



**FUSION
FOR
ENERGY**

EPS 2025 POSITION PAPER ON ENERGY

Energy: A Foundation for Prosperity and Stability

Alfredo Portone, EPS Energy Group Chair

On behalf of EPS and its Energy Group

15th May 2026





“The pooling of coal and steel production... will change the destinies of those regions which have long been devoted to the manufacture of munitions of war, of which they have been the most constant victims.” Robert Schuman’s Declaration, 9 May 1950.

Energy plays a crucial role in economic development and stability and has long been a strategic priority for Europe. Since the creation of the European Coal & Steel Community and Euratom, EU energy policy has been shaped by technical, economic, environmental, political, and societal considerations.

- **World energy consumption.** Fossil fuels supply $\cong 80\%^*$ of world's primary energy (stable % over past 30 y). Transitioning to alternative solutions is key for EU that imports $\cong 80\%$ of gas and over 90% of oil.
- **Global emissions & Paris Agreement (2015).** EU is leading the path to de-carbonisation. Indeed, from 1990 to 2022:
 - EU-27 reduced its GHG emissions by 33%. Partial decarbonisation of EU electricity sector contributed to such GHG emission reduction (wind, solar and nuclear technologies) with fossil fuel backup systems necessary to compensate VRES#.
 - EU-27 global share of GHG emissions dropped from 16% to 7% due to the implementation of energy policies, industrial carbon leakage and development of other nations.
 - Global world emissions increased by 65% ... and they continue to increase....

* [Energy Institute latest figure](#) $\cong 87\%$

VRES = Variable Renewable Energy Sources

EPS 2025 POSITION PAPER ON ENERGY EMISSIONS AND THE WORLDWIDE CONTEXT

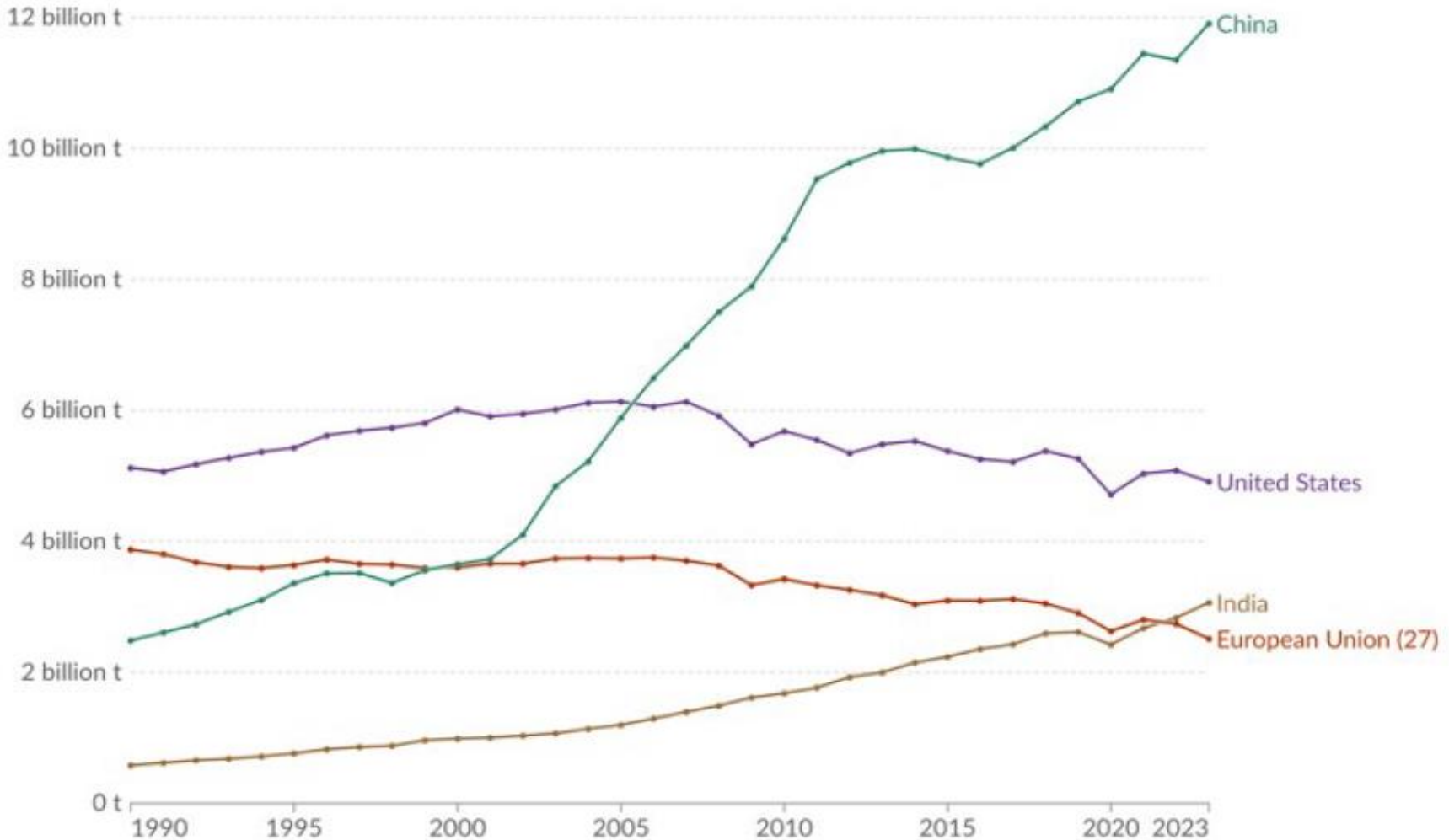


FUSION FOR ENERGY

Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry. Land-use change is not included.

Our World in Data

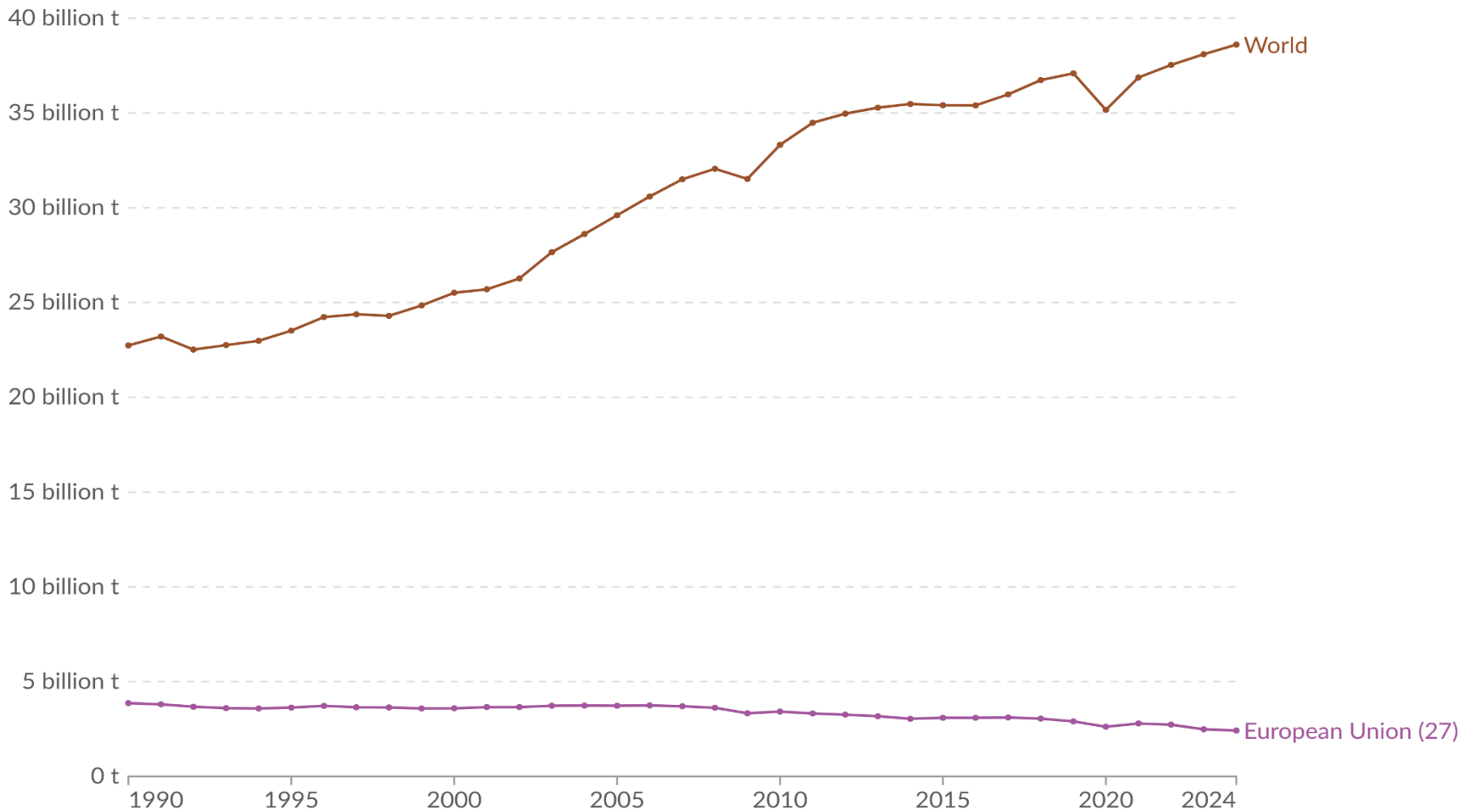


Data source: Global Carbon Budget (2024)

OurWorldinData.org/co2-and-greenhouse-gas-emissions | CC BY

Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land-use change emissions² are not included.

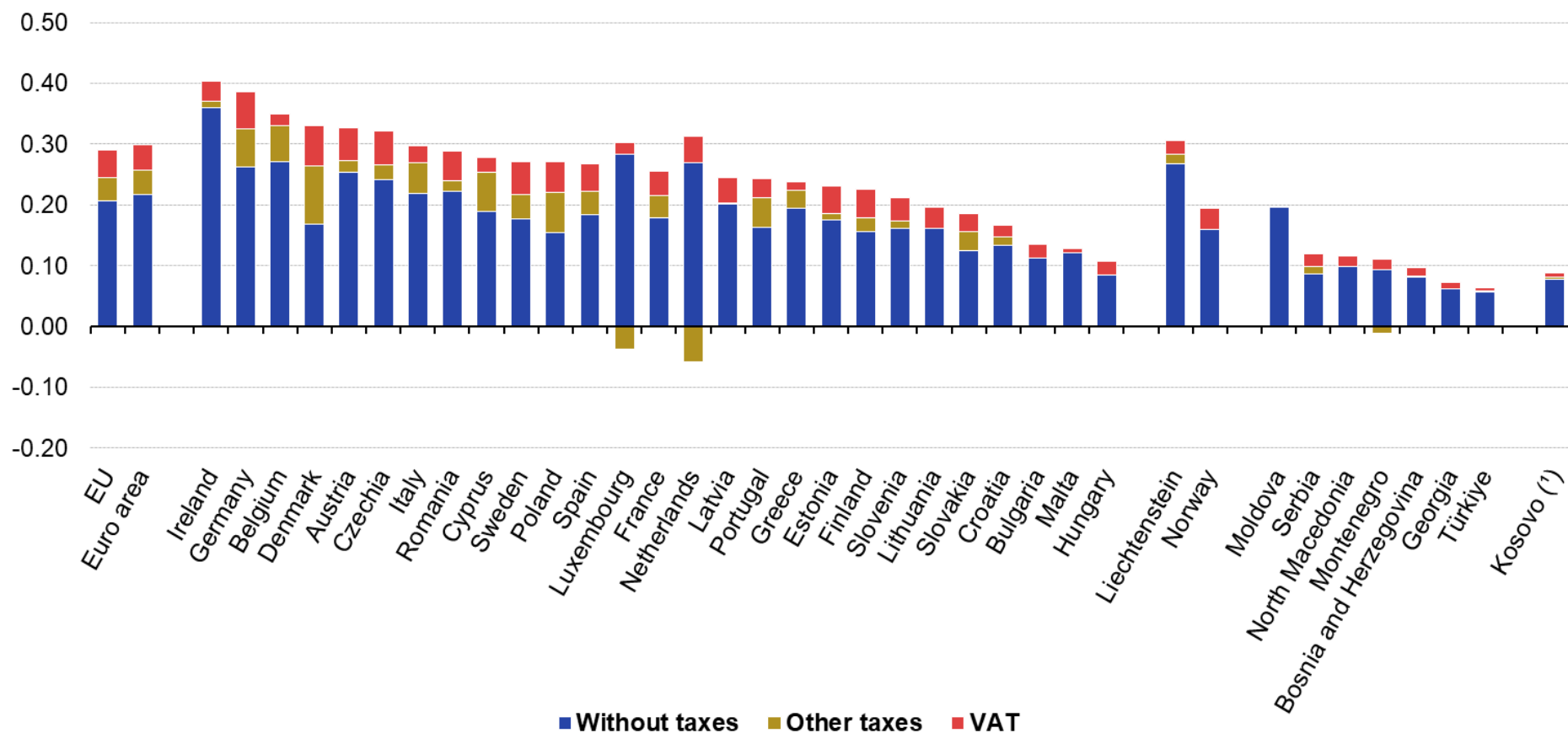


NET zero. To reduce EU emissions to net zero by 2050, EU plans to increase its share of VRES, requiring, according to most recent EC estimate, \cong €10 trillion investment by 2040. While VRES contribute to decarbonisation, *increasing their share of the electric energy market poses significant challenges*. Ensuring a continuous, affordable, and reliable energy supply requires the following points to be addressed:

- a) **Grid stability and thermal energy supply remain major challenges for high shares of VRES.** Until affordable large-scale storage becomes available, flexible dispatchable sources—mainly gas plants—will still be needed for backup, creating both cost and decarbonisation challenges.
- b) **Carbon Capture and Storage (CCS) reduces efficiency and increases costs.** Despite years of development, CCS has shown limited progress and is increasingly viewed as an unsuitable long-term decarbonisation solution.
- c) **Hydrogen-based electricity storage faces major efficiency and scaling limitations.** Low overall conversion efficiency combined with variable renewable output raises serious concerns about cost & practicality of large-scale H₂ deployment for power generation.
- d) **Critical raw materials are becoming strategically essential for the energy transition.** Clean energy technologies increasingly depend on secure access to critical minerals and rare earth elements.

EPS 2025 POSITION PAPER ON ENERGY ELECTRICITY PRICES

Electricity prices for household consumers, second half 2025
(€ per kWh)



(*) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.

Source: Eurostat (online data code: nrg_pc_204)

EPS 2025 POSITION PAPER ON ENERGY ELECTRICITY PRICES



Country	Residential (\$/kWh)	Business (\$/kWh)	vs. World Average
United States	~\$0.15-0.16	~\$0.12	Near average
China	~\$0.08	~\$0.09	~50% below
Japan	~\$0.25-0.28	~\$0.18	+50-65% above
Germany	~\$0.41	~\$0.24	+140% above
India	~\$0.08-0.10	~\$0.10-0.12	~40-50% below
Brazil	~\$0.12-0.14	~\$0.10	~20% below
United Kingdom	~\$0.35-0.40	~\$0.28	+100%+ above
France	~\$0.26	~\$0.18	+50% above
Canada	~\$0.12	~\$0.10	~30% below
Australia	~\$0.25-0.30	~\$0.18	+50-75% above

<https://www.globalelectricity.org/electricity-prices-by-country/>

Data compiled from multiple sources including GlobalPetrolPrices, Eurostat, and EIA

- **Germany** leads Europe—and the world among major economies—with residential electricity prices reaching **€0.38 per kWh** (approximately **\$0.41/kWh**) in the first half of 2025, according to Eurostat data. This represents a 34% premium *above the EU average of €0.29/kWh*. German consumers face a unique combination of:
 - **Renewable energy surcharges:** the Energiewende (energy transition) policy has added costs to support renewable deployment
 - **High grid fees:** extensive infrastructure investments to accommodate distributed generation
 - **Significant tax burden:** Taxes and levies account for a substantial portion of the final price
- **China's electricity prices are approximately half those of the United States**, reflecting the country's abundant coal resources, state-controlled utility sector, and strategic priority of maintaining industrial competitiveness.
- In contrast, prices in **Japan and Germany** are significantly higher due to their unique energy circumstances—Japan's post-Fukushima reliance on imported LNG and Germany's ambitious renewable energy transition

ON THE BASIS OF THE

1. Decarbonisation level already reached by the EU,
2. NET ZERO challenges (see slide 6)
3. Electricity costs

WE RECOMMEND SHIFTING PRIORITIES TO ENHANCE THE ENERGY SYSTEMS:

- A. Security of supply
- B. Affordability
- C. Sustainability

- 1. Diversification of Energy Strategies.** The 1955 Messina Declaration and Article 194(2) of Lisbon Treaty highlight *energy security and national control over energy mix*. Diversifying energy sources improves supply security, cost stability, and resource use, supporting long-term sustainable development.
- 2. Advancement of Nuclear Energy.** Euratom Treaty supports nuclear energy for energy security. Extending existing reactors and developing Gen III+, Gen IV, SMRs, breeder reactors, fuel recycling, and fusion can strengthen energy independence and reduce resource constraints. (*Shifting political landscape taking place: German Chancellor declared nuclear exit a serious error. Belgian government wishes to restart all stopped nuclear plants,*).
- 3. Support to Energy Research.** Electrification calls for *resilient electricity systems*. Investments in storage, smart grids, efficiency and diverse energy technologies enhance competitiveness, enable energy transition & economic resilience via scalable, sustainable solutions.
- 4. Thermal Energy.** Industry and buildings rely heavily on gas for heat. While alternatives are developing, natural gas remains a key transitional and industrial feedstock, requiring efficient use and reduced dependency due to import reliance.
- 5. Public Awareness and Education.** Clear, fact-based energy education improves public understanding and supports informed debate. Education on energy systems, technology, and sustainability helps build engagement in energy policy decisions.

References

1. Energy Institute, June 2024. [Online]. Available: <https://www.energyinst.org/statistical-review>.
2. Eurostat, "Energy Imports dependency," [Online]. Available: https://doi.org/10.2908/NRG_IND_ID.
3. M. Baude, M. Herry, M. Bérengère and I. Richaud, "Key Figures on Climate - France, Europe and Worldwide," 2024. [Online]. Available: <https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/chiffres-cles-du-climat/en/part3-how-much-greenhouse-gas-is-emitted-in-europe>.
4. M. Crippa, D. Guizzardi, E. Schaaf, R. Quadrelli and F. Monforti-Ferrario, "GHG emissions of all world countries – 2023," Publications Office of the European Union" 2023. [Online]. Available: <https://data.europa.eu/doi/10.2760/953322>
5. European Parliament, 2021. [Online]. Available: <https://www.europarl.europa.eu/topics/en/article/20210303STO99110/carbon-leakage-preventing-firms-from-avoiding-emissions-rules>.
6. Crippa, M., Guizzardi, D., Pagani, F., Banja, M., Muntean, M. et al., *GHG emissions of all world countries – 2025*, Publications Office of the European Union, 2025, <https://data.europa.eu/doi/10.2760/9816914>.
7. Action Plan for Affordable Energy Unlocking the true value of our Energy Union to secure affordable, efficient and clean energy for all Europeans COM/2025/79 final," EU Commission, February 2025. [Online]. Available: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52025DC0079>
8. Nuclear Energy Agency, "The Costs of Decarbonisation: System Costs with High Shares of Nuclear and Renewables," 2019.[Online]. Available: https://www.oecd-nea.org/jcms/pl_15000/the-costs-of-decarbonisation-system-costs-with-high-shares-of-nuclear-and-renewables?details=true.
9. F. Delprat-Jannaud, "CO2 capture and storage," *Reflets de la Physique*, 2024.
10. EUROPEAN COURT OF AUDITORS, "Special report No 24/2018: Demonstrating carbon capture and storage and innovative renewables at commercial scale in the EU: intended progress not achieved in the past decade," 2018. [Online]. Available: <https://www.eca.europa.eu/en/publications?did=47082>
11. S. Furfari, *The Hydrogen Illusion*, 2020
12. M. Draghi, "The future of European competitiveness," 2024. [Online]. Available: https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en.
13. Archives historiques du Conseil de l'Union européenne, "The Messina Declaration,« 1955. [Online].Available: https://www.cvce.eu/obj/resolution_adopted_by_the_foreign_ministers_of_the_ecsc_member_states_messina_1_to_3_june_1955-en-d1086bae-0c13-4a00-8608-73c75ce54fad.html.
14. European Commission, "Green Paper - Towards a European strategy for the security of energy supply /* COM/2000/0769 final */," 2000. [Online]. Available: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:52000DC0769>
15. European Union , "Euratom Treaty (CONSOLIDATED VERSION OF THE TREATY ESTABLISHING THE EUROPEAN ATOMIC ENERGY COMMUNITY)," 2016. [Online]. Available: <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:12016A/TXT&qid=1700135847292>.
16. European Physical Society, "Energy For the Future the Nuclear Option," 2007. [Online]. Available: <https://www.eps.org/wp-content/uploads/2025/01/Energy-for-the-Future-The-Nuclear-Option.pdf>

1. The EPS position paper has been conceived to be based on data and observations **NOT** on political issues. Our goal, as main Authors, was to outline possible solutions based on scientific facts **not lying within political boundaries** set by EU policy-making institutions.
2. On emissions, as Scientists, we strive to look at the problem in its correct proportions, and this includes **evaluating costs/benefits of what EU can achieve** by looking at its own emissions, which are about 7% of the global CO₂ emissions.
3. Addressing the broad, multi-faceted issues associated to energy transition, including economics and social aspects should be perceived as **an added value that EPS can bring to the energy debate**.
4. In this context Europe's best scientific contribution to lower global GHG emissions lies in the development of **cheap, scalable, dispatchable, clean energy solutions while ensuring a secure and safe energy supply**.

OTHER EPS ENERGY GROUP ACTIONS

1. Support to education of students on general energy topics

- (a) [SIF/EPS Energy School, Varenna](#) (23-28 June 2025)
- (b) [F4E/EPS Energy School, Barcelona](#) (15-19 June 2026)

2. Group Biennial Meetings

Cadarache ITER fusion reactor (14-15 May 2024)



Villa Rufolo, Ravello (29th September 2026)



F4E/EPS ENERGY SCHOOL

BARCELONA 15-19 JUNE 2026



F4E/EPS ENERGY SCHOOL 2026

15-19 JUNE, 2026

LECTURES PROGRAMME

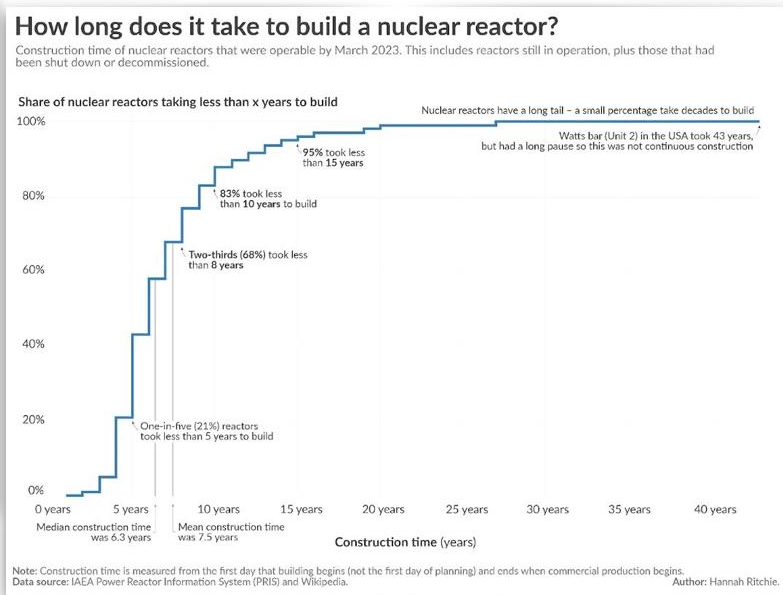
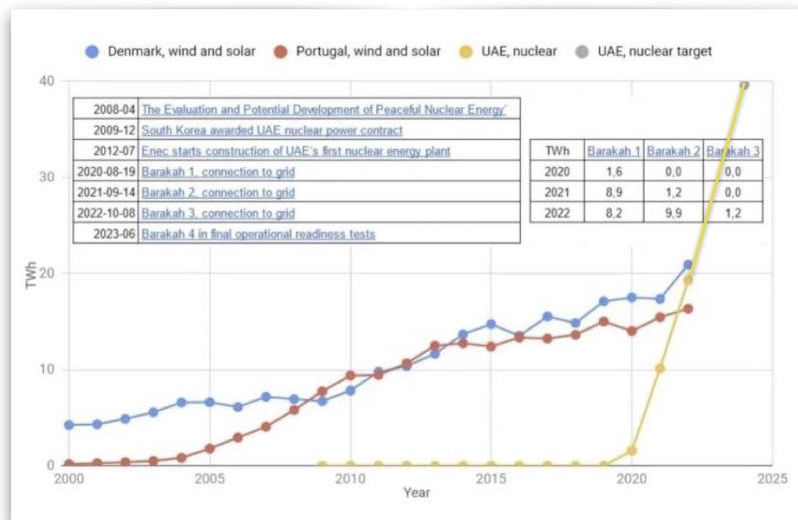
	Monday 15/6	Tuesday 16/6	Wednesday 17/6	Thursday 18/6	Friday 19/6
09:00-10:00	Registration and Welcome (F4E/EPS)	Solar photovoltaic (F. Buzzi)	Nuclear fission (M. Ripani)	Energy economy (C. Stagnaro)	Optimized energy scenarios (G. Zollino)
10:00-11:00	Course Introduction (A. Portone)	Solar photovoltaic (F. Buzzi)	Nuclear fission (M. Ripani)	Energy economy (C. Stagnaro)	Optimized energy scenarios (G. Zollino)
11:00-12:00	Principles of thermo-dynamics (F. Buzzi)	Wind (G. Tzounas)	Nuclear fusion (J. Ongena)	Energy policies (M. Deffrennes)	General discussion
12:00-13:00	Principles of thermo-dynamics (F. Buzzi)	Wind (G. Tzounas)	Nuclear fusion (J. Ongena)	Energy policies (M. Deffrennes)	Student feedback
13:00-14:00	LUNCH				
14:00-15:00	Principles of energy transmission (F. Milano)	Gas (S. Furfari)	Biofuels, biomass and waste to energy (J Woods)	Impact on health (F. Forastiere)	
15:00-16:00	Principles of energy transmission (F. Milano)	Coal (S. Furfari)	Solar thermal and thermal storage (M. Petrollese)	Impact on health (F. Forastiere)	
16:00-17:00	Principle of energy generation (S. Furfari)	Energy Storage: batteries (F. Milano)	Geothermal power (J. Kristiansen Nøland)	Communication In science (L. Romano)	
17:00-18:00	Principle of energy generation (S. Furfari)	Hydrogen technologies: energy storage (A. Taraco)	Hydro power (J. Kristiansen Nøland)	Communication In science (L. Romano)	
20:00-22:00				SOCIAL DINNER	





**THANK YOU FOR
THE ATTENTION**

Timescales of building NNPs



<https://zionlights.substack.com/p/barakah-nuclear-energy-blessing>

<https://www.ewec.ae/en/power-plant/barakah-nuclear-energy-plant>

<https://www.sustainabilitybynumbers.com/p/nuclear-construction-time>