RDFZ ICC - The Disruptor's Challenge

Student Reference Extract | Sunday, 10 May 2026 | 08:30 to 12:00 | RDFZ Main School Building

Levelized Cost of Electricity (LCOE)

AI-Generated Document — Read Before Using

- AI can summarise — it cannot verify. Always check key numbers against the original IRENA source.
- Errors travel fast. If one figure is wrong, every conclusion built on it is also wrong.
- Your job is to think, not just to copy. Use AI to find data. Use your brain to judge it.
- This document was AI-synthesised from IRENA, Lazard, and IEA data (2024-2025). Cross-reference anything critical.

1. What is LCOE?

The Levelized Cost of Electricity (LCOE) measures the average cost of generating one unit of electricity ($/MWh or $/kWh) over a power plant's entire lifetime. It accounts for:

- Capital cost — what it costs to build the plant
- Operating and maintenance costs — what it costs to run it
- Fuel costs — zero for renewables, significant for fossil fuels
- Capacity factor — how often the plant actually generates power

LCOE allows fair comparison across entirely different technologies. A lower LCOE means cheaper electricity generation — but geography, reliability, and grid context always matter.

2. The Big Picture — 2024 Headline Data

In 2024, renewable energy achieved a historic milestone. According to IRENA, 91% of newly commissioned renewable projects delivered electricity at a lower cost than the cheapest new fossil fuel alternative.

$0.034/kWh
Onshore Wind — Global Average LCOE (2024)
70% cheaper than in 2010

$0.043/kWh
Solar PV (Utility-scale) — Global Average (2024)
90% cheaper than in 2010

3. LCOE Comparison Table (2024–2025)

Source: Lazard LCOE+ Report (June 2025), IRENA Renewable Power Generation Costs in 2024. All values in USD per MWh unless stated.

Technology	Capacity Factor	LCOE Range ($/MWh)	Midpoint ($/MWh)	2023-24 Trend
RENEWABLE TECHNOLOGIES				
Onshore Wind	25–55%	27–73	70	▼ -3%
Offshore Wind	45–55%	74–139	190 (US)	▲ +4%

Technology	Capacity Factor	LCOE Range ($/MWh)	Midpoint ($/MWh)	2023-24 Trend
Solar PV (Utility-scale)	20–30%	38–78	74	▲ +0.6%
Hydropower	40–60%	30–100	57	▼ -2%
Geothermal	80–90%	50–100	60	▼ -16%
CSP with Storage	30–50%	70–150	92	▼ -46%
FOSSIL FUEL TECHNOLOGIES				
Coal (New Plant)	65–85%	71–173	122	▼ -7%
Natural Gas (CCGT)	30–90%	48–109	78	▲ +8%
Natural Gas (Peaker)	10–20%	149–251	200	—

Note: ▼ = cost falling (positive trend for that technology). ▲ = cost rising. Green = competitive; Red = worsening position.

4. China Regional Context

China is the global leader in cost competitiveness in renewable energy. This matters directly for your challenge — you are designing a system for China.

Technology	China LCOE	Global Average
Onshore Wind	**$0.029/kWh**	$0.034/kWh
Solar PV	**$0.033/kWh**	$0.043/kWh
Offshore Wind	**$0.056/kWh**	$0.079/kWh

China achieves these competitive figures through vertically integrated supply chains, domestic manufacturing scale, and streamlined project execution. However, LCOE alone does not determine the best solution — resource availability, geography, and grid reliability requirements all constrain what can actually be deployed in a given location.

5. Key Factors That Affect LCOE

When evaluating any energy system, consider all of the following:

- Capital cost — the largest cost component for renewables (70–85% of LCOE)
- Fuel cost — zero for solar and wind; volatile and significant for gas and coal
- Capacity factor — how much of the time the plant actually generates power
- Geography — the best solar LCOE is useless without strong solar irradiance
- Intermittency — solar and wind do not generate 24/7; storage or backup is required
- Financing cost — capital costs range from 3.8% (Europe) to 12% (Africa); this can add $30–50/MWh
- Grid integration — connecting variable renewables to the grid adds $5–15/MWh in system costs
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6. What Makes a Solution 'Investable'?

The winning solution is not simply the one with the lowest LCOE. **Investors fund credible cases** — not just cheap numbers. A strong pitch will:

- **Justify every energy source with actual LCOE data from IRENA or the LCOE table above**
- **Address intermittency — explain how your system works when the sun doesn't shine, or wind doesn't blow**
- **Demonstrate geographic fit — show that your chosen sources match China's actual resource conditions**
- **Show the LCOE calculation — not just a number, but how you arrived at it**
- **Make a clear reliability claim — can this system power a city 24/7?**

Primary Sources

IRENA. (2025). Renewable power generation costs in 2024. International Renewable Energy Agency.

Lazard. (2025, June). LCOE+ Levelized cost of energy analysis. Lazard Ltd.

IEA. (2025). Breakthrough Agenda Report 2025: Power. International Energy Agency.