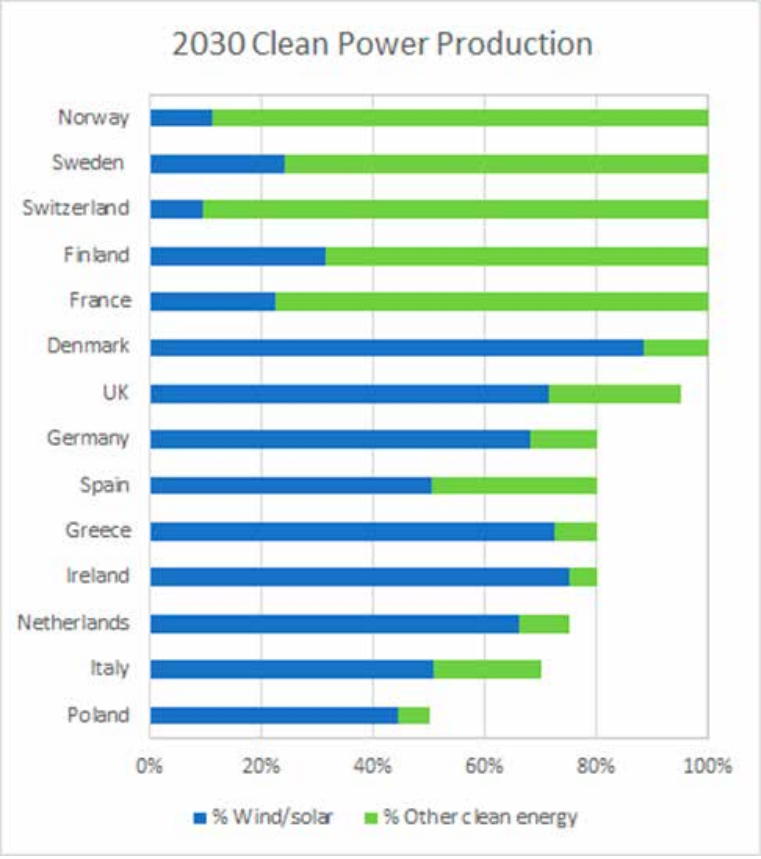
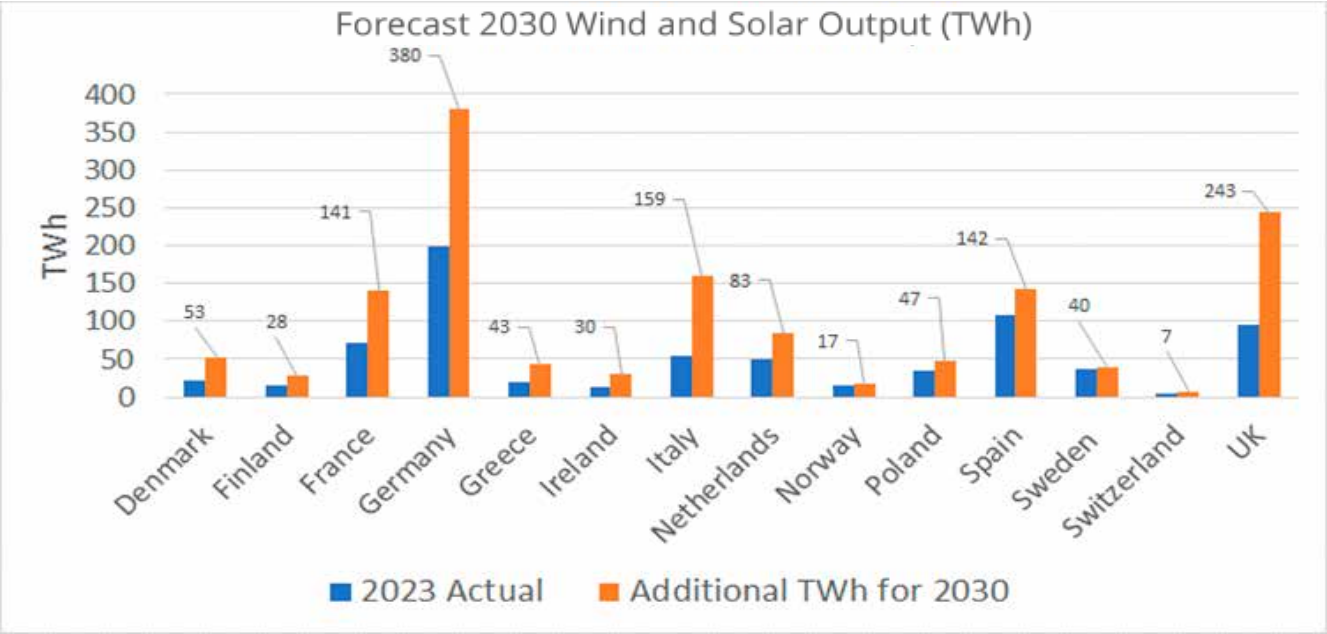


Figure 7: Solar and wind forecasts for 2030



Most countries are anticipating high growth for solar and wind output by 2030 compared to 2023 levels. However, the TWh growth assumptions for Germany and the UK are significantly higher than other countries. Germany faces the greatest challenge in reaching its 2030 targets, with 380TWh of solar and wind renewable resources being required. The UK would need to achieve 243TWh of solar and wind output.

As indicated earlier, this growth in renewables will need to be accompanied by comparable growth in flexible electricity resources, including storage, demand-side flexibility, interconnectors, and other low carbon generation. If these renewable and flexibility resources are not available, then decarbonisation targets may not be met, and costs to consumers may be higher than necessary.

5. Conclusions

ETRI reports have been published by the REA since 2019 and this update has highlighted the progress made in renewable and flexibility resource deployment by the ETRI14 countries, which represent 85% of European electricity production and demand.

Key findings from the report are:

- Renewable deployment - 2023 demonstrated continuing progress in renewable energy deployment from solar and wind in most countries. However, there was a 3% demand reduction from 2022 as the impact of the energy crisis continues.

- Demand-side flexibility - growth in EVs and Heat Pumps continues, led by Nordic countries, but a wide divergence between countries remains. Battery storage capacity is increasing, particularly in UK, Germany and Italy.

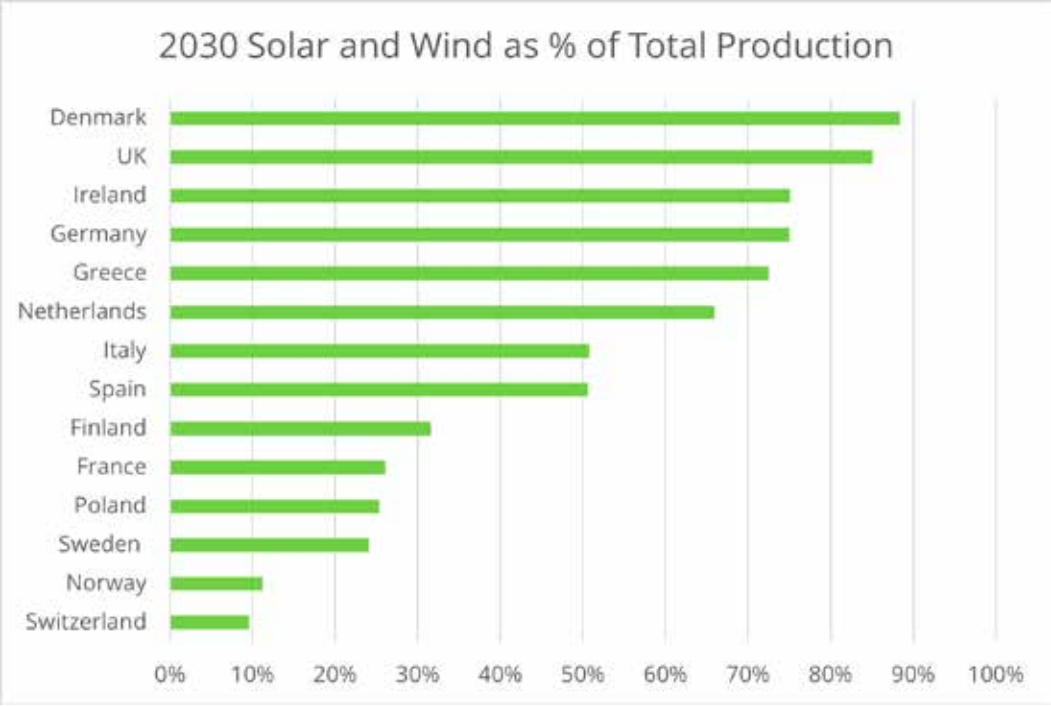
- Enabling technologies - the growth of demand side flexibility is dependent on enabling technologies such as smart meters, smart grid communication systems and the associated digital infrastructure for control, trading, and power system optimisation. Progress is mixed across the ETRI14. Cybersecurity measures to ensure effective security of supply are also becoming ever more essential.

- Emerging issues included the potential for rapid growth in data centre demand to serve the burgeoning Artificial Intelligence (AI) market, the growth in battery storage, and the challenges faced in deploying wireless control systems.

- 2030 targets for clean power and renewables. Policies are being introduced across the EU and the UK to accelerate the deployment of renewables. If these targets are realised, then it is estimated that wind and solar production will increase by 20% across the ETRI14, from 27% of total production in 2023 to 47% in 2030.

This increase in solar and wind presents a significant flexibility challenge, with some countries impacted more than others. The following chart illustrates the proportion of variable wind and solar (% of total electricity production) expected in each country in 2030, demonstrating the scale of the flexibility challenge. If these variable renewables are not available, they will need to be replaced by other clean flexible resources if clean power targets are to be achieved.

Figure 8: The flexibility challenge - 2030 solar and wind as % of total production in ETRI14



The chart shows that countries on the upper end of the scale i.e. Denmark, UK, Ireland, Germany, Greece and Netherlands face a significant flexibility challenge with solar and storage representing over 60% or total electricity demand by 2030 (projected). Many others in the middle range also face challenges from growing solar and wind penetration, which will increase beyond 2030 as their clean power targets increase.

Flexibility - Benefits and Barriers

The benefits to consumers from effective flexibility deployment are huge. In the UK, alone, government analysis estimates savings of between £40-70 billion by 2050[13]. Across the EU27, analysis[14] by Smart Energy Europe and DNV estimate that €71 billion could be saved annually by consumers from 2030.

However, there are many challenges to achieving this goal, including:

- **Ill-defined strategies or targets for low carbon flexibility resources;**
- **Grid connection queues and lack of grid capacity;**
- **Inadequate policies to incentivise investment in flexibility assets;**
- **Planning restrictions and delays in realising consents;**
- **Restricted access to, and availability of, flexibility markets;**
- **Competition from fossil-fuel flexibility assets with sunk costs;**
- **Inadequate metering, data and communications technologies, including suitable smart grid communication systems to enable agile and responsive electricity networks;**
- **The challenges in addressing increasing cybersecurity risks.**

Policies to address these challenges, and encourage investment in flexibility resources, will be required to ensure a lack of power system flexibility does not prevent the achievement of clean power targets for 2030 and beyond.

6. References

[1]Historic electricity market data for this report has been derived from the Ember climate and energy database. Ember (2024) Electricity Data Explorer, https://ember-climate.org/data/data-explorer/

[2]Savills (2024) European data centre power capacity projected to rise to approximately 13,100 MW by 2027, https://www.savills.co.uk/insight-and-opinion/savills-news/362723-0/european-data-centre-power-capacity-projected-to-rise-to-approximately-13-100-mw-by-2027

[3]LCPDelta (2024) European Market Monitor on Energy Storage 8.0 https://www.energystoragenl.nl/wp-content/uploads/2024/06/EMMES_8.0_Final-Report_for-distribution.pdf

[4]Smartgrid digital spectrum analysis provided by UK Joint Radio Company Ltd

[5]Ofcom (2023) Resilience guidance consultation and Call for Input on mobile RAN power back up https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-1-10-weeks/272921-resilience-guidance-and-mobile-ran-power-back-up/associated-documents/consultation-resilience-guidance-and-mobile-ran-power-back-up/?v=330556

[6]The Register (2024) Three and Vodafone: We need to merge because our networks are rubbish https://www.theregister.com/2024/10/07/three_vodafone_merger/?utm_source=daily&utm_medium=newsletter&utm_content=article

[7]JRC (2022) Operational Control of Mission Critical Networks and the Service Limitations of Public Mobile Networks, https://www.jrc.co.uk/Plugin/Publications/assets/pdf/ICT-Operational-Control-of-Mission.pdf

[8]JRC and Gemserv (2021) Economic rationale for enabling Smart Grid functionality of the UK energy system via a Private Radio Frequency-based enhanced Operational Communications Solution, https://www.jrc.co.uk/Plugin/Publications/assets/pdf/ICT-Economic-rationale-for-enabling-Smart.pdf

[9]National Grid (2019) Western Power Distribution NIA Project Registration and PEA Document for LTE Connecting Futures, https://www.nationalgrid.co.uk/downloads-view-reciteme/79219

[10]NIC (2023) The Second National Infrastructure Assessment, https://nic.org.uk/app/uploads/Final-NIA-2-Full-Document.pdf

[11]450 Alliance (2021) 450connect Receives the 450 MHz License Rights for the Next 20 years, https://450alliance.org/450connect-receives-the-450-mhz-license-rights-for-the-next-20-years/

[12]Where 2030 demand estimates are not available, 10% growth (2023-2030) has been assumed.

[13]BEIS (2021) Transitioning to a net zero energy system: smart systems and flexibility plan 2021, https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021 (stated saving of £30-£50bn converted from 2012 to 2024 prices)

[14]smartEN (2022) New report into Demand-side Flexibility quantifies huge scale potential in 2030 for both consumers and EU clean energy transition, https://smarten.eu/wp-content/uploads/2022/10/DNV-study-event-Press-release.pdf

Images courtesy of National Grid, BSR, JRC & E.ON.

With special thanks to report sponsors the Joint Radio Company.

Joint Radio Company (JRC) is a joint venture between National Grid Electricity Transmission (NGET), National Gas Transmission (NGT) and the Energy Networks Association (ENA). Their mission is to ensure the enhanced operational control, flexibility and resilience of the UK's gas and electricity networks. By enabling smart grid capability through resilient wireless communications, the UK will benefit from more robust electricity supplies, lower consumer energy bills, and accelerated decarbonisation. To make this happen, they are calling on the Government to grant access to dedicated radio spectrum for the UK energy network operators. www.jrc.co.uk/

Find Out More and Support the Sector

For further information, please contact:

Frank Gordon - Policy Director
fgordon@r-e-a.net
Francesca Cullaney - Policy Analyst, Power & Flexibility with Green Finance fcullaney@r-e-a.net

If you're interested in REA membership or sponsorship, please contact:

Lindsay Barnett - Director of Membership, Marketing & Events lbarnett@r-e-a.net
Amalia Moca - Business Development Executive
amoca@r-e-a.net

The report is available on the REA website, here:
www.r-e-a.net/our-resources

Follow REA on X: @REAssociation
on LinkedIn: renewable-energy-association

November 2024

ETRI 2024 CAN BE
VIEWED ONLINE
OR DOWNLOADED
BY SCANNING
THIS QR CODE

AN REA PUBLICATION:

WWW.R-E-A.NET