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Levelized Cost of Energy & Storage

The Iberian Adaptation

Adapting the Lazard 2026 LCOE+ (LCOE v19.0 / LCOS v11.0) to Portugal & Spain

Focus: PV+BESS · Wind+BESS · PV+Wind+BESS hybrids · standalone BESS

Market advisory memorandum · July 2026



The bottom line

Lazard's dollar LCOEs don't read across to Iberia. Three structural corrections make Iberian **cost** more favourable — cheaper capex, higher solar yield, lower contracted WACC, and no ITC/PTC either side. A fourth factor turns hard against unmanaged solar: **captured revenue**.

€23–50 /MWh

Solar PV utility

€40–90 /MWh

PV + BESS hybrid

€50–105 /MWh

Wind + BESS hybrid

€100–160 /MWh

Standalone BESS 4h (LCOS)

Iberia-adapted, illustrative (unsubsidised, € @1.08 USD/EUR)

Standalone BESS LCOS lands 30–45% below Lazard's US figure — European battery capex is roughly half the US level, with no lithium-ion import tariff. But cost is no longer the constraint in Iberia:

Spanish solar capture rates fell from **83% (2023)** → **mid-50s% (2025)**, with monthly readings as low as ~0.18 in Feb 2026, and negative-price hours are multiplying. Firming — storage & hybridisation — is what now protects the revenue side.



What the Lazard 2026 LCOE+ says

Technology (US, unsubsidised)	LCOE \$/MWh
Solar PV — utility	\$40–98
Solar PV + storage (4h)	\$61–156
Onshore wind	\$37–99
Wind + storage (4h)	\$49–140
Standalone BESS 4h (LCOS)	\$210–292
Gas combined cycle (ref.)	\$51–129

Three findings that travel to Iberia

- 1 Costs rose again** Higher capital costs, sustained rates, tariffs and supply-chain repricing — the era of automatic annual declines has paused, in Europe too.
- 2 Firming is now explicit** Lazard adds a levelized firming charge (nameplate × (1-ELCC) × Net CONE): intermittent MWh ≠ firm MWh.
- 3 Storage reversed course** LCOS rose — driven partly by US tariffs on lithium-ion cells & Foreign-Entity-of-Concern rules. This is exactly where Europe diverges.

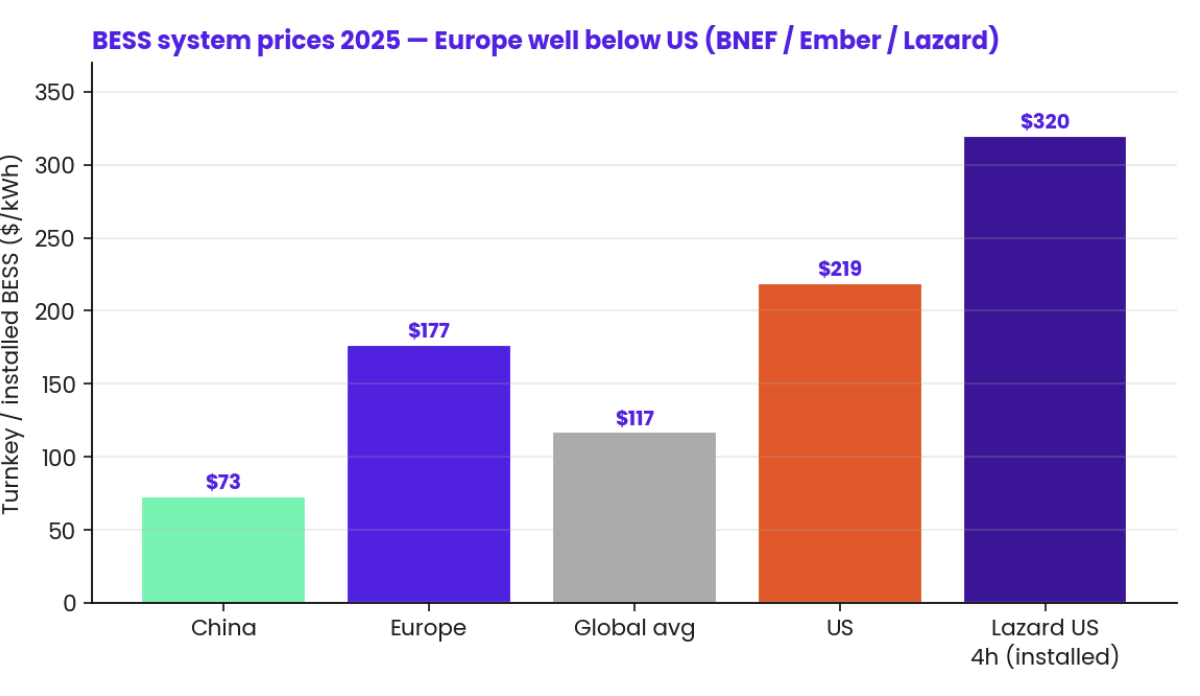


Why US LCOE cannot be read across to Iberia

Capital cost	Util PV ~€550–800/kWp (lowest in Europe); EU turnkey BESS ~€120–165/kWh vs US \$270–365	▼ lower
Resource	PV ~1,750–2,050 kWh/kWp (CF 20–24%); onshore wind CF ~24–30%	≈ solar strong
Cost of capital	Contracted assets ~3–5%; merchant ~8–9%; IRENA Europe 3.8% vs Lazard ~7.7%	▼ lower
Subsidy / tax	No ITC/PTC — capex grants (Spain EDRF, Portugal auctions) + capacity payments from 2026	= unsubsidised
Revenue capture	Severe MIBEL cannibalisation: capture-rate collapse & negative prices dominate risk	▲ higher risk



European & global cost benchmarks



Europe's battery capex is ~20% below the US and falling faster — the opposite of Lazard's US tariff story.

Fraunhofer ISE (2024)

Util PV €41–69 · PV+battery €60–108 · wind €43–92 /MWh; real WACC 3.2–3.9%

IRENA (2024)

Util PV \$43 · wind \$34 /MWh; BESS \$192/kWh; Europe WACC 3.8%

BNEF (2025)

Turnkey BESS: Europe \$177 · US \$219 · China \$73 /kWh (–31% YoY)

Ember (Oct 2025)

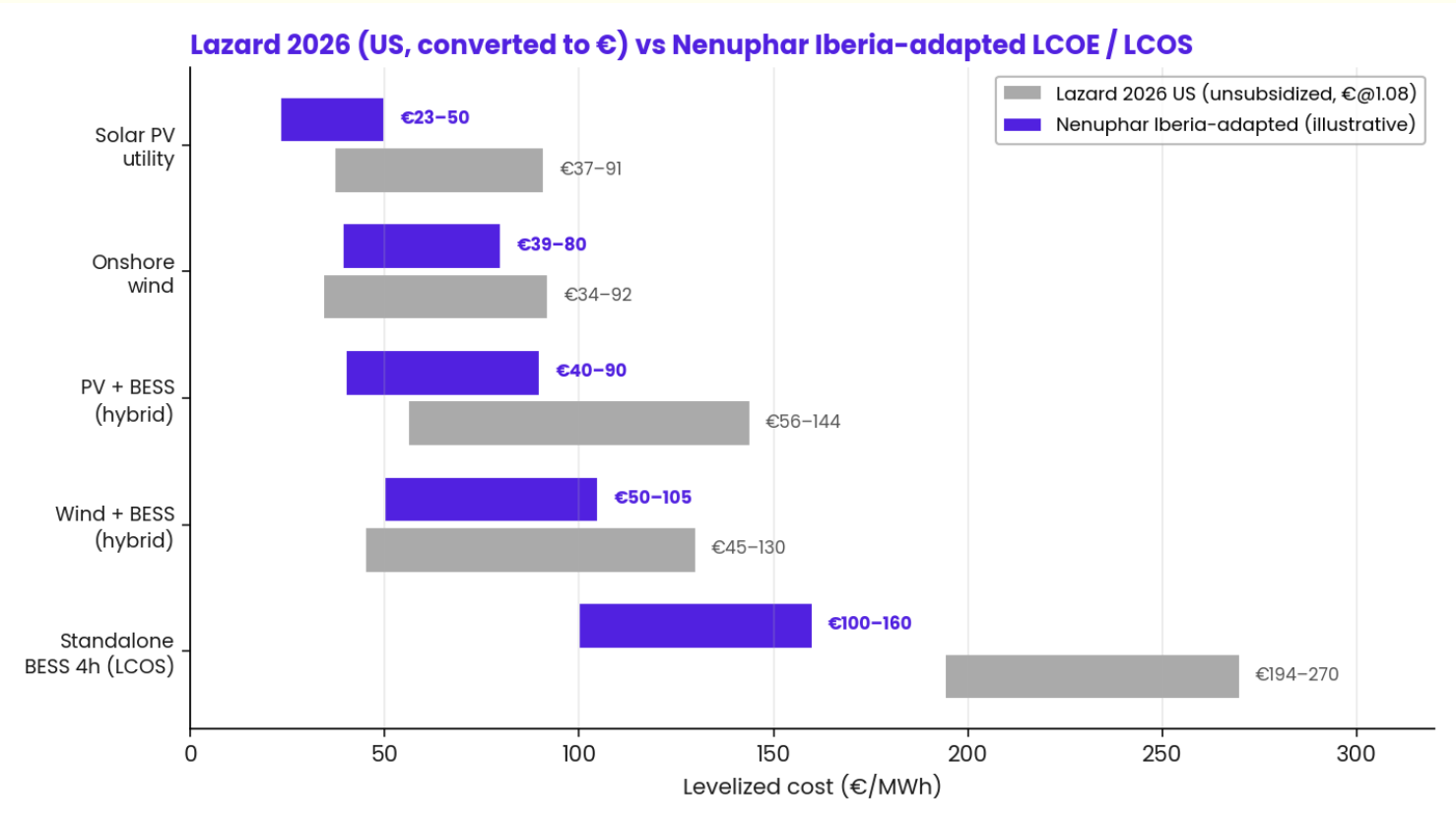
4h+ capex ex-CN/US ~\$125/kWh → LCOS ~\$65/MWh; dispatchable solar ~\$76

Aurora (Iberia)

Standalone 4h ~11% IRR with full stack; 'missing money' without capacity market



Iberia-adapted LCOE / LCOS ranges

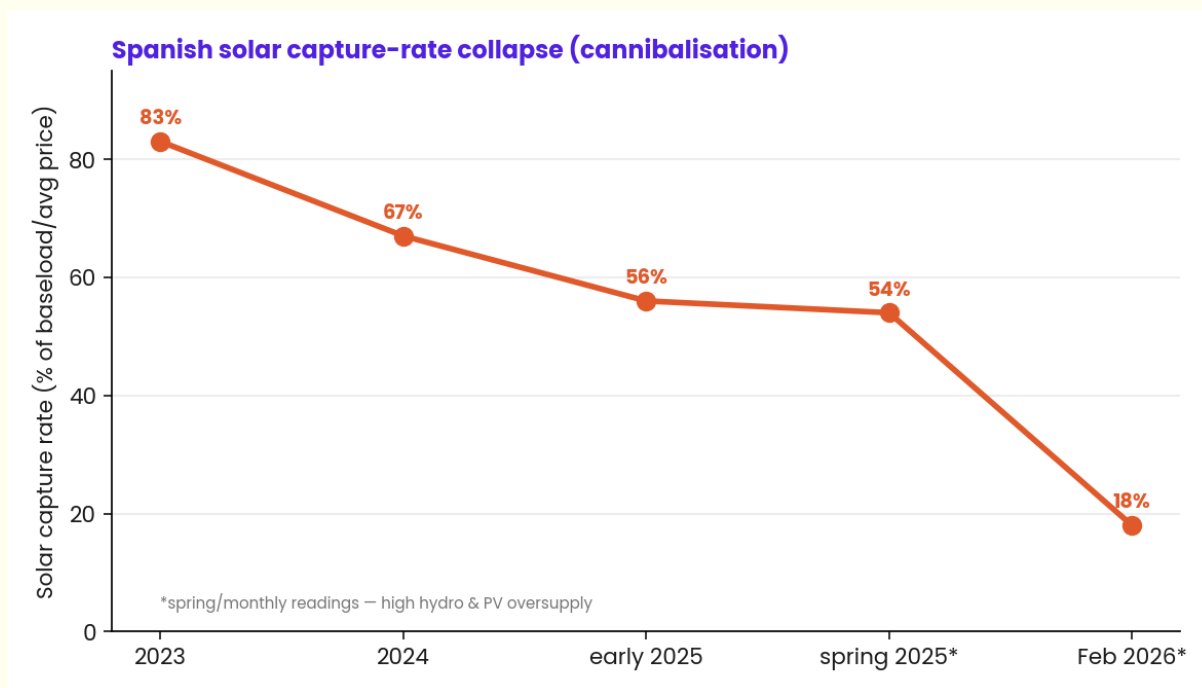


Illustrative screening estimates. PV capex €550–800/kWp, CF 20–24%; BESS all-in €160–300/kWh, 350 cyc/yr; WACC 5.5–8.5%.

vs Lazard US (€ @1.08)		
Technology	US	Iberia
Solar PV utility	€37–91	€23–50
Onshore wind	€34–92	€39–80
PV + BESS	€56–144	€40–90
Wind + BESS	€45–130	€50–105
BESS 4h LCOS	€194–270	€100–160
Standalone storage is where Iberia diverges most — 30–45% below Lazard on capex alone.		



The revenue reality — where cost stops being the problem



The metric is shifting from LCOE to the levelized cost of **dispatchable** energy — LCOE + firming.

779 h

at $\leq$ €0/MWh in Spain in 2024; 404 negative-price hours in spring 2025 (72% > Germany)

€52 →
€98

avg intraday spread /MWh (Jan–Apr 2024 → 2025) — the arbitrage signal for BESS

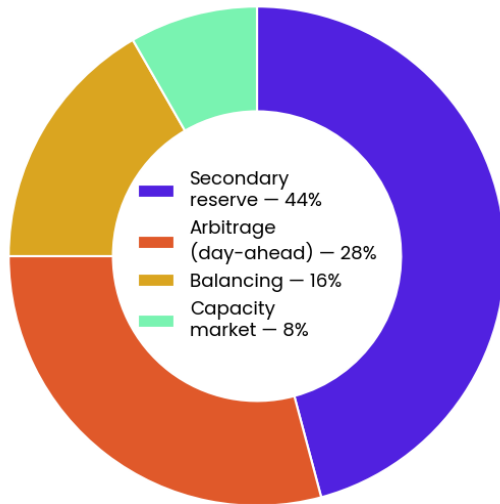
€30–35

Spanish solar PPA /MWh, being pushed below €30 — near or below many projects' LCOE



Storage & hybrid economics — standalone vs co-located

Iberian standalone BESS revenue stack
(Aurora, 4h asset, ~11% IRR)



Aurora: ~11% IRR only with the full stack — and 'missing money' without a capacity market.

The case for hybridisation / co-location

+55% gross margin Co-locating a battery with solar (AC-coupled) vs a standalone battery — charge on cheap/negative midday, discharge into peak.

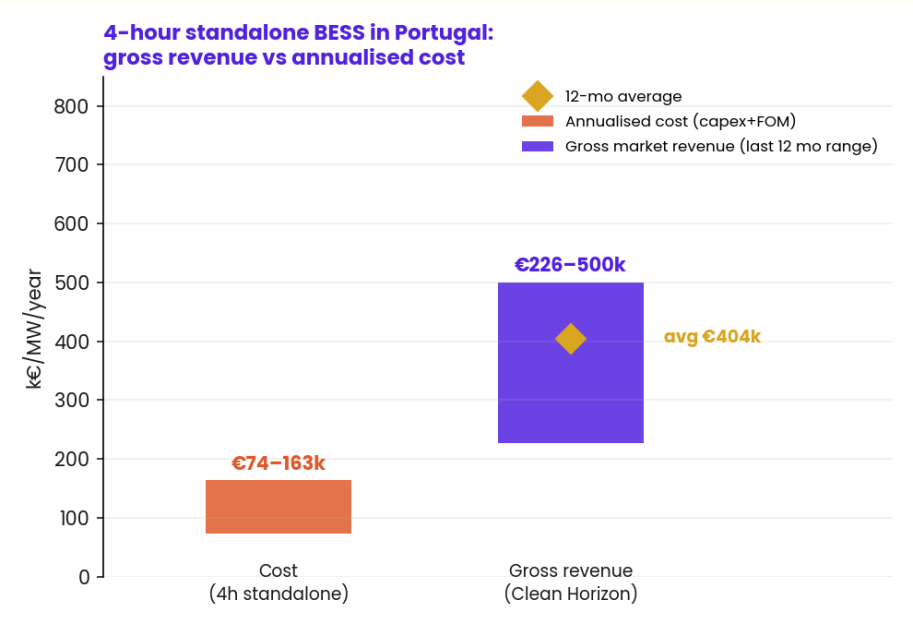
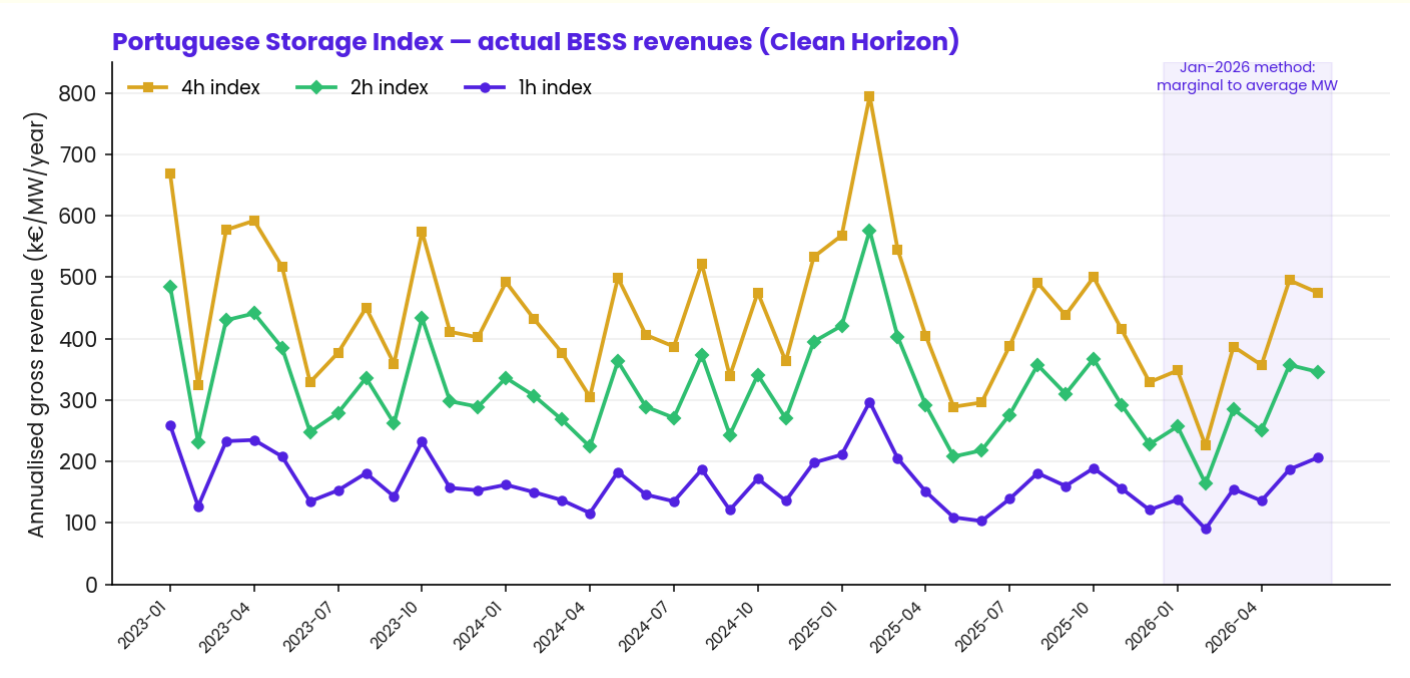
Cheaper grid access Shared connection point, no new access permit, ~half the economic guarantees — decisive where grid capacity is scarce.

Policy favours hybrids Spain's EDRF tender: 69 of 126 grants went to co-located projects vs 39 standalone.

Bankable offtake emerging Greenergy's Spain-first 10-yr toll (150 MW/600 MWh); ~12 GW/23 GWh of EU FPAs in 2025 (~3× 2024).



Portuguese BESS revenues — real market data



Gross revenue (day-ahead + intraday + aFRR + mFRR), 85% RTE, 1.5 cyc/day. Portugal has no capacity market or FCR yet. Jan-2026: methodology moved marginal → average MW.

k€/MW/yr	last-12 avg	2026 YTD
1h index	€155k	€152k
2h index	€291k	€276k
4h index	€404k	€381k

4h battery is revenue-positive today: gross revenue €226–500k/MW/yr (avg €404k) vs cost €74–163k. But it's gross — and a nascent market: ancillary revenue compresses as storage deploys. Contracted revenue + hybridisation protect the case.



Regulatory & support landscape for storage + hybrids

SPAIN

Capacity market

EC-approved: up to €9 bn over 2026–2036 (~€900 m/yr), from May 2026. Storage eligible; de-rating 40% (2h) / 60% (4h); up to 15-yr contracts.

Capex grants (EDRF)

~€818–827 m to ~126–133 projects, ~2.2–2.4 GW / ~9.4–10 GWh; 7× oversubscribed; deadline 30 Sep 2029. Hybrids dominated.

Hybridisation

RD 1183/2020: add storage (and a 2nd generation tech) on an existing connection point — basis for PV+Wind+BESS on one POI.

PORTUGAL

Capacity mechanism

In development (reliability standard 1.46 h/yr); open to generation, storage, demand response & flexibility. Needs EC State-aid approval.

750 MVA battery auction

Dedicated storage auction planned — with a 75% renewable-charging requirement that favours co-located renewable+storage.

Hybridisation

DL 15/2022 enables storage on existing connection points; DGEG, REN & ERSE govern the framework.

28 Apr 2025 Iberian blackout + 15-min settlement (Sep 2025) have sharpened demand for fast storage & flexibility.



STRATEGIC IMPLICATIONS FOR IBERIAN DEVELOPERS

Five conclusions for the Iberian market

1

Cost is no longer the differentiator

Iberian LCOEs are among Europe's lowest; advantage comes from captured revenue & firming, not marginal capex.

4

Storage is cheaper than the US suggests

European battery capex ~half the US level, no import-tariff penalty → LCOS 30–45% below Lazard.

2

Hybridisation is the value lever

Co-located PV/Wind+BESS lifts margins ~55%, shares scarce grid connections, and is favoured by both countries' schemes.

5

Policy windows define timing

Spain capacity market (May 2026) & EDRF (Sep 2029); Portugal capacity mechanism + 750 MVA auction set the calendar.

3

Standalone merchant BESS is premature

Arbitrage alone doesn't clear the hurdle in Spain; bankability needs stacked revenue + capacity market or a toll.



Sources & method

- Lazard — LCOE+ v19.0 / LCOS v11.0 (Jul 2026, report)
- Fraunhofer ISE — Levelized Cost of Electricity study (2024)
- IRENA — Renewable Power Generation Costs in 2024 (Jul 2025)
- BNEF & Ember — via Energy-Storage.News (2025)
- Aurora Energy Research — Iberian Energy Day (Nov 2024); EU BESS outlook (Oct 2025)
- Clean Horizon — Portuguese Storage Index (Jan 2026 methodology; data to Jun 2026)
- Modo Energy — Iberia BESS; Spain solar capture; PPAs & negative prices
- Pexapark — capture-factor collapse; Market Outlook 2026
- ESS News / pv magazine / Strategic Energy — Spain capacity market, EDRF tender, Portugal auction, Grenergy toll
- Gore Street, MDPI Energies, IEEFA, Solar Data Atlas — market & input data

Method & disclaimer

Lazard figures quoted from the uploaded July 2026 report. European/Iberian figures from the sources listed (2024–2026). USD→EUR at 1.08. Iberia-adapted LCOE/LCOS ranges are illustrative Nunuphar screening estimates from a transparent levered-LCOE model on the stated capex, capacity-factor, WACC and cycling assumptions — not bankable outputs and not financial or investment advice. Single-source / monthly readings are flagged in the report text.



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Let's talk

Nenuphar Advisors — renewable-energy (solar PV, BESS, wind) project developer, advisory firm and M&A assets intermediary across Portugal, Spain, the UAE and Africa.