

Average LCOE from main Market Studies in USA, Germany, Europe, Global

Presented By
Raul Assuncao



www.nenupharadvisors.com



+971 54 486 1971

+34 602 453 375

+351 961 953 547

LCOE – Jul 2025 – v1



NENUPHAR ADVISORS



Disclaimer



This presentation is provided for informational purposes only and does not constitute an offer, invitation, or solicitation for the sale or purchase of securities, assets, or financing of the business described herein.

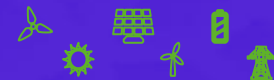
It is not intended to form the basis of, or act as an inducement to enter into, any contract or investment activity. **Nenuphar Advisors** and its affiliates, including **Nenuphar Advisors – FZCO**, **Nenuphar Frontier, Lda.** and **Nenuphar Advisors SL**, and **Nenuphar Advisors – FZCO** ("**Nenuphar Advisors**"), make no representation or warranty, express or implied, as to the accuracy, completeness, or reliability of the information provided.

The information contained herein, sourced from publicly available materials or provided to **Nenuphar Advisors**, has not been independently verified and should not be relied upon. **Nenuphar Advisors**, its directors, officers, employees, and advisers accept no liability for any errors, omissions, or misstatements, or for any direct, indirect, or consequential loss arising from reliance on this presentation.

Prospective investors or financiers are advised to perform their own independent investigation and analysis.

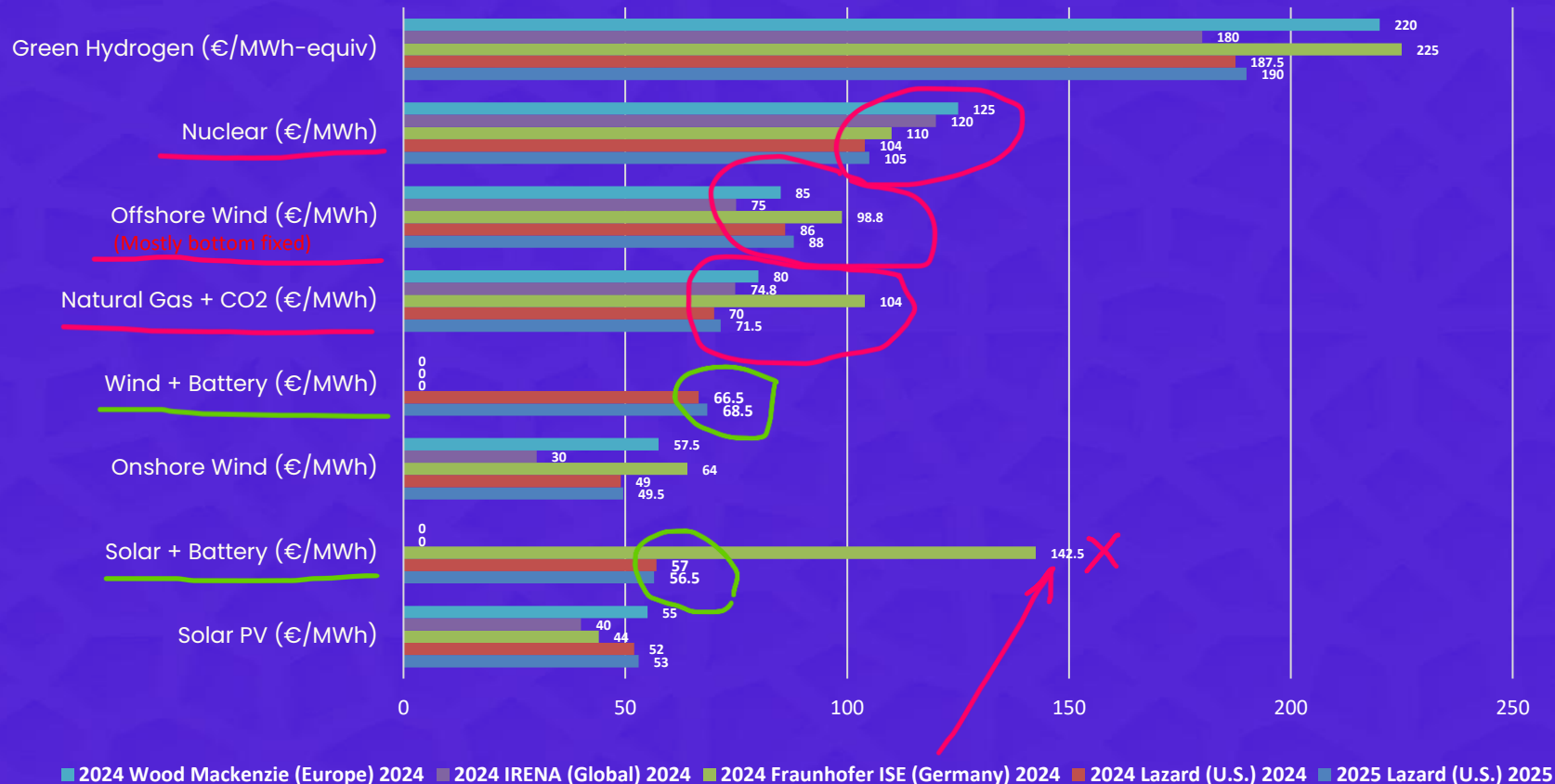
Nenuphar Advisors reserves the right to amend or terminate negotiations or procedures related to any transaction without prior notice or liability.

No obligation is undertaken to update this presentation or provide additional information.



Costs or expenses incurred by recipients in connection with the evaluation of this presentation are their sole responsibility.






Average LCOE from main Market Studies in USA, Germany, Europe, Global




Average LCOE from main Market Studies in USA, Germany, Europe, Global

Average LCOE from main Market Studies in USA, Germany, Europe, Global												
Year	Study / Region	Solar PV (¢/MWh)	Solar + Battery (¢/MWh)	Onshore Wind (¢/MWh)	Wind + Battery (¢/MWh)	Natural Gas + CO2 (¢/MWh)	Offshore Wind (¢/MWh)	Nuclear (¢/MWh)	Green Hydrogen (¢/MWh-equiv)			
2025	Lazard (U.S.) 2025	53	56.5	49.5	68.5	71.5	88	105	190			
2024	Lazard (U.S.) 2024	52	57	49	66.5	70	86	104	187.5			
2024	Fraunhofer ISE (Germany) 2024	44	142.5	64	–	104	98.8	110	225			
2024	IRENA (Global) 2024	40	–	30	–	74.8	75	120	180			
2024	Wood Mackenzie (Europe) 2024	55	–	57.5	–	80	85	125	220			
2023	IRENA (Global)	40	–	30	–	63	75	115	190			
	© Nenuphar Advisors Jul 2025											
	🔑 Key Assumptions:											
	USD→EUR conversion used: 1 USD = 0.92 EUR											
	Lazard's cost ranges reflect unsubsidized LCOE											
	Solar + Battery and Wind + Battery in Lazard are based on 4–8h duration											
	Fraunhofer battery-included costs depend on battery size and cycle assumptions											
	🔍 Highlights											
	Lazard (2025):											
	Solar PV: 33–68 €/MWh (38–78 USD)											
	Onshore wind: 32–75 €/MWh (37–86 USD)											
	Gas (CCGT + CO ₂): 42–93 €/MWh (48–107 USD) renewablesnow.com + tarriv.org + ireuters.com											
	Fraunhofer ISE (2024) remains a strong European benchmark, especially for PV + storage (60–225 €/MWh).											
	IRENA (2023/2024) provides global averages: Solar and Wind each around 40 €/MWh and 30 €/MWh, respectively.											
	✅ Observations											
	Renewables continue to be the lowest-cost options for new-build generation across regions.											
	Battery integration adds significant cost, particularly evident in the wide range of PV + storage from Fraunhofer.											
	Natural gas costs are elevated in the Lazard 2025 figures, reflecting recent supply-side and CO ₂ pricing pressures.											

Average LCOE from main Market Studies in USA, Germany, Europe, Global

Global CO2 cost									
Here's a clearer breakdown of CO ₂ pricing in 2024:									
 Global Average Carbon Price									
The weighted average explicit carbon price (via ETS and carbon taxes) globally stood at US \$32 per tonne CO₂ in 2024. This falls about \$18 below what climate experts say is needed by 2030 to align with the Paris Agreement goals (decarbonization.visualcapitalist.com).									
 Voluntary Carbon Credit Market									
In the voluntary offset market (companies buying credits to offset emissions), the average price plunged to about USD \$4.8 per tonne in 2024, marking a 20% decrease from the prior year (carboncredits.com).									
However, prices vary widely:									
Avoided emissions credits (e.g., clean cookstoves, forest protection) typically trade around \$4/tCO₂ .									
Engineered removal credits (e.g., direct air capture) can go for approximately \$350/tCO₂ (carboncredits.com, ft.com).									
 Summary Table									
Category	Price (USD/t CO ₂)								
Global average explicit pricing	\$32								
Voluntary credit average	\$4.8								
Avoided-emission credits	~\$4								
Removal-engineered credits	~\$350								
 Why it Matters									
Explicit pricing reflects government policies and compliance markets—it's becoming more common but remains too low globally, covering ~24–25% of emissions (carboncredits.com, sustainable-markets.com, ft.com).									
Voluntary credits are cheaper but often lack quality, while high-integrity removals are much pricier.									
To accelerate decarbonization, experts argue carbon prices must rise significantly , both in compliance and voluntary markets.									
 Bottom Line									
The true global average carbon price (ETS + taxes) was around US \$32/tCO₂ in 2024.									
Offsets in the voluntary market averaged just US \$4.8/t , although high-quality removal credits cost up to \$350/tCO₂ .									
Let me know if you'd like a closer look at regional pricing (like EU ETS, California), or into future projections!									

Average LCOE from main Market Studies in USA, Germany, Europe, Global

Here's the cost of CO₂ in 2024 converted to EUR (assuming an average 2024 exchange rate of 1 USD = 0.92 EUR):							
 Global Average CO₂ Pricing (2024, in EUR)							
Category	Price (USD/t CO₂)	Price (EUR/t CO₂)					
Global avg. (ETS + taxes)	\$32	€ 29.40					
Voluntary market avg.	\$4.8	€ 4.40					
Avoided-emission credits	~\$4	€ 3.70					
Engineered removals (e.g. DAC)	~\$350	€ 322					
<input checked="" type="checkbox"/> Summary							
€29.4/tCO ₂ is the global average price from regulated carbon pricing mechanisms (ETS + taxes).							
€4.4/tCO ₂ is the average voluntary credit price—though low-cost offsets can be ~€3.7 and high-integrity removals can exceed €320/tCO ₂ .							
Let me know if you'd like this in Excel, or broken down by region or sector (e.g., EU ETS, oil & gas).							

Average LCOE from main Market Studies in USA, Germany, Europe, Global

To convert €/tonne CO₂ into €/MWh, we need to estimate the CO₂ emissions per MWh for different technologies or fuels. Here's how it works:



Common Emission Factors

Generation Technology	CO ₂ Emissions (ton/MWh)							
Coal (hard)	0.90 – 1.05							
Natural Gas (CCGT)	0.35 – 0.42							
Oil	0.70 – 0.75							
Grid average (world)	~0.45							
Renewable (Solar/Wind)	0							



Conversion Formula

CO₂ Cost (€/MWh) = CO₂ Cost (€/tCO₂) × Emission Factor (tCO₂/MWh)



2024 CO₂ Cost (in €/MWh) Based on €29.4/tCO₂

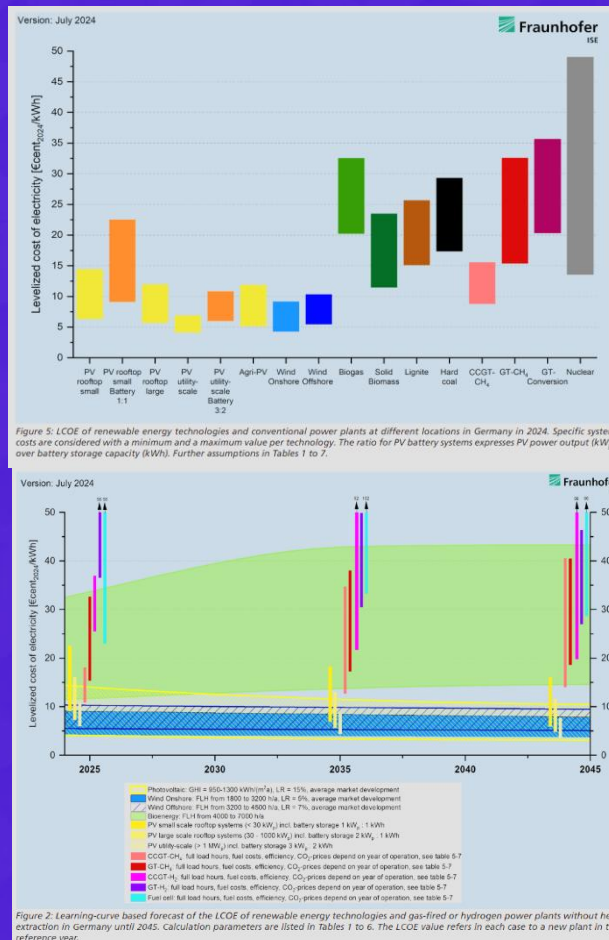
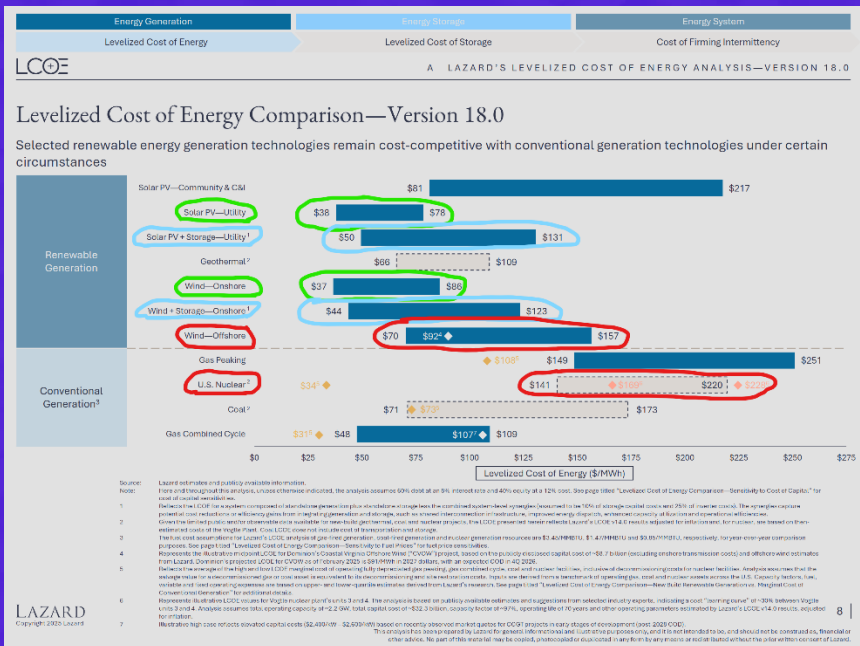
Generation Type	Emission Factor (t/MWh)	€/MWh (CO ₂ cost only)						
Coal	0.95	€ 27.90						
Natural Gas (CCGT)	0.4	€ 11.80						
Oil	0.72	€ 21.20						
Grid avg. (world)	0.45	€ 13.20						
Renewables	0	€ 0						



Notes:

These values represent carbon cost per MWh based on 2024 global average CO ₂ price (€29.4/t).								
For EU ETS, the 2024 price was closer to €60–85/t, which would double or triple these €/MWh figures.								

Average LCOE from main Market Studies in USA, Germany, Europe, Global



THANK YOU FOR YOUR ATTENTION

Contact Us



www.nenupharadvisors.com



info@nenupharadvisors.com



Madrid, Spain

+34 602 453 375



Lisboa, Portugal

+351 961 953 547



Dubai, UAE

+971 54 486 1971



Nairobi, Kenya

+254 791 865 589