R&I challenges and opportunities for secure, sustainable and competitive clean energy value chains

EC-JRC and IEA-EGRD Workshop

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EUROPE'S CHOICE

POLITICAL GUIDELINES
FOR THE NEXT EUROPEAN COMMISSION
2024−2029

Ursula von der Leyen

We need a new European Prosperity Plan to:

- *Make business easier and deepen our Single Market;*
- *Build a Clean Industrial Deal to decarbonise and bring down energy prices;*
- *Put research and innovation at the heart of our economy;*
- *Boost productivity with digital tech diffusion;*
- *Invest massively in our sustainable competitiveness;*
- *Tackle the skills and labour gap.*

Recent and upcoming Commission initiatives with R&I focus

- Competitiveness compass – January 2025
  - Clean Industrial Deal
- Start-up and scale-up strategy – May 2025
- European Strategy on Research and Technology Infrastructure – September 2025

- Upcoming
  - European Innovation Act
  - European Research Area Act
  - ….

What is the SET Plan?

The Strategic Energy Technology Plan (SET Plan) is a platform designed to accelerate the development, manufacturing and market uptake of clean, resilient and competitive energy technologies in Europe. Steered by the Member States and the European Commission, the platform brings together governments, industry and academia to align public and private research and innovation priorities on strategic energy technologies in Europe. It is the Energy Union's primary instrument for driving research, innovation, and competitiveness in the clean energy sector.

THE IMPLEMENTATION LANDSCAPE

2025	IWG	ETIP	CSA	EERA JOINT PROGRAMMES	INDUSTRIAL ASSOCIATION
	Solar photovoltaics	ETIP PV	-	JP PV	SolarPower Europe
	Concentrated solar technologies	-	CST4All (until September 2025)	JP CSP	ESTELA Solar
	Wind energy	ETIP Wind	SETIPWind (until August 2025)	JP Wind	WindEurope
	Geothermal energy	ETIP Geothermal	GEOTHERM FORA (until August 2025)	JP Geothermal	European Geothermal Energy Council
	Ocean energy	ETIP Ocean	SEETIPOcean (until July 2025)	JP Ocean Energy	Ocean Energy Europe
	Direct current technologies	-	DCforEU (until October 2025)	JP Smart Grids	ENTSO-E
	Positive energy districts	ECTP	-	JP Smart Cities	-
	Energy systems	ETIP Smart networks for energy transition	-	JP Smart Grids JP Energy Systems Integration	-
	Energy efficiency in buildings	Renewable Heating and Cooling Platform	IWG Buildings Secretariat (until August 2025)	-	European Construction and sustainable built environment Technology Platform (ECTP)
	Sustainable and efficient energy use in industry	-	SET-IndEU (until August 2025)	JP Energy Efficiency in Industrial Processes	A.SPIRE
	Batteries	Batteries Europe	-	JP Energy Storage	Batteries European Partnership Association (BEPA)
	Renewable fuels and bioenergy	ETIP Bioenergy	-	JP Bioenergy	-
	CCS – CCU	Zero Emissions Platform	CCUS Secretariat (until July 2025)	JP CCS	Carbon Capture and Storage Association (CCSA)
	Nuclear safety	Sustainable Nuclear Energy Technology Platform	SNETPFORWARD (until December 2025)	JP Nuclear Materials	nucleareurope
	TWG Hydrogen	-	SET4H2 (until April 2025)	JP Fuel Cells & Hydrogen	-

Source: SET Plan Progress Report 2025 - Strategic energy technologies for a competitive, secure and sustainable Europe

#HorizonEU

THE EU
RESEARCH & INNOVATION
PROGRAMME 2021 – 27

This presentation is based on the political agreement of 11 December 2020 on the Horizon Europe. Information on some parts is pending revision.

19 March 2021

Research and Innovation

Our Vision

The EU's key funding programme for research and innovation:

- Tackles climate change
- Helps to achieve the UN's Sustainable Development Goals
- Boosts the EU's competitiveness and growth
- Facilitates collaboration and strengthens the impact of research and innovation in developing, supporting and implementing EU policies while tackling global challenges
- Supports the creation and better diffusion of excellent knowledge and technologies
- Creates jobs, fully engages the EU's talent pool, boosts economic growth, promotes industrial competitiveness and optimises investment impact within a strengthened European Research Area.

Credits: https://www.un.org/sustainabledevelopment/sustainable-development-goals/

European Commission

Screening of H2020 and HE WPs for Competitiveness Indicators (ongoing; example of PV/solar)

Programme	WP	Call		KPI
Horizon 2020	WP 2014 – 2015	Competitive Low-Carbon Energy	LCE 3 – 2014/2015: Demonstration of renewable electricity and heating/cooling technologies	▪ Costs ▪ Efficiency ▪ Life cycle environmental impact ▪ EU energy security ▪ Reliability ▪ Manufacturing ▪ Creating jobs
	WP 2016 – 2017	Competitive Low-Carbon Energy – Renewable Energy Technologies	LCE-07-2016-2017: Developing the next generation technologies of renewable electricity and heating/cooling	▪ Costs ▪ Efficiency
			LCE-09-2016: Increasing the competitiveness of the EU PV manufacturing industry	▪ Manufacturing ▪ Supply chain ▪ Cost ▪ Efficiency
			LCE-10-2017: Reducing the cost of PV electricity	▪ Costs ▪ Efficiency ▪ Recycling
			LCE-11-2017: Near-to-market solutions for reducing the water consumption of CSP Plants	▪ Costs
	WP 2018 – 2020	Building A Low-Carbon, Climate Resilient Future: Secure, Clean And Efficient Energy – Global Leadership In Renewables	LC-SC3-RES-15-2019: Increase the competitiveness of the EU PV manufacturing industry	▪ Costs
			LC-SC3-RES-35-2020: Reduce the cost and increase performance and reliability of CSP plants	▪ Costs ▪ Efficiency ▪ TRL 6-8 ▪ Reliability
Horizon Europe	WP 2023 – 2025	Sustainable, secure and competitive energy supply	HORIZON-CL5-2023-D3-02-03: Industrial manufacturing for lower-cost solar thermal components and systems	▪ Costs ▪ Reduce emissions ▪ Circularity

Clean Energy Technology Observatory (CETO)

CETO is a Commission in-house project to

- monitor EU research and innovation activities on clean energy technologies needed for the delivery of the European Green Deal
- assess the competitiveness of the EU clean energy sector and its positioning in the global energy market and contribute to NZIA monitoring
- JRC runs CETO under an administrative agreement with DG RTD and in cooperation with DG ENER and DG GROW

- **CETO Reports 2024**
- CETO2025 Reports are coming online!

- **More on CETO** Clean Energy Technology Observatory - European Commission

European Commission

CETO: SWOT- PV

Table 1. CETO SWOT analysis for the competitiveness of photovoltaics.

Strengths	**Weaknesses**
– The EU is a technology leader in polysilicon as well as certain manufacturing equipment. – The EU has advanced and highly automated manufacturing techniques. – Strong EU support (under REPowerEU policy) and global markets. – Strong R&I activities regarding new materials (e.g. perovskites) and applications. – Low carbon footprint for EU sourced and produced PV modules.	– Energy and labour costs in the EU are significantly higher than for trading partners. – Planning procedures and permitting is too long, which increases costs. – Financing is a major issue to build PV production plants along the value chain. – Limited acceptance of low profit margins in value chain parts of PV manufacturing. – Shortage of skilled workers in case of strong growth of manufacturing and deployment in the EU. – Negative trade balance for the EU, particularly with China. – The limited support schemes for manufacturing do not follow the global market growth. – The EU has decreased its share in global inventions.
Opportunities	**Threats**
– The EU has several world-leading R&D clusters for silicon PV and thin film technologies. – PV manufacturing in the EU could be competitive under the condition that: i) it is done in large gigawatt-scale factories (economy of scale) and ii) these factories are fully integrated across all stages of the value chain (ingot, wafer, cell and module) and highly automated. – Creation of green jobs in both the manufacturing and the deployment sectors. – High automation in manufacturing will decrease labour costs.	– The economic availability of critical raw materials used in current module designs may be a limitation. – The concentration of large share parts of the supply chain in one country poses a risk for the security of supply and resilience of the industry. – More direct and targeted support schemes for manufacturing are being applied in the US (IRA) and India (PLI).

Source: JRC 2024

Photovoltaics in the European Union

As part of the Clean Energy Technology Observatory (CETO), this report on Photovoltaics (PV) is built on three sections: the technology state of the art, future developments and trends, the value chain analysis and the EU position and global competitiveness. PV is the fastest-growing source of...

European Commission

Study on R&I opportunities to strengthen EU clean energy security now and looking to 2050

Thomas Schleker (Ed.), Maarten de Vries and Susan Guthrie

Specific contract RTD/2022/SC/023 - Study on clean energy R&I opportunities to ensure European energy security by targeting challenges of distinct energy value chains for 2030 and beyond

Energy security assessment of clean energy value chains

Energy security indicators

- The energy security assessment of each value chain was carried out with ten energy security indicators. Each indicator was assigned a score from 1-3 (1: low risk, 3: high risk) for the intrinsic risk carried by the technology value chain.

List of energy security indicators
1. Geopolitical availability of Critical Raw Materials
2. Abundance of Critical Raw Materials or biomass
3. Circularity
4. Supply chain complexity
5. Supply chain location
6. Digital vulnerability
7. Physical vulnerability
8. Broader sustainability
9. Affordability
10. Skills

European Commission

R&I action plan: Priority group 1

Supply chain location and complexity

Batteries

Improving the energy efficiency of lithium-based battery manufacturing and recycling.

PV

Collaborative industry programme to increase the efficiency of silicon-based PV manufacturing in the EU.

Hydrogen

A call for solutions to increase the resilience of hydrogen value chains.

CRM abundance and availability

Energy Transmission & Distribution

Increasing circular economy processes, recycling and re-use of electronics for smart energy technologies.

Geothermal Energy

Implementing a 'design to recycling' scheme for geothermal energy.

Smart grids; Buildings & District Heating Tech

Increasing circular economy processes, recycling and re-use of electronics.

CRM

Research and public engagement on mining of critical raw materials.

Sustainability and other environmental impacts

Compressed Air Energy Storage (CAES)

Developing a better understanding of the potential locations for underground CAES.

Digital vulnerability

Smart grids; Building & District Heating Tech

Addressing cybersecurity risks.

European Commission

Horizon Europe – cluster 5 work programme 2025
Examples on topics targeting energy security:

- HORIZON-CL5-2026-02-D3-14: Development of innovative solutions strengthening the security of renewable energy value chains
  - Area 1- Sustainability and social awareness of specific renewable energy value chains as a limiting factor for their roll-out and performance over time (bioenergy or hydropower)
  - Area 2- Skills for renewable energy value chains as a limiting factor for innovation and deployment of relevant clean energy technologies;
  - Area 3- Complexity for specific renewable energy value chains (grid based RFNBOs and/or direct solar fuels)
  - 6M€ - 2M€/project – CSA
- HORIZON-CL5-2025-01-Two-Stage-D3-23: Critical elements for energy security of grid and storage technologies
  - Area 1- Advanced tools to address cybersecurity risks to 1) energy system transmission and distribution and 2) renewables to storage and storage to energy network interface technologies;
  - Area 2- Increasing circular economy processes, recycling, re-use or substitution of sustainably supplied critical materials and electronics for energy network and storage technologies;
  - Area 3- Sustainability and public perception of energy network and storage technologies as a limiting factor for their required capacity build-up and efficient performance in a secure energy system
  - 9M€ - 3M€/project – RIA

European Commission

Horizon Europe – work programme 2026-2027

- Co-creation process and consultations with Programme Committees started in early 2025
- Target publication: end 2025
- Advanced draft available online: https://ec.europa.eu/transparency/comitology-register/core/api/integration/ers/501306/107811/5/attachment
- Draft topic on competitiveness:

Targeting key value chain components for increasing the competitiveness of renewable energy technologies in Europe (RIA)

The structure of the new Horizon Europe

Pillar I
EXCELLENT SCIENCE

- EUROPEAN RESEARCH COUNCIL
- MARIE SKŁODOWSKA-CURIE ACTIONS
- SCIENCE FOR EU POLICIES

Pillar II
COMPETITIVENESS AND SOCIETY

COMPETITIVENESS[1] :

1. Clean Transition and Industrial Decarbonisation
2. Health, Biotech, Agriculture and Bioeconomy
3. Digital leadership
4. Resilience and Security, Defence Industry and Space

SOCIETY:

1. Global societal challenges
2. EU Missions
3. New European Bauhaus Facility

Pillar III
INNOVATION

- EUROPEAN INNOVATION COUNCIL
- INNOVATION ECOSYSTEMS AND THE KNOWLEDGE TRIANGLE

Pillar IV
EUROPEAN RESEARCH AREA

- ERA POLICIES
- RESEARCH AND TECHNOLOGY INFRASTRUCTURES
- WIDENING PARTICIPATION AND SPREADING EXCELLENCE

[1] Consistent with activities under the European Competitiveness Fund

Thank you

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