

Power Sector Decarbonization Action Plan Series: European Union

November 30, 2023

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Webinar & Speaker Introductions

Moderated by Jal Desai, National Renewable Energy Laboratory

November 30, 2023

Agenda

- Overview of the Clean Energy Solutions Center
- Overview of the 21st Century Power Partnership
- European Union: Technical Presentations
- Q&A

Webinar Speakers



Jai Desai

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**National Renewable
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**National Renewable
Energy Laboratory**



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Matthieu Ballu

Policy Officer, DG Energy,
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Michela Marasco

Policy Officer, DG
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Commission**



Antonio De Paola

Scientific Project
Officer, Joint Research
Centre, **European
Commission**



Isabel González Cuenca

Scientific Project Officer,
Joint Research Centre,
European Commission

Overview of the Clean Energy Solutions Center

Presented by Jal Desai, National Renewable Energy Laboratory

November 30, 2023

The Clean Energy Solutions Center

OBJECTIVE

To accelerate the transition of clean energy markets and technologies.

RATIONALE

Many developing governments lack capacity to design and adopt policies and programs that support the deployment of clean energy technologies.

AMBITION/TARGET

Support governments in developing nations of the world in strengthening clean energy policies and finance measures

ACTORS

Leads:



Operating Agent:



Partners:

More than 40 partners, including UN-Energy, IRENA, IEA, IPEEC, REEEP, REN21, SE4All, IADB, ADB, AfDB, and other workstreams etc.

ACTIONS

- **Deliver** dynamic services that enable *expert assistance, learning, and peer-to-peer sharing of experiences. Services are offered at no-cost to users.*
- **Foster** dialogue on emerging policy issues and innovation across the globe.
- **Serve** as a first-stop clearinghouse of clean energy policy resources, including policy best practices, data, and analysis tools.

UPDATES

Website:

www.cleanenergyministerial.org/initiatives-campaigns/clean-energy-solutions-center

Factsheet:

www.nrel.gov/docs/fy22osti/83658.pdf

Requests: Now accepting Ask an Expert requests!

The Clean Energy Solutions Center



Ask an Expert Service

- Ask an Expert is designed to help policymakers in developing countries and emerging economies identify and implement **clean energy policy** and finance solutions.
- The Ask an Expert service features a network of more than **50** experts from over **15** countries.
- Responded to **300+** requests submitted by **90+** governments and regional organizations from developing nations since inception



Training and Capacity Building

- Delivered over **300** webinars training more than **20,000** public & private sector stakeholders.



Resource Library

- Over **1,500** curated reports, policy briefs, journal articles, etc.



For additional information and questions, reach out to Jal Desai, NREL, jal.desai@nrel.gov

Overview of the 21st Century Power Partnership

Presented by Prateek Joshi, National Renewable Energy Laboratory

November 30, 2023

21CPP Objectives: Power System Transformation

Accelerate the transition to clean, efficient, reliable, and cost-effective power systems.

**Evolving Generation
Portfolios**

**Electrification of
Transport,
Buildings, and
Industry**

**Smart Grid, Energy
Efficiency &
Demand Response**

**Cross Cutting Issues:
Operations,
Transmission,
Distributed Generation,
Market Design**

**Coordinated Power
System Planning,
Building, and Operating
Best Practices**

*Peer-learning, knowledge-
sharing, and technical
assistance*

Coordinating with related CEM Campaigns

21CPP: Focus Areas

Annual Program of Work often includes:

- “Thought Leadership” studies that focus on generic power system transformation topics across the world
- In-country technical assistance, often as part of a larger development assistance effort, focused on *Planning, Building, and Operating best practices for decarbonizing power systems*.
 - High-resolution grid integration studies often highlight this work.
- Information exchange, capacity building, fellowship programs, and other exercises to share lessons-learned and knowledge transfer.

21CPP: Recent Activities

2021-2022:
Released a collaborative report for energy ministers on lessons learned for rapid decarbonization of power sectors.



2022-2023:

Worked with a first cohort of countries to develop Action Plans for power sector decarbonization based off the report.



European Union



India



Chile



Australia



United Kingdom

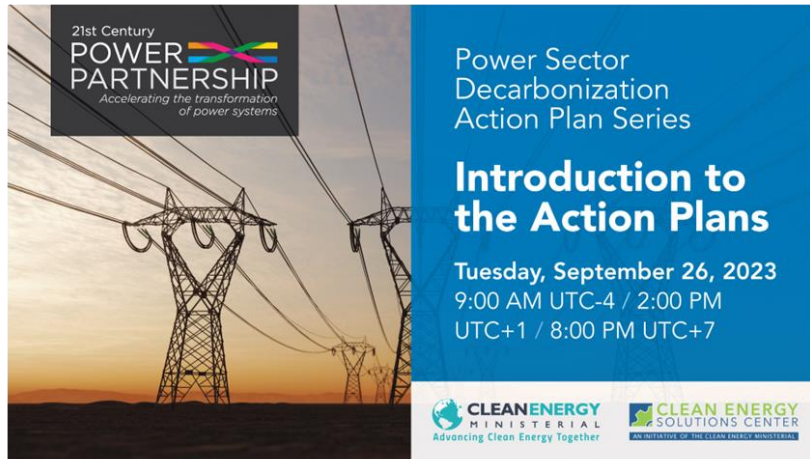
March 2023: Workshop on transmission planning and operations

May 2023: Workshop on resource adequacy and grid flexibility

21CPP: Planned Activities

2023-2024:

Webinar series to discuss details of Action Plans in the first cohort.



Work with a second cohort of countries to develop Action Plans to be released at CEM15 in Brazil.

Potential for technical workshops, thought leadership report, etc.

EU Technical Presentation

Presented by

Paula Pinho, Matthieu Ballu, Michela Marasco – European Commission, DG Energy

Antonio De Paola, Isabel González Cuenca – European Commission, JRC

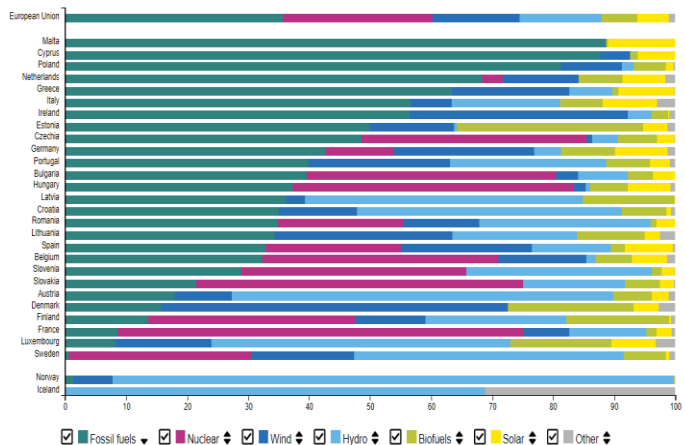
November 30, 2023



EU POWER GENERATION MIX

- Around **23% of the final energy consumed in the EU is electricity**, coming from different sources.
- **In 2020, renewable energy sources** accounted for 39% of the electricity supply in the EU, overtaking **fossil fuels** (36%) as the main power source for the first time. In addition, 25% of the electricity came from **nuclear** power plants.
- Among renewable sources, the highest share of electricity came from **wind turbines** (14%), **hydropower plants** (13%), **biofuels** (6%) and **solar power** (5%). The sources of electricity production vary among the Member States

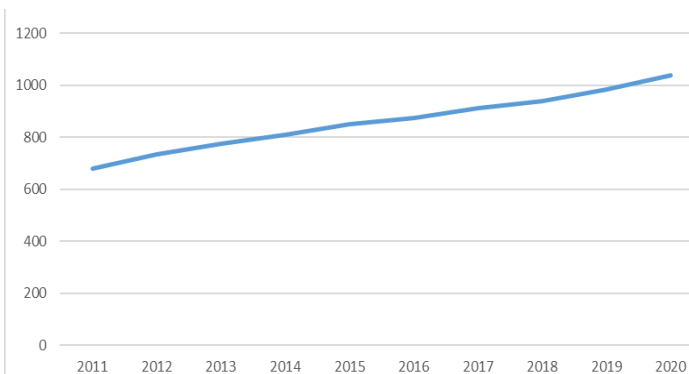
Production of electricity by source, EU27, 2020 (in %)



Hydro includes pumped hydro, which for certain Member States, in particular Lithuania and Luxembourg, leads to a higher share for this category.
Other includes electricity from geothermal, non-renewable waste, heat from chemical sources and other sources.

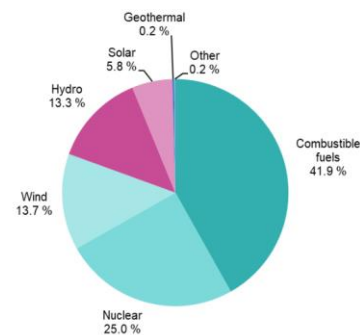
Source: Eurostat - [access to dataset](#)

Use of Renewables for electricity in the EU (2011-2020, GWh)



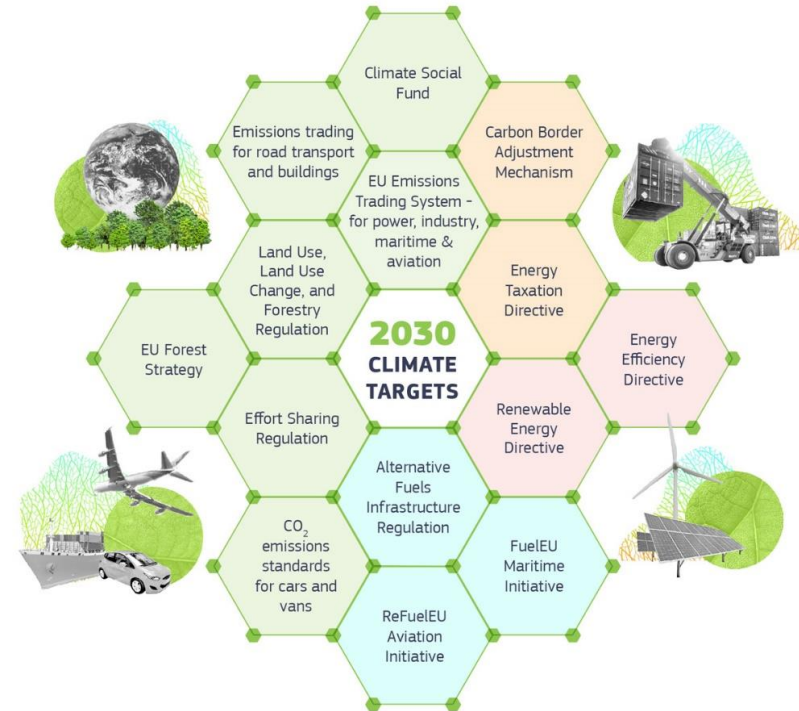
Source: JRC analysis from Eurostat data

Net electricity generation, EU27, 2021 (% based on GWh)



Source: Eurostat

EUROPEAN GREEN DEAL



The [European Green Deal](#) (2019) is the EU's long-term, whole-of-the-economy plan to make **Europe climate neutral by 2050**.

The [European Climate Law](#) (2021) made climate-neutrality a legally binding target for the block, along with **reducing greenhouse gas (GHG) emissions by at least 55% by 2030**, compared to 1990 levels.

In 2021, the Commission presented its '[Fit for 55](#)' legislative package, outlining policy measures to reduce GHG emissions by 55% by 2030. The package included a **review of all relevant legislation** to align with the new climate target, including for renewables and electricity markets.

REPOWEREU

- The [REPowerEU](#), launched in May 2022, is the EU's response to global energy market disruption caused by Russia's invasion of Ukraine.
- It seeks to transform Europe's energy system by **ending the EU's dependence** on Russian oil and gas imports and **tackling the climate crisis**.
- The measures in the REPowerEU Plan include **energy savings, diversification of energy supplies, and accelerated roll-out of renewable energy**.

Some results from 2022: 57 GW new installed renewable energy sources



16 GW for **wind** power generation (+34% + than in 2021)



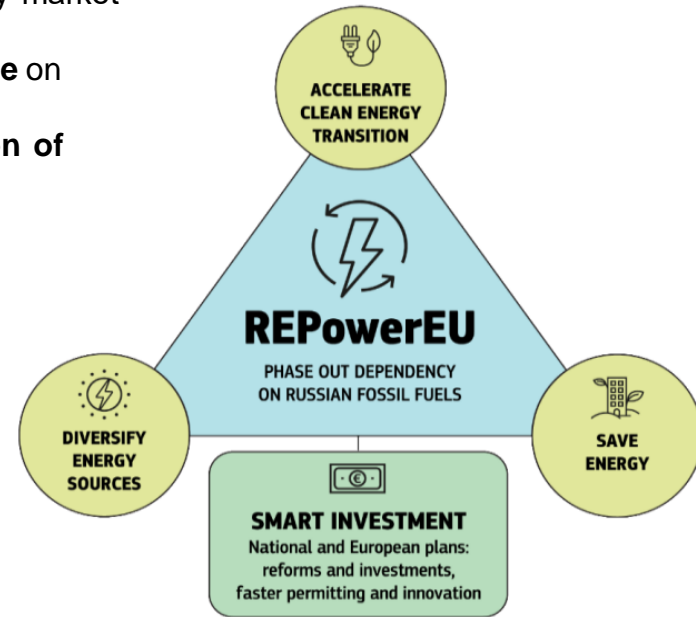
41 GW for **solar** power generation (+47% + than in 2021), 60% rooftop



1 GW for **other renewables** power generation

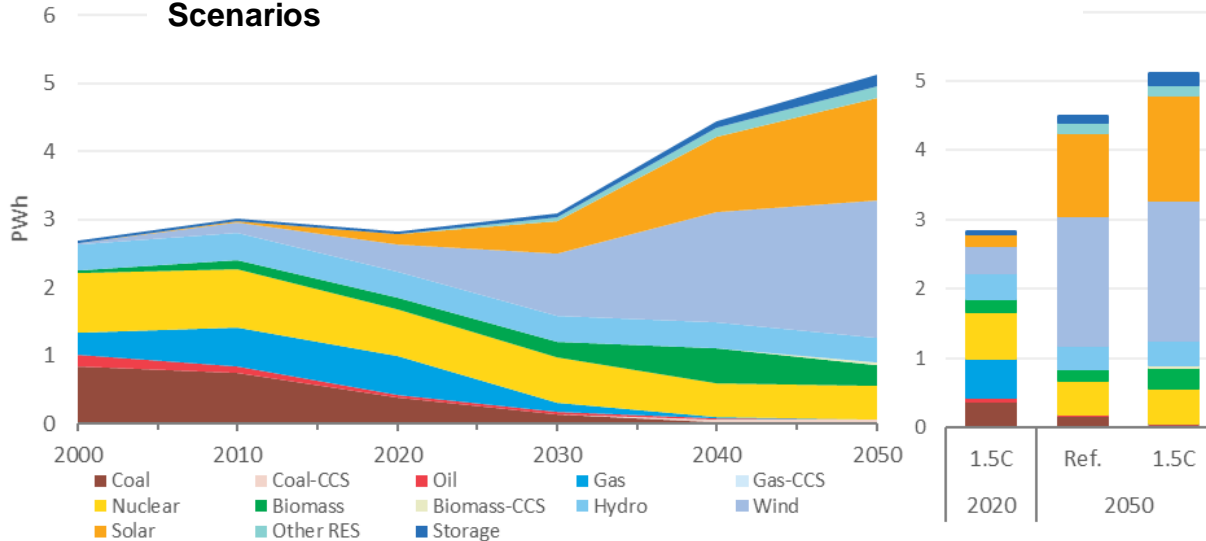
Wind and solar together generated 22% of EU's electricity, overtaking natural gas for the first time as well as coal.

Sales of heat pumps have increased by 40% and sales of fully electric cars reached a market share of 15%, surpassing the share of new diesel cars



EU POWER SECTOR DECARBONISATION: A PATHWAY TO 2050

EU power generation, by technology, Reference and 1.5°C Scenarios



The Global Energy and Climate Outlook ([GECO](#)) of the EU's Joint Research Centre (JRC) provides **long-term global and EU energy and emissions projections** under different scenarios

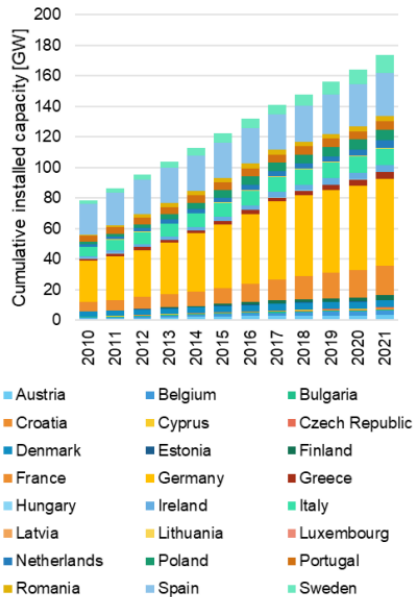
In the 1.5°C Scenario, the EU power generation mix is **dominated by wind and solar**. Nuclear is the third largest source of generation.

Power plants fitted with CCS provide only 1.9% of generation in 2050.

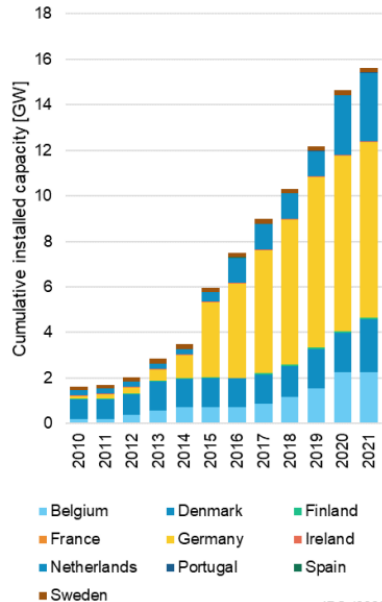
Source: POLES-JRC model

WIND AND OFFSHORE RENEWABLE ENERGY POLICY (2023)

Cumulative installed capacity of onshore (left) and offshore wind (right) in the EU (2010-2021)



JRC (2022)



JRC (2022)

Wind accounted for **over one-third (37%)** of the total electricity generated from renewable sources in the EU in 2021 (source: [Eurostat](#)).

A record 16 GW were installed in 2022, a 47% increase compared to 2021.

The wind sector is also a **significant contributor to the EU economy**: it provided between 240,000 and 300,000 jobs in 2020, of which about 62,000 were in the offshore wind industry (source: WindEurope).

EU wind power action plan ([COM/2023/669](#)) & communication of offshore wind ([COM/2023/668](#))

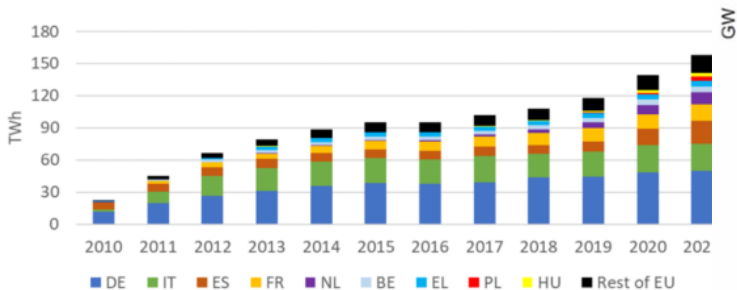
Delivery of increased objectives (capacity to grow to almost 500 GW wind, 111 GW offshore renewables in 2030).

- New offshore must increase to almost **12 GW per year**.
- Key areas include:
 - Permitting and predictability, maritime spatial planning
 - Auction design
 - Grid infrastructure deployment and resilience
 - Supply chain and skills

Source: JRC based on GWEC (2022)

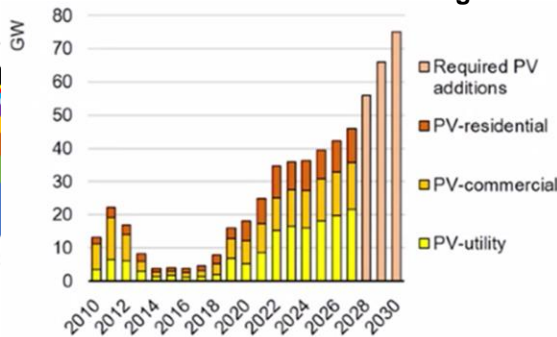
SOLAR PHOTOVOLTAIC POLICY (2022)

Cummulative EU solar PV generation per country (2010-2021)



Source: JRC analysis based on Eurostat

EU solar PV net capacity additions and forecast (2021-2027) vs. Required additions needed to reach REPowerEU targets



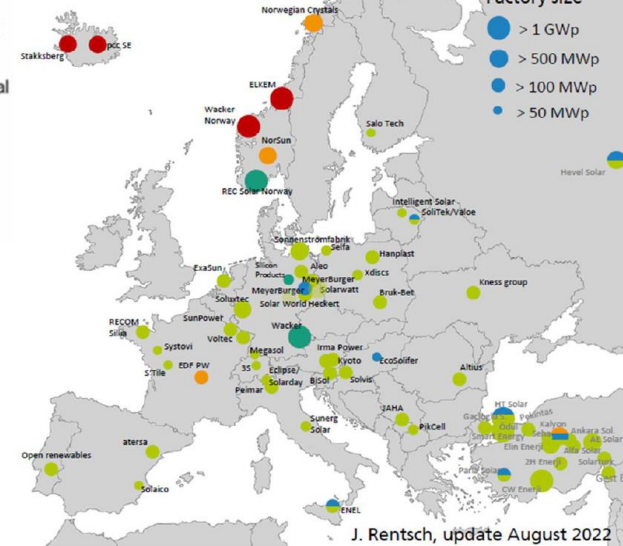
Source: IEA

Current European c-Si PV manufacturing landscape in August 2022.

Status Quo - PV Production

Overview of PV production along the value chain

Source: Map: kartoxjm (fotolia) / europakarte.org



Communication on EU solar energy strategy: [COM\(2022\)221](#)

- **By 2025**: to bring online over **320 GW** of solar photovoltaic capacity (in 2020, the EU had 136 GW installed solar PV capacity)
- **By 2030**: to bring online almost **600 GW** of solar photovoltaic capacity
 - => average annual additions of 46 GW (from 2020 levels)

RENEWABLE ENERGY DIRECTIVE(S)

Renewable Energy Directive (RED)

The Renewable Energy Directive provide the **legal framework** for the development of renewable energy across all sectors of the EU economy, and supports cooperation across EU countries. Since the introduction of the RED in 2009, the **share of renewable energy** in gross final energy consumption has kept growing, **reaching 22% in 2020**.

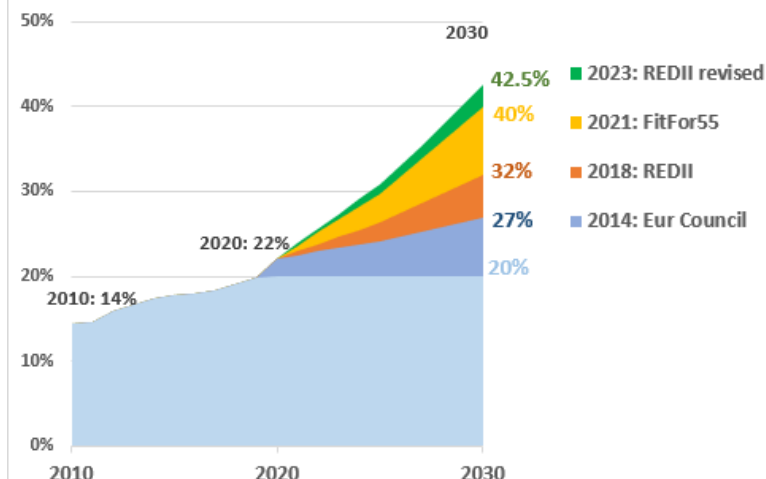
RED revised in 2023 => 42.5% renewable energy by 2030

The ambition and measures in RED have been revised several times in line with the evolution of EU energy and climate policies.

- In May 2022, as part of the **REPowerEU Plan**, the EC proposed to increase the share of renewables (COM/2022/230 final);
- In October 2023, EU co-legislators agreed to raise the target **share of renewable energy in the EU total energy consumption to 42.5% by 2030**. This implies a share of renewables in electricity over 70%.

The revised RED will increase the share of renewables in all sectors (heating and cooling, transport, industry, buildings), help accelerate and simplify permitting, boost investments and further strengthen criteria for sustainable bioenergy.

Evolution of RE targets for 2030



PERMITTING PROCEDURES (ARTICLE 15-16)

RES projects: easier and faster permitting procedures with two types of areas:

- ❖ **For most of the territories** suitable for deploying renewables: simpler and faster.

2 years max for all permits (3 years for offshore)

- ❖ **For “Renewables acceleration areas”** where environmental impacts are expected to be lower, with shorter deadlines and streamlined environmental assessments per project

1 year max for all permits (2 years for offshore)

Designation of dedicated areas (optional) for **infrastructure projects**

- Member States may exempt projects in these areas from an EIA if comply with a mitigation rulebook
- Screening for exempted projects; mitigation measures for problematic projects

TRANS-EUROPEAN NETWORKS FOR ENERGY (TEN-E)



Energy infrastructure, the backbone of a secure and climate-neutral energy system

Interconnectors are the circulatory system of the EU allowing energy to flow seamlessly across borders, ensuring security of supply, the integration of renewable energy and keeping prices in check.

The EU's cross-border energy system has developed significantly since the 1990s and in particular through the modernised TEN-energy policy since 2013 and is more resilient and flexible than any system across the globe.

It is a true European success story of integration, cooperation and mutual support.

New Regulation on **guidelines for trans-European energy infrastructure** (EU 2022/869)

New TEN-E infrastructure categories: offshore, hydrogen, electrolysers, smart gas grids, as well as (in addition to the electricity transmission) smart electricity grids, CO2 networks and energy storage

Ten-Year Network Development Plan

TEN-YEAR NETWORK DEVELOPMENT PLAN

TYNDP

Every two years, the European Network of Transmission System Operators for Electricity (ENTSO-E) and gas (ENTSO-G) publishes **a non-binding EU-wide ten-year network development plan**.

The TYNDP builds on national and regional investment plans prepared by the **transmission system operators (TSOs)**.

The TYNDP is **consulted with stakeholders** who contribute to its elaboration via open workshops, public consultations and meetings.

TYNDP: a collaborative effort

National System Operators and ENTSO-E

European Commission Joint Research Centre

National competent authorities and Regulators

ACER Other stakeholders

VIDEO: <https://youtu.be/sz1c6dcNWrc>

High-Level Report TYNDP 2022 was published in January 2023

- ENTSO-E TYNDP 2022 includes scenario analysis, system needs analysis and project assessment.
- Overall, the ENTSO-E TYNDP 2022 portfolio represents 43,000 km of lines or cables.
- ENTSO-E TYNDP will assess **141 transmission projects of which 85 cross-border projects, and 23 storage projects**.
- You can check how these projects respond to the 2030 and 2040 scenarios here: [TYNDP 2022 Project Collection](#)

PROJECTS OF COMMON INTEREST (PCIs)

The PCIs are key infrastructure projects aimed at completing the European energy market, ensure security of supply and achieve EU 2030 and 2050 energy policy and climate objectives. Projects selected as PCIs can benefit from many advantages stemming from the Trans-European Network - Energy (TEN-E) Regulation, including:

- an **accelerated permit granting**;
- **improved regulatory treatment**;
- the possibility to apply for **financial support** under the Connecting Europe Facility (CEF) for Energy: total budget of €5.84 billion (2021-2027);
- dedicated rules to facilitate the development of **offshore renewable grids**;
- strengthened **cross-sectoral** energy infrastructure planning.

In order to be eligible for inclusion in the PCI lists, electricity and hydrogen projects must be part of the latest available EU-wide ten-year network development plan (TYNDP).



CEF ENERGY 2023
CALL FOR PROPOSALS

EUR 750 MILLION

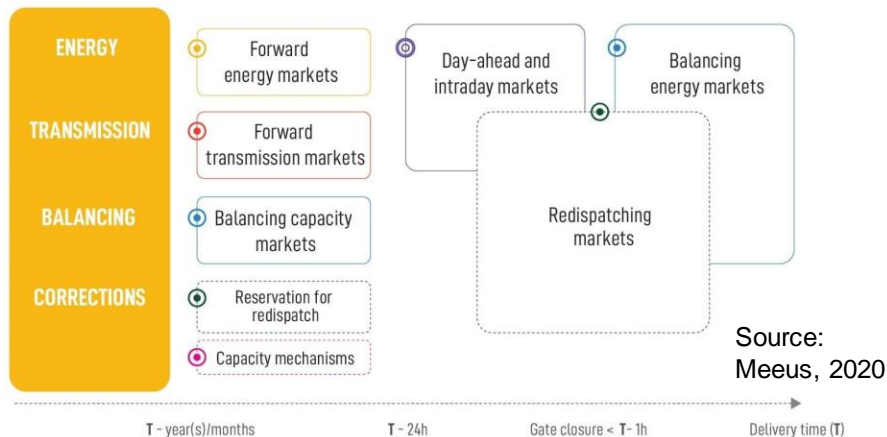
Funding for
PROJECTS OF COMMON INTEREST (PCIs)
- Works & Studies

DEADLINE
5 SEPTEMBER

 #CEEnergyPCIs

EU ELECTRICITY MARKET DESIGN

Sequence of Electricity Markets in Europe



- European harmonisation and integration process started in 1996
- **Day-ahead and intraday markets:** coupling completed in 2022
- **Balancing energy markets:** creation of common market platforms (*PICASSO, MARI, TERRE*)
- So far: ~ €1bn/year of benefits for EU customers (source: ACER)

EC proposals for revised Electricity Market Design

COM(2023) 148 final

Next Steps:

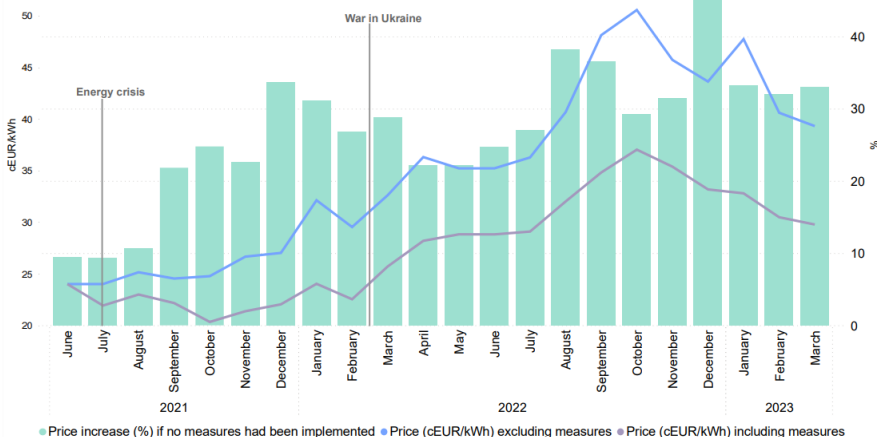
- **Protect consumers and industry** from high energy prices
- **Reduce the influence of fossil fuels** on electricity prices
- **Limit the impact of price volatility** and regulatory intervention on investments
- **Increase flexibility resources** to support renewable integration



REVISED ELECTRICITY MARKET DESIGN

1. Protect and empower consumers

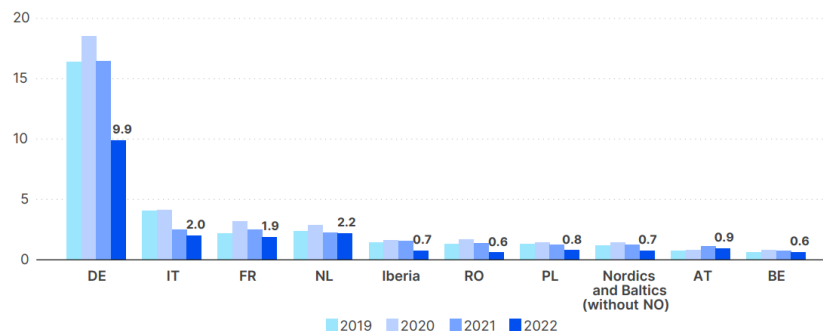
- **Right to fixed price contacts** added to existing right to dynamic price contracts.
- **Retail price regulation:** regulated retail prices for households and SMEs in the event of a crisis



Effect of emergency measures on retail prices. Source: VaasaEET

2. Reinforce long-term markets

- Support the development of **Power Purchase Agreements** (streamlined legislation, instruments to cover default risks, ...)
- Use of **Two-way contracts for Differences** (support schemes for new investments, redistribution mechanism of market revenues)
- **Improve liquidity of forward markets.**

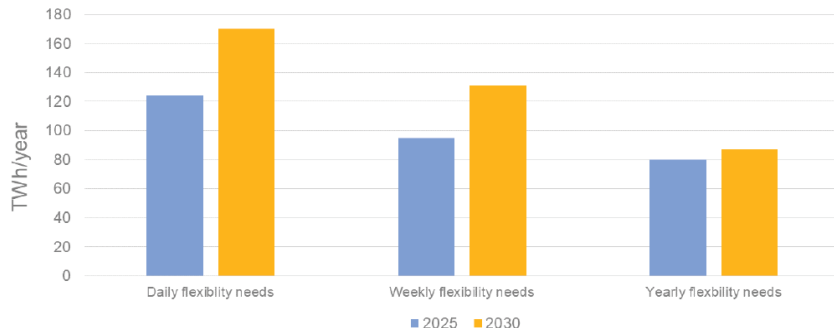


Churn factor in European forward markets. Source: ACER

REVISED ELECTRICITY MARKET DESIGN

3. Flexibility to support integration of renewables

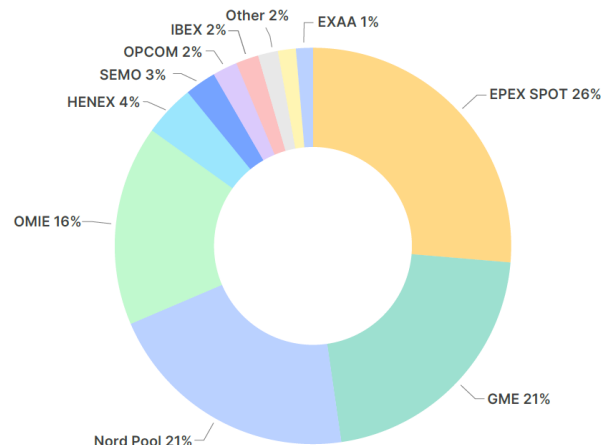
- **Definition of national objectives** for demand response and storage technologies.
- Possible application of **support schemes for non-fossil flexibility capacity**.
- **Clearer role of system operators** (new peak shaving product, transparency, network tariffs)



Flexibility needs of the EU system. Source: ACER

4. Market monitoring

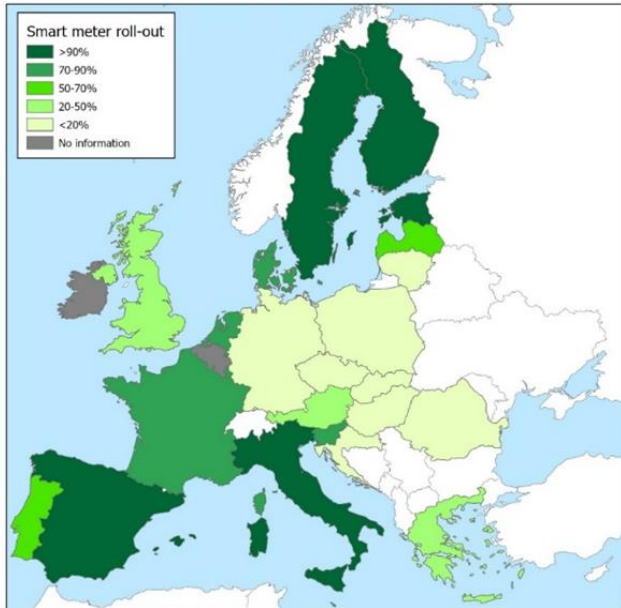
- Improving process for the **collection of inside information and market transparency**
- **Enhanced supervision** of reporting parties
- Stronger role for ACER in **investigations of significant cross-border anomalies**



Market share of main operators in day-ahead market

Source: ACER elaboration of REMIT data

SMART METERING DEPLOYMENT



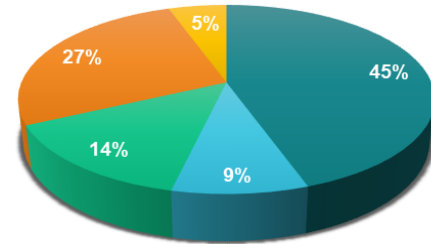
By 2020, **smart meters have covered 43% of the electricity consumers**, with a total of 123 million installed smart meters.

Estimation of **reaching 77% of European customers by 2024**.

Source: Vitiello, Andreadou, Ardelean, and Fulli (2022)*
* Data has been retrieved from published reports until 31/12/2021

At the level of DSOs:

EU Directives (2009, 2019) have been a great stimulus to the deployment of smart metering systems: **95% of distribution system operators (DSOs) have started implementing** a smart meter roll-out program (JRC DSOs Observatory 2022).



Status of smart meter roll-out by DSOs.

- Completed roll-out
- About to complete a roll-out
- Roll-out in progress
- Early stage/pilot
- No roll-out

Source: JRC DSOs Observatory 2022

CITIZENS' ENGAGEMENT: ENERGY COMMUNITIES

The EU legal framework recognises **Energy Communities**, enabling citizen-driven action, contributing to the **decarbonisation of the power system**, and allowing for **direct benefits to citizens**. Its reform (COM(2023) 148 final) will give **consumers the right to share renewable energy**:

- Consumers will have the **right to have injected electricity deducted from their total metered consumption**
- **System operators will need to collect, validate and communicate** relevant metering data

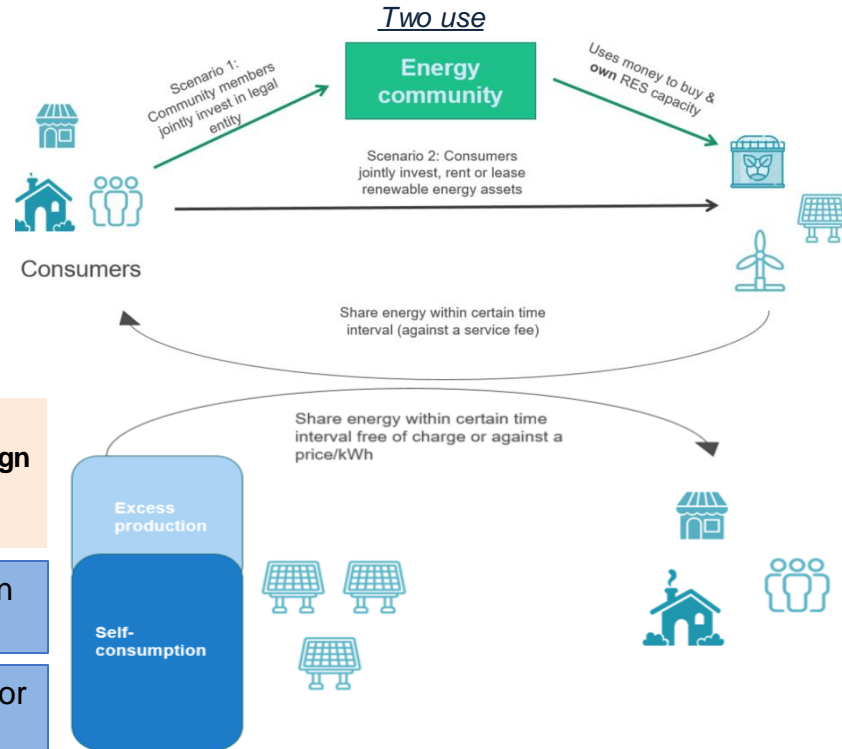
Renewable Energy Directive (2018) to empower Renewable Energy Communities

Directive on common rules for the internal market for electricity (2019) to enable active consumer participation

Revision of the Electricity market design (2023): to give right to share renewable energy

Energy Communities Repository: supporting local actors in the creation and management of energy communities in urban areas.

Rural Energy Community Advisory Hub: technical and admin. advice for creation of energy communities in rural areas.



Q&A and Discussion

Thank you for joining!



**Visit the Solutions
Center website**



**Visit the 21CPP
website**