

# L'Avvocato dell'Atomo

28.03.2024 Audizione Camera X commissione

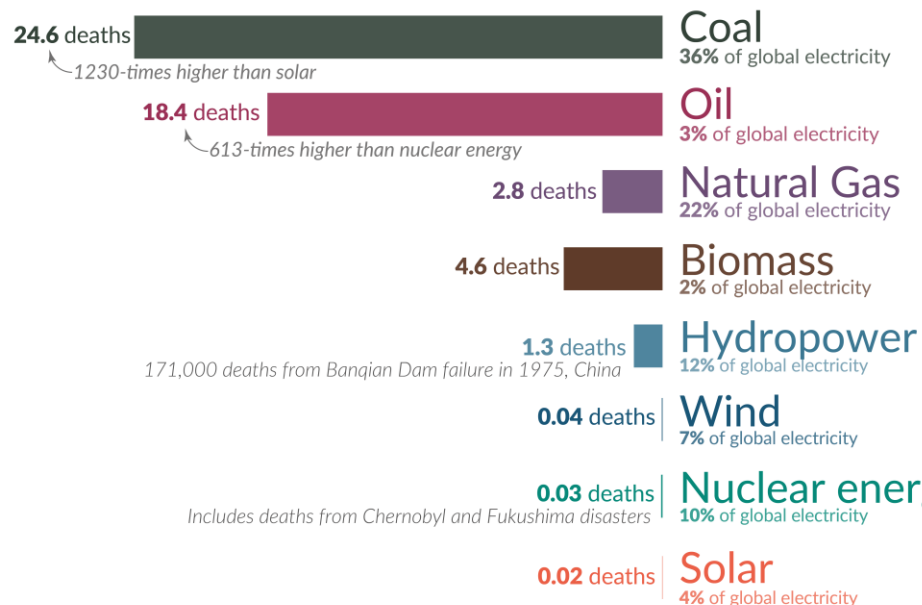
**Luca Romano**

# Morti/TWh

## What are the **safest** and **cleanest** sources of energy? Our World in Data

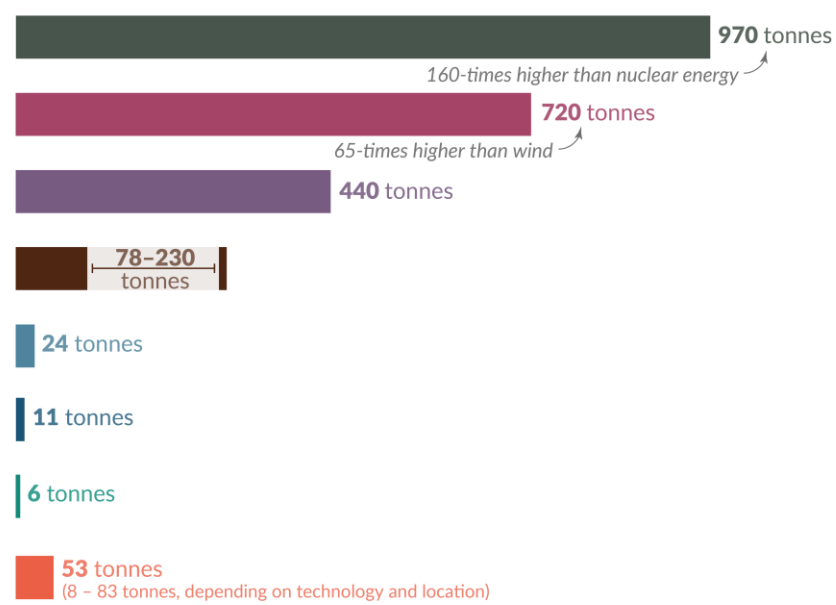
### Death rate from accidents and air pollution

Measured as deaths per terawatt-hour of electricity production.  
1 terawatt-hour is the annual electricity consumption of 150,000 people in the EU.



### Greenhouse gas emissions

Measured in emissions of CO<sub>2</sub>-equivalents per gigawatt-hour of electricity over the lifecycle of the power plant.  
1 gigawatt-hour is the annual electricity consumption of 150 people in the EU.



Death rates from fossil fuels and biomass are based on state-of-the-art plants with pollution controls in Europe, and are based on older models of the impacts of air pollution on health. This means these death rates are likely to be very conservative. For further discussion, see our article: [OurWorldinData.org/safest-sources-of-energy](https://ourworldindata.org/safest-sources-of-energy). Electricity shares are given for 2021. Data sources: Markandya & Wilkinson (2007); UNSCEAR (2008; 2018); Sovacool et al. (2016); IPCC AR5 (2014); UNECE (2022); Ember Energy (2021).

[OurWorldinData.org](https://ourworldindata.org) - Research and data to make progress against the world's largest problems.

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# Emissioni-fake

## How does electricity affect the environment?

CO<sub>2</sub> equivalent (gram per kilowatt-hour)\*

~1,034  
Brown coal (lignite)

~864  
Hard coal (anthracite)

~442  
Natural gas

~117  
Nuclear

~33  
Photovoltaic\*

~9  
Onshore wind farms\*\*

~7  
Offshore wind farms\*\*

~4  
Hydropower

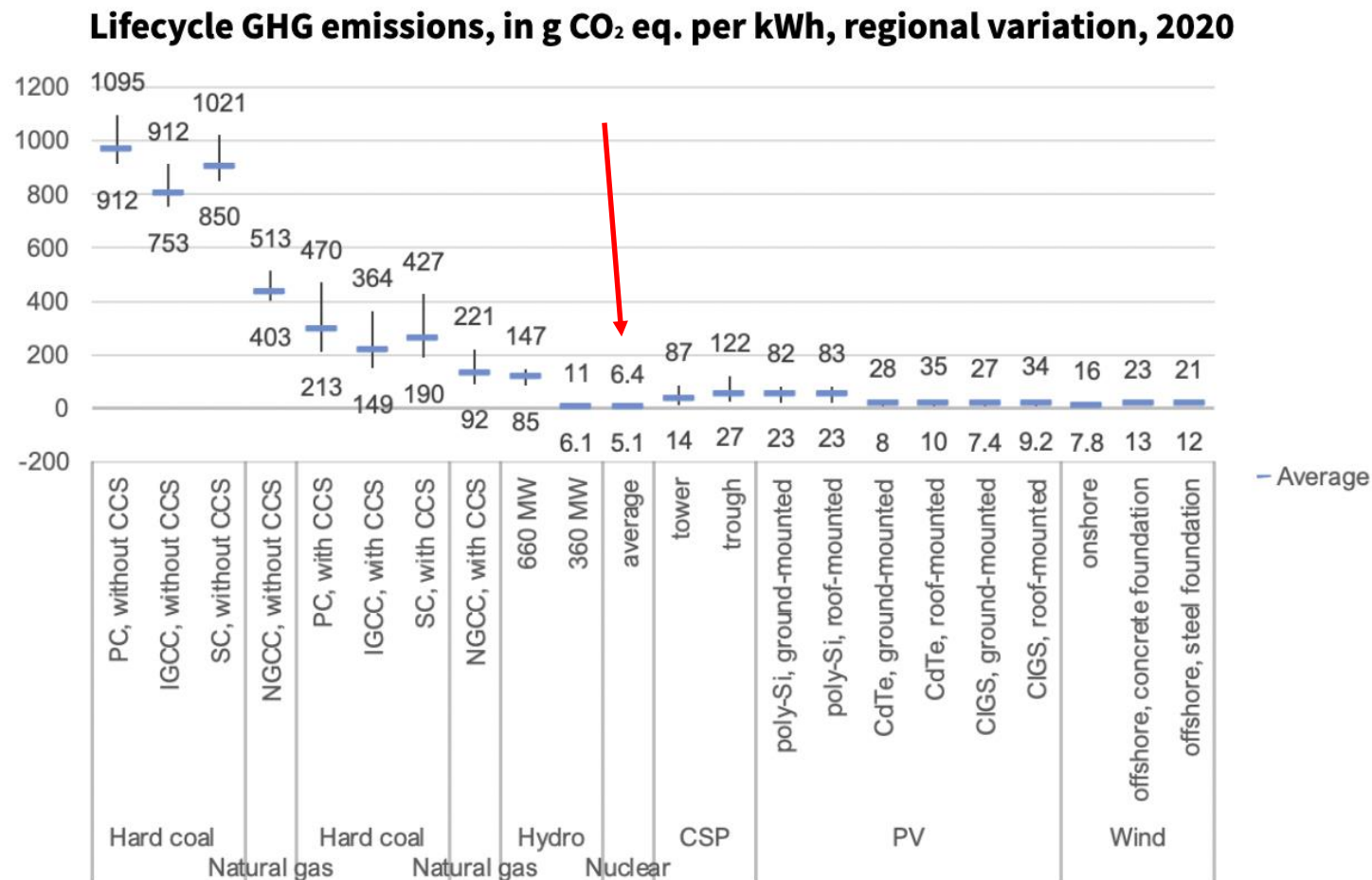
\* *complete life cycle*

\*\* *solar panels using silicon*

\*\*\* *most recent generation of wind turbines*

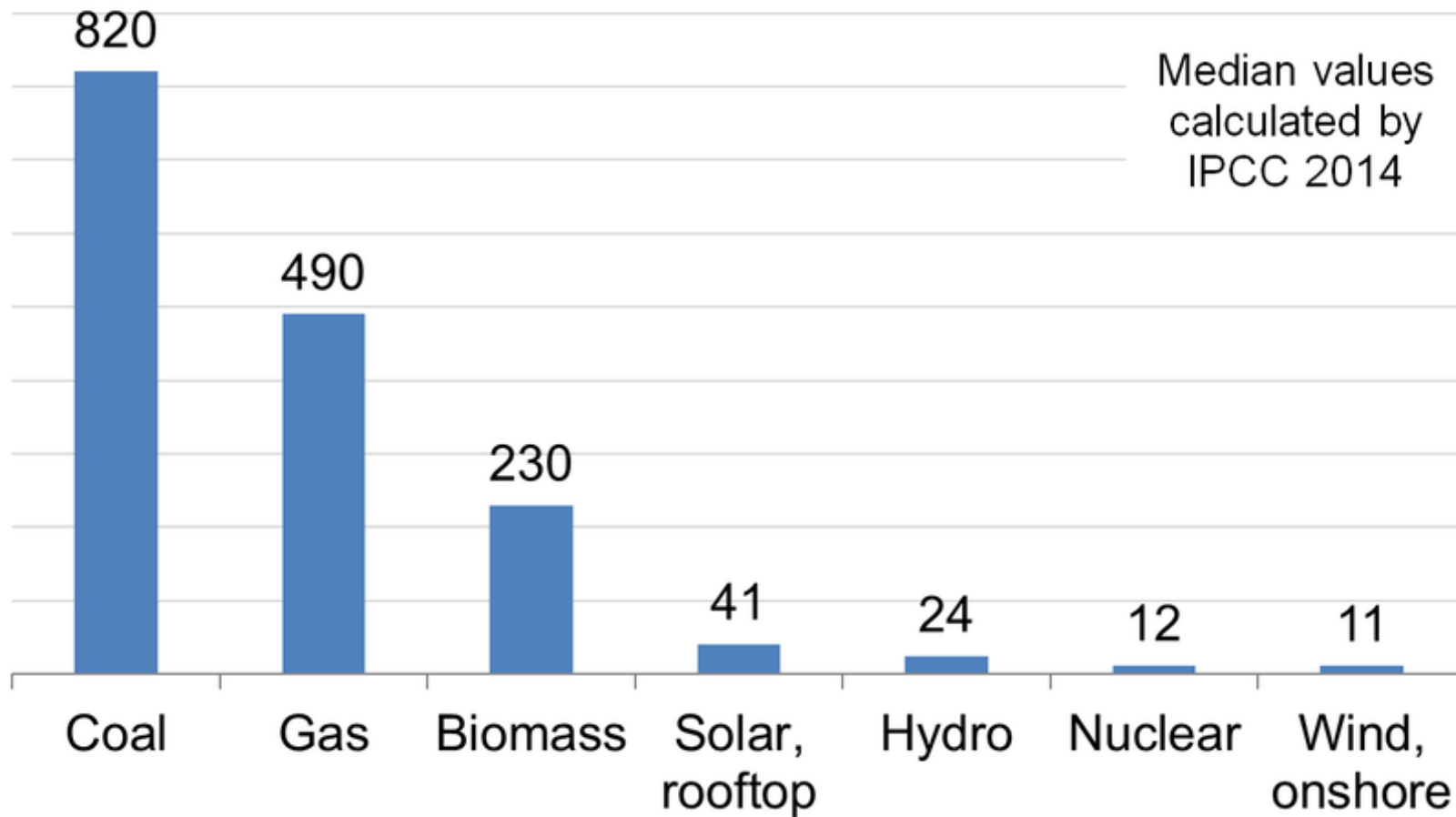
# Emissioni

**Figure 1** Lifecycle greenhouse gas emission ranges for the assessed technologies



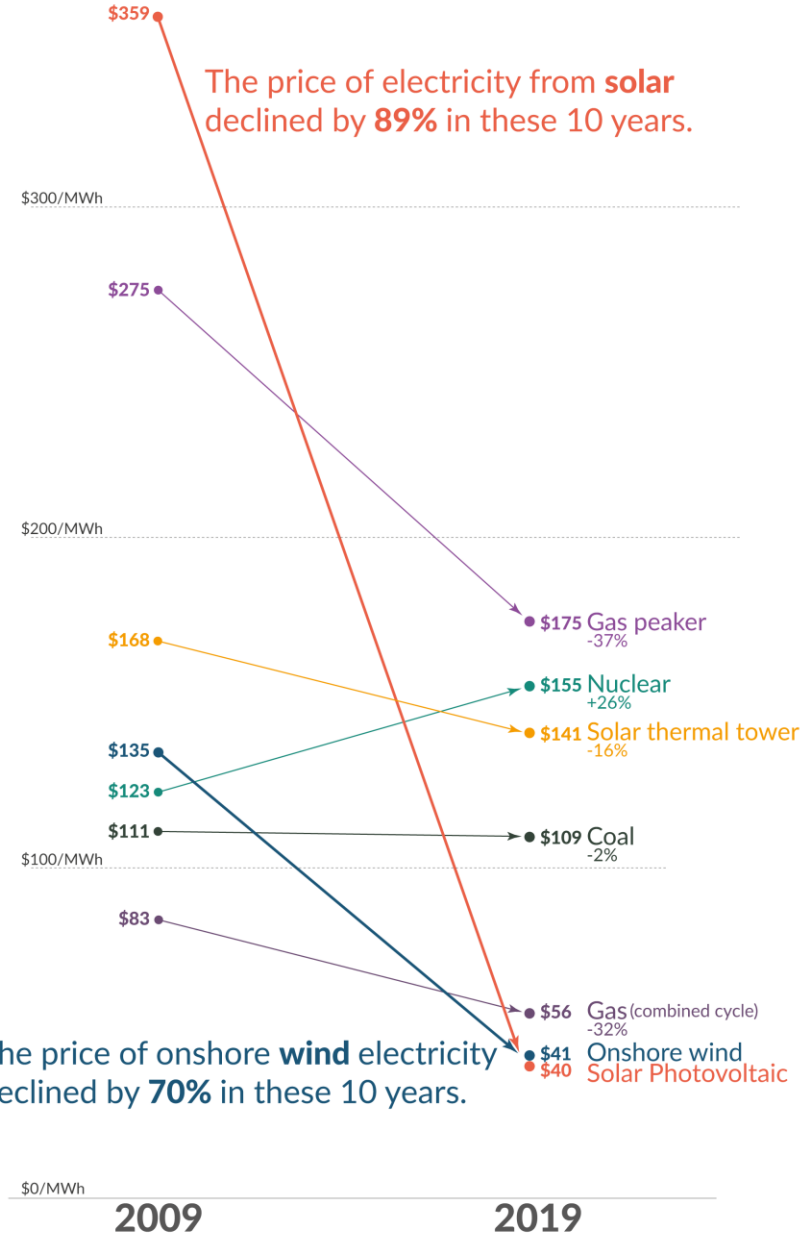
# Emissioni

Lifecycle CO<sub>2</sub>-equivalent emissions (g/kWh)



# Costi

The price of electricity from new power plants  
Electricity prices are expressed in 'levelized costs of energy' (LCOE).  
LCOE captures the cost of building the power plant itself as well as the ongoing costs for fuel and operating the power plant over its lifetime.

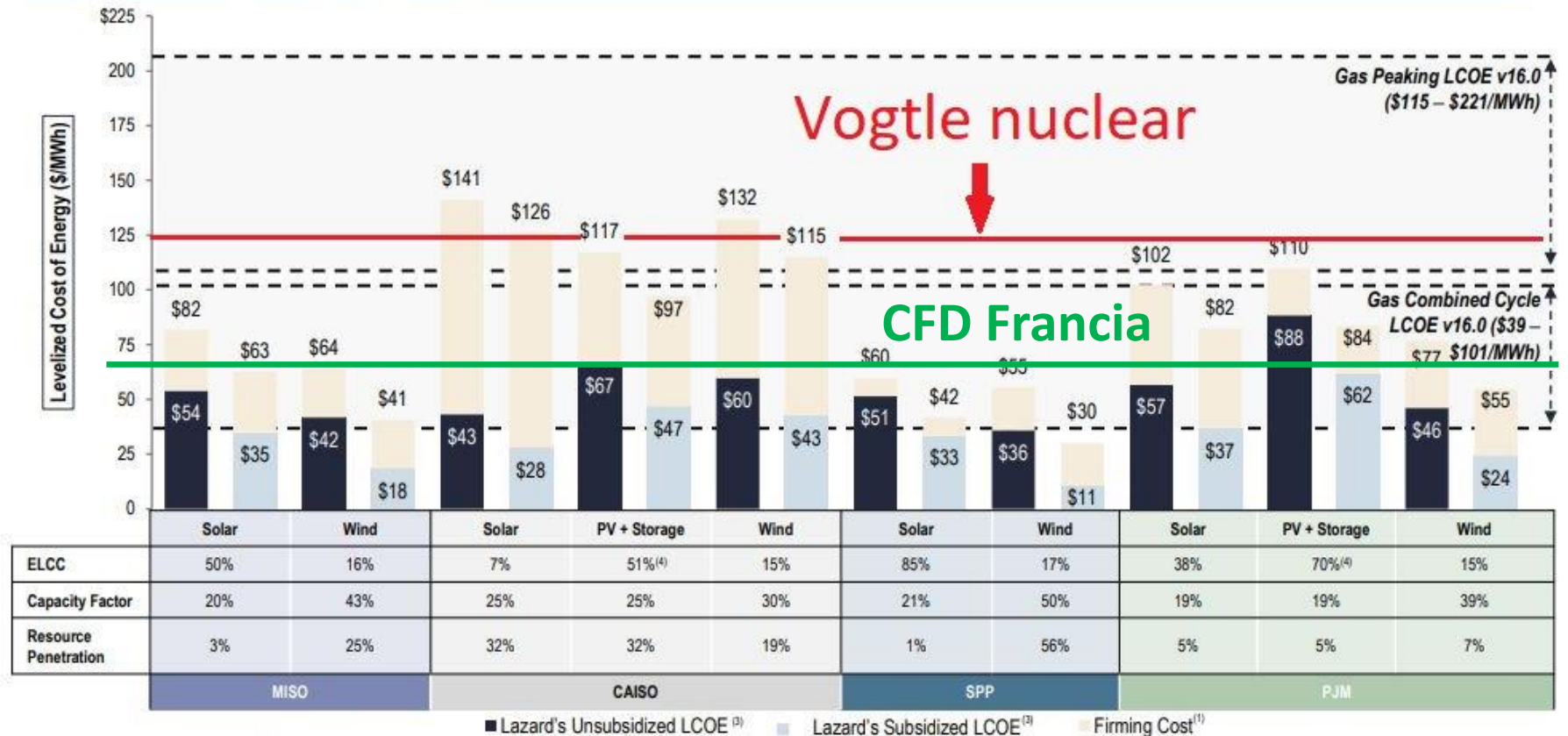




## Levelized Cost of Energy Comparison—Cost of Firming Intermittency

The incremental cost to firm<sup>(1)</sup> intermittent resources varies regionally, depending on the current effective load carrying capability (“ELCC”)<sup>(2)</sup> values and the current cost of adding new firming resources—carbon pricing, not considered below, would have an impact on this analysis

LCOE v16.0 Levelized Firming Cost (\$/MWh)<sup>(3)</sup>



Source: Lazard and Roland Berger estimates and publicly available information.

- (1) Firming costs reflect the additional capacity needed to supplement the net capacity of the renewable resource (nameplate capacity \* (1 - ELCC)) and the net cost of new entry (net "CONE") of a new firm resource (capital and operating costs, less expected market revenues). Net CONE is assessed and published by grid operators for each regional market. Grid operators use a natural gas CT as the assumed new resource in MISO (\$8.22/kW-mo), SPP (\$8.56/kW-mo) and PJM (\$10.20/kW-mo). In CAISO, the assumed new resource is a 4 hour lithium-ion battery storage system (\$18.92/kW-mo). For the PV + Storage cases in CAISO and PJM, assumed Storage configuration is 50% of PV MW and 4 hour duration.
- (2) ELCC is an indicator of the reliability contribution of different resources to the electricity grid. The ELCC of a generation resource is based on its contribution to meeting peak electricity demand. For example, a 1 MW wind resource with a 15% ELCC provides 0.15 MW of capacity contribution and would need to be supplemented with 0.85 MW of additional firm capacity in order to represent the addition of 1 MW of firm system capacity.
- (3) LCOE values represent the midpoint of Lazard's LCOE v16.0 cost inputs for each technology adjusted for a regional capacity factor to demonstrate the regional differences in both project and firming costs.
- (4) For PV + Storage cases, the effective ELCC value is represented. CAISO and PJM assess ELCC values separately for the PV and storage components of a system. Storage ELCC value is provided only for the capacity that can be charged directly by the accompanying resource up to the energy required for a 4 hour discharge during peak load. Any capacity available in excess of the 4 hour maximum discharge is attributed to the system at the solar ELCC. ELCC values for storage range from 90% - 95% for CAISO and PJM.



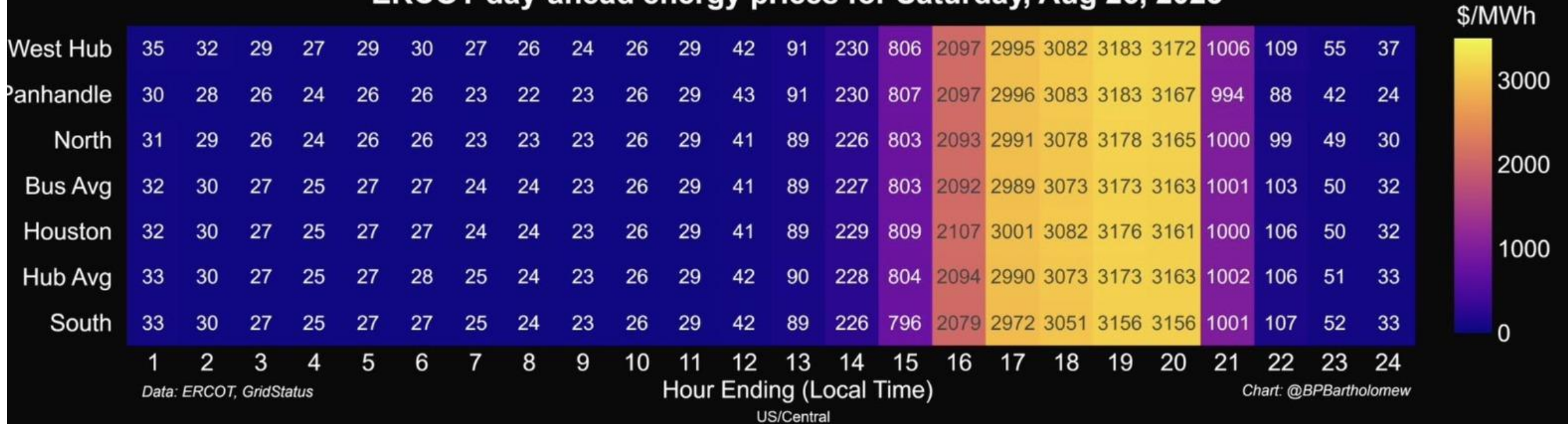
# Costi Vs Prezzi

Ora	14
Prezzo (€/MWh)	0,62



# Costi Vs Prezzi

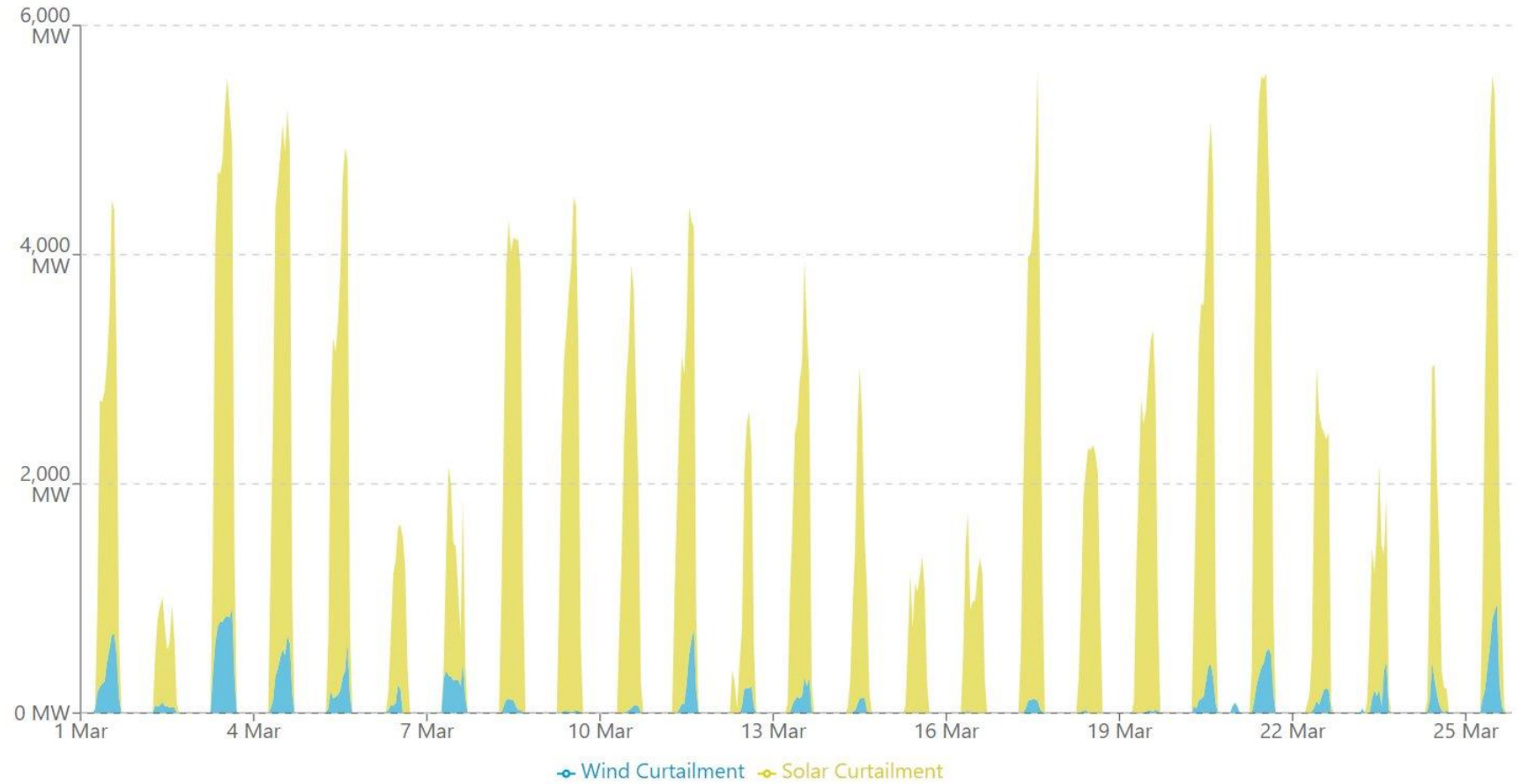
ERCOT day-ahead energy prices for Saturday, Aug 26, 2023



# Costi Vs Prezzi e sprechi

Curtailment - CAISO

Mar 1 - Mar 27, 2024 US/Pacific



Source: CAISO, GridStatus.io. Data is released around 10am PT for the previous day

# Costi Vs Prezzi

<b>Mountain</b>	<b>13.33</b>	<b>12.78</b>	<b>10.48</b>
Arizona	14.11	12.62	11.46
Colorado	14.26	14.20	10.84
Idaho	10.79	10.58	8.64
Montana	11.98	10.73	11.62
Nevada	16.38	16.81	11.15
New Mexico	13.76	13.53	10.54
Utah	10.85	10.65	8.04
Wyoming	10.86	10.28	9.52
<b>Pacific Contiguous</b>	<b>21.11</b>	<b>19.48</b>	<b>19.11</b>
California	29.49	26.48	22.93
Oregon	13.84	12.04	11.20
Washington	11.09	10.48	10.52
<b>Pacific Noncontiguous</b>	<b>34.01</b>	<b>33.37</b>	<b>31.16</b>
Alaska	23.78	21.68	21.31
Hawaii	44.28	44.96	42.20
<b>U.S. Total</b>	<b>15.45</b>	<b>15.47</b>	<b>12.68</b>

See Technical notes for additional information on the Commercial, Industrial, and Transportation sectors.

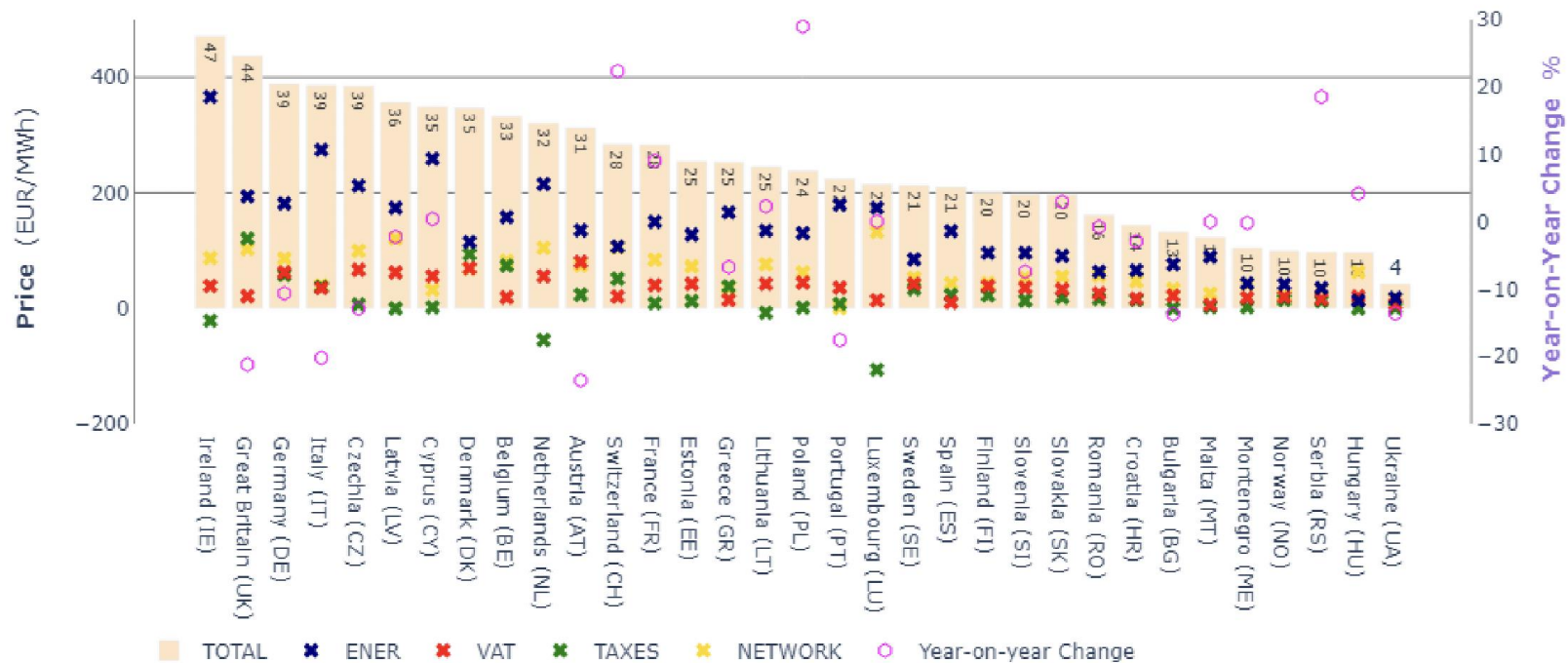
Notes: - See Glossary for definitions. - Values are preliminary estimates based on a cutoff model sample.

See Technical Notes for a discussion of the sample design for EIA-826.

Utilities and energy service providers may classify commercial

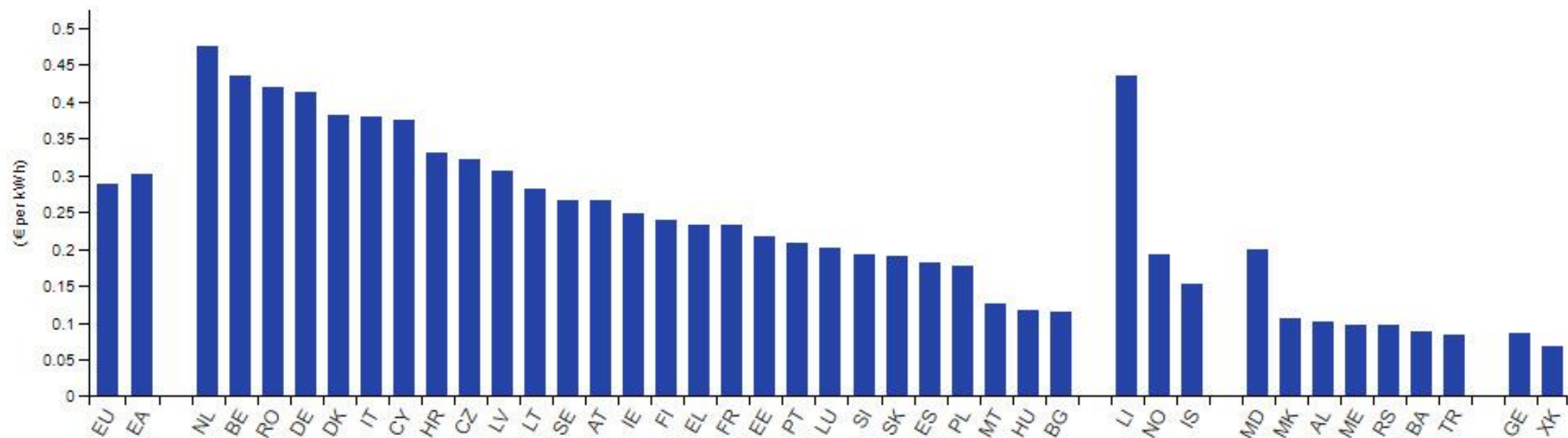
# Costi Vs Prezzi

Figure 27 – The Household Energy Price Index (HEPI) in European capital cities in Eurocents per kWh, Q3 2023



# Costi Vs Prezzi

Electricity prices for household consumers, first half 2023



Kosovo (XK): 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 codes: nrg\_pc\_204)



# Costi Vs Prezzi

## Germany loses manufacturing crown

2015=100

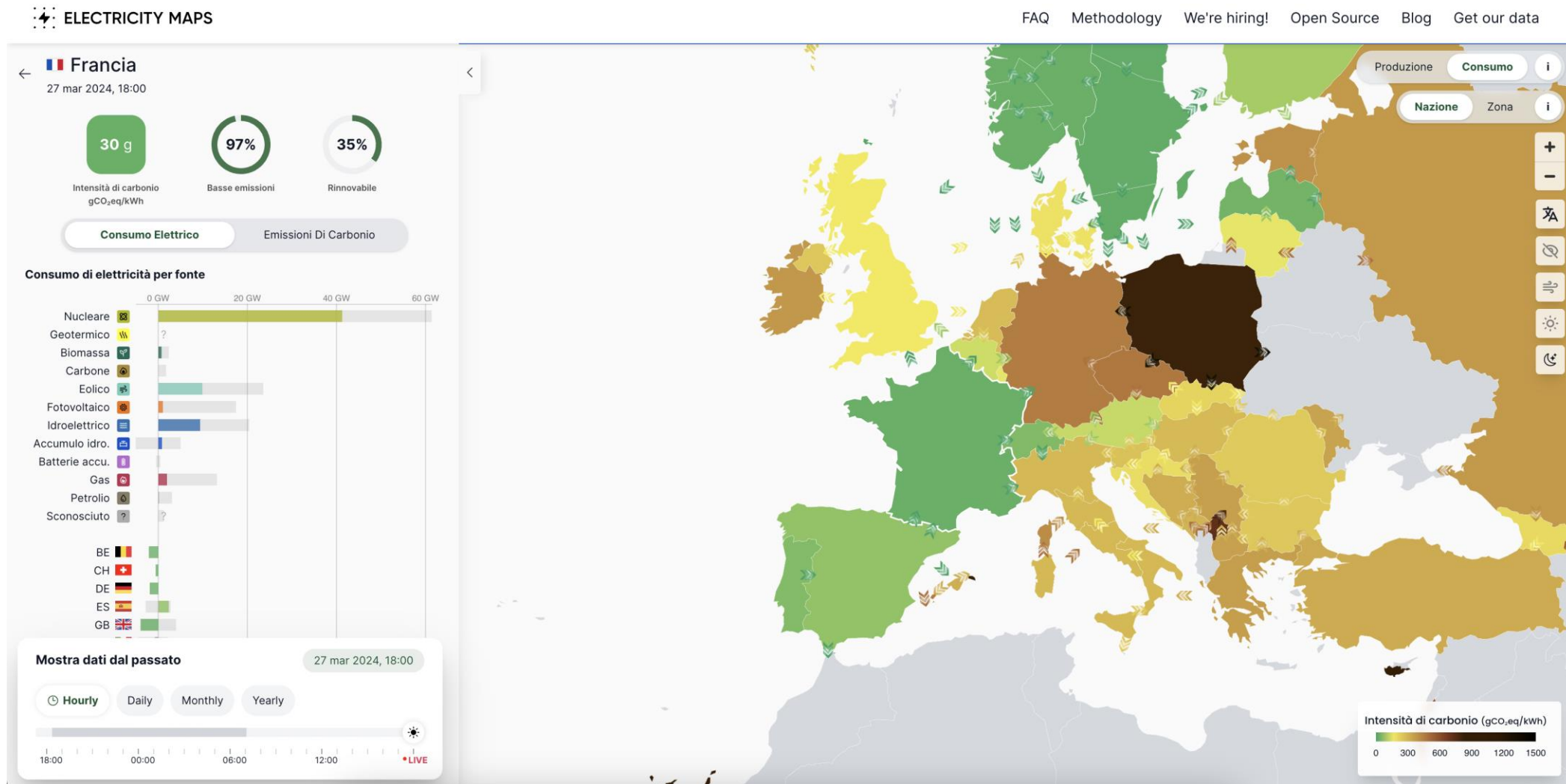
— Industrial production — Energy-intensive industrial production



SOURCE: STATISTISCHES BUNDESAMT



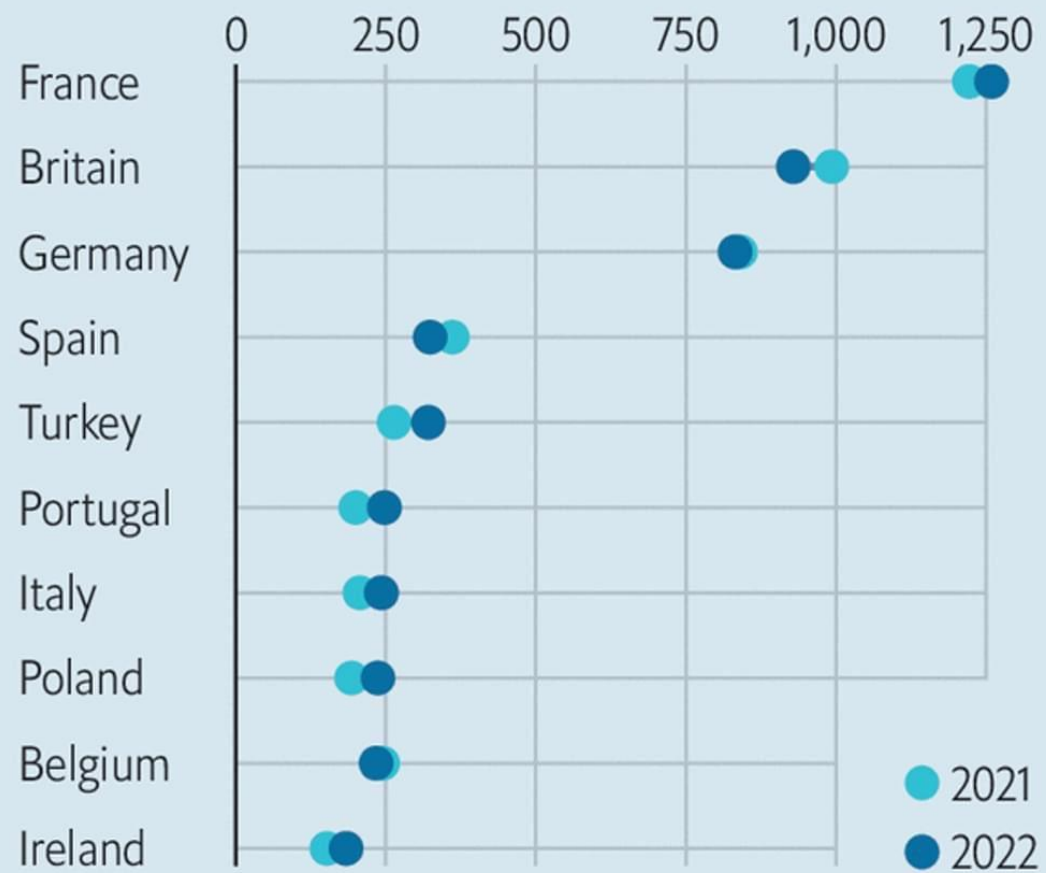
# Costi vs Prezzi vs Emissioni



# Costi vs Prezzi vs Emissioni

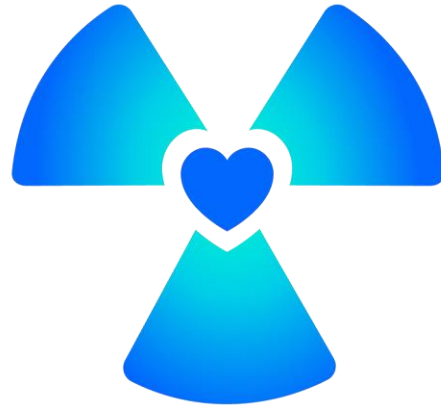
## Gallic attraction

Europe, number of foreign-direct-investment projects announced, top ten countries in 2022

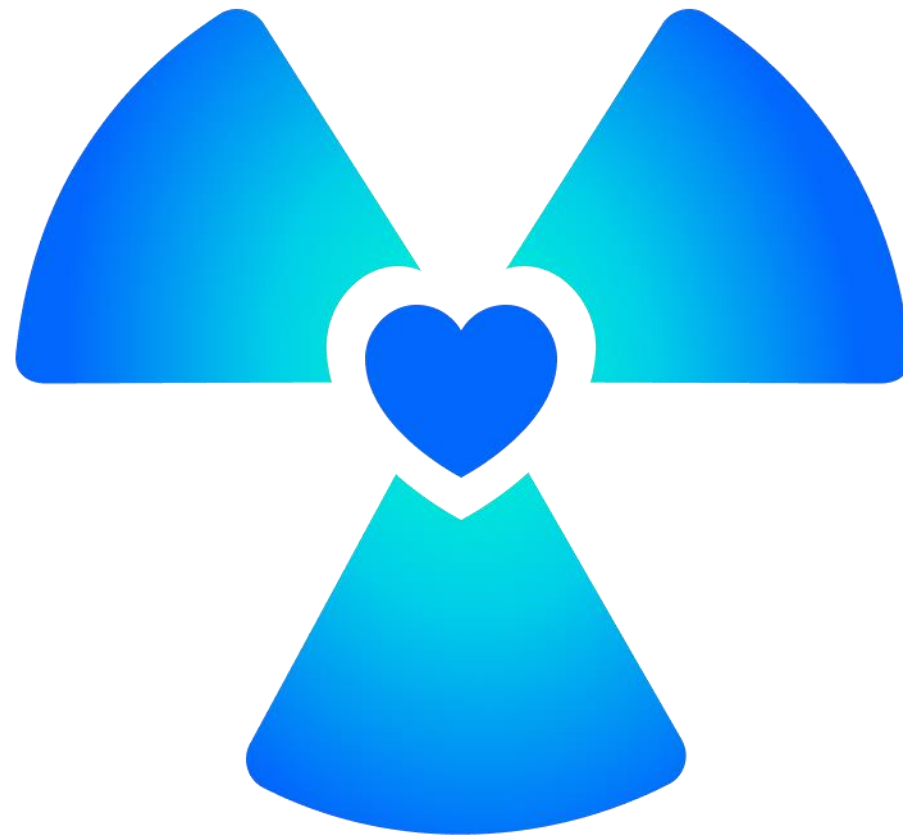


Source: EY

IMAGE: THE ECONOMIST



**Nucleare è ambiente, risparmio, indipendenza, progresso, scienza.**



**Grazie dell'attenzione**