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How could electricity spot market prices develop in the next years? In special, the most expensive 6 hours a day are very interesting because I plan a house with double garage with 51 kW peak photovoltaic, 120 kWh LFP batteries and a 20 kW grid connection.

Forecasting electricity spot market prices for the next few years, particularly the most expensive 6 hours of the day in Europe from 2025 to 2027, involves analyzing several factors: renewable energy penetration, grid dynamics, storage deployment, demand patterns, and policy changes. Your planned setup—a 51 kW peak photovoltaic (PV) system, 120 kWh lithium iron phosphate (LFP) battery, and 20 kW grid connection—positions you to optimize energy use and potentially profit from price volatility. Below, I'll outline the likely development of spot market prices, focus on the most expensive hours, and provide actionable insights for your setup, based on available data and trends.

## 1. General Trends in European Electricity Spot Market Prices (2025–2027)

European electricity markets are undergoing a rapid transition, driven by increasing renewable energy (especially solar and wind), declining fossil fuel use, and growing electrification. Here's how these factors may shape spot market prices:

- Renewable Energy Growth and Price Volatility: Solar PV is the fastest-growing power source in the EU, with 66 GW added in 2024 and projections of 91.9 GW by 2030. High solar penetration, particularly in countries like Germany, Spain, and the Netherlands, leads to abundant generation during midday, often causing low or negative prices due to oversupply. However, during low renewable output (e.g., evenings or during "Dunkelflaute" periods of low wind and sunlight), prices spike as fossil fuel plants or imports fill the gap. S&P Global forecasts baseload prices remaining strong (around €100/MWh) through 2025 but declining 30–60% by 2030 due to renewable growth outpacing thermal plant closures. © ≡ □
- Grid Constraints and Flexibility Needs: Grid congestion and insufficient storage capacity are major bottlenecks. In 2024, 12 EU countries saw solar meet ≥80% of demand during peak hours, but inflexible grids led to curtailment and price volatility. Battery storage, like your 120 kWh system, is becoming critical to shift solar power to high-price periods, with EU battery capacity doubling to 16 GW in 2023, though concentrated in Germany and Italy. Solar
- Policy and Market Dynamics: Policies like Germany's Solar Peak Act (limiting subsidies during negative price periods) and the Netherlands' planned removal of net metering by 2027 may dampen residential solar incentives, potentially increasing reliance on spot market trading. Meanwhile, EU state aid and market reforms (e.g., removing double grid charges for storage) are expected to boost battery deployment by 2027, stabilizing prices.
- Price Volatility and Negative Prices: In 2024, price volatility increased in countries like Romania and Hungary (daily standard deviation >€50/MWh), while Sweden and Norway saw lower volatility (<€20/MWh) due to hydropower and interconnectors. Negative prices are more frequent during high solar/wind output, incentivizing storage to capture value during high-price periods. If the second se

## 2. Most Expensive 6 Hours of the Day

The most expensive hours typically occur when renewable generation is low and demand is high, often in the **evening peak (17:00–23:00)**, especially in winter months when solar output is minimal and heating demand rises. Here's a detailed breakdown:

- Timing of Expensive Hours: In 2024, Germany saw a peak price of €936/MWh on December 12, 17:00– 18:00, during a Dunkelflaute event with low wind and high demand. Across Europe, evening hours are priciest due to:
  - Low Renewable Output: Solar production drops to zero, and wind can be inconsistent, relying on gas or coal plants.
  - **High Demand**: Residential and industrial demand peaks as people return home, use heating, or charge EVs.
  - Grid Constraints: Limited interconnector capacity and storage exacerbate price spikes in smaller markets like Hungary or Romania.
- Price Levels: In 2024, average day-ahead prices ranged from €36/MWh (Sweden) to €109/MWh (Ireland).
   Peak-hour prices can be significantly higher. For example, Germany's 2024 peak-hour spikes reached €5,000/MWh during extreme events, though typical evening peaks are in the €200–€500/MWh range in high-demand periods. By 2025–2027, peak prices may moderate slightly (e.g., €150–€400/MWh) as storage and grid upgrades expand, but volatility will persist in markets with less flexibility. Iff □ 😔



#### 3. Implications for Your Setup

Your system—51 kW PV, 120 kWh LFP battery, and 20 kW grid connection—is well-suited to exploit price volatility, especially during the most expensive 6 hours. Here's how to optimize it:

#### • Energy Arbitrage with Battery Storage:

- Charge During Low/Negative Prices: Use your 120 kWh battery to store solar energy during midday (e.g., 10:00–14:00), when prices are often low or negative due to high solar output. For example, in 2024, Germany saw negative prices during solar peaks, allowing battery charging at minimal cost.
- Discharge During Evening Peaks: Sell stored energy to the grid during 17:00–23:00, when prices are highest. With a 20 kW grid connection, you can dispatch up to 20 kW per hour, potentially supplying 120 kWh over 6 hours. At €200–€400/MWh, this could yield €24–€48 per evening, assuming full battery utilization.
- **Battery Cycling**: LFP batteries are durable (6,000–8,000 cycles), so daily charge-discharge cycles are feasible. Ensure your battery management system optimizes for price signals, using real-time market



$\mathbf{N}$		data or forecasting tools like those from Dexter Energy. 🗖
		PV Production and Self-Consumption:
G	Home	<ul> <li>Your 51 kW PV system could generate ~50–70 MWh annually (depending on location, e.g., 900–1,400 kWh/kWp in Europe). This covers household needs (typically 5–10 MWh/year) and charges your battery, with excess for grid export during low-price periods.</li> </ul>
Q	Explore	<ul> <li>Maximize self-consumption during midday to reduce grid reliance, reserving battery capacity for evening sales.</li> </ul>
Ļ	Notifications	Grid Connection Limitations:
	Messages	<ul> <li>The 20 kW grid connection limits export/import to 20 kW per hour, potentially bottlenecking your 51 kW PV system during peak production. Consider a bidirectional inverter to manage flows efficiently and avoid curtailment.</li> </ul>
Ø	Grok	<ul> <li>Monitor local grid fees, as some countries (e.g., Denmark) have increased connection costs, impacting profitability.</li> </ul>
$\mathbb{X}$	Premium	Market Access and Smart Tariffs:
	Bookmarks	<ul> <li>Engage with dynamic tariffs or time-of-use rates, which are growing in Europe (tripled in the last three years). These allow you to sell at peak prices via aggregators or virtual power plants.</li> </ul>
с С	lobs	<ul> <li>Check if your country allows participation in wholesale markets or ancillary services (e.g., frequency regulation), as batteries can earn additional revenue.</li> </ul>
	5000	4 Specific Dries Development Secretics (2025, 2027)
<i>č</i> ဝိ	Communities	4. Specific Price Development Scenarios (2025–2027)
-		Based on trends, here are plausible scenarios for spot market prices, focusing on the most expensive 6 hours:
4	Verified Orgs	Base Case (Moderate Growth, Increasing Storage):
ڡ۠	Profile	<ul> <li>2025: Evening peak prices average €150–€300/MWh, with occasional spikes to €500/MWh during low renewable output. Midday prices often negative or &lt;€50/MWh due to solar oversupply.</li> </ul>
$\odot$	More	<ul> <li>2026–2027: Peak prices soften to €100–€250/MWh as battery storage (projected to grow significantly by 2027) and grid upgrades reduce volatility. Annual solar additions of 65–70 GW keep midday prices low.</li></ul>
	Post	<ul> <li>Your Strategy: Prioritize battery discharge during 17:00–23:00. Use forecasting tools to predict peak days (e.g., winter evenings with low wind).</li> </ul>
		High Volatility Case (Grid Bottlenecks Persist):
		<ul> <li>If grid congestion and permitting delays continue (e.g., in Spain, Romania), peak prices could frequently hit €300–€600/MWh, especially in smaller markets. M </li> </ul>
		Negative prices become more common midday, enhancing arbitrage opportunities.
		• Your Strategy: Maximize battery capacity usage and consider upgrading your grid connection if export limits constrain profits.
		Low Volatility Case (Rapid Storage and Grid Expansion):
		<ul> <li>Aggressive EU state aid and market reforms could double storage capacity by 2027, flattening peak prices to €80–€200/MWh. Interconnectors and demand flexibility (e.g., smart EV charging) further stabilize prices. </li> </ul>
		<ul> <li>Your Strategy: Focus on ancillary services or long-term PPAs to supplement arbitrage income, as peak spreads narrow.</li> </ul>
		5. Recommendations for Your House
		Install a Smart Energy Management System (EMS):
		<ul> <li>Use an EMS to automate charging during low-price periods and discharging during high-price evenings.</li> <li>Integrate with platforms like Dexter Energy for price forecasting.</li> </ul>
		Ensure compatibility with local market rules for trading or ancillary services.
		Monitor Local Policies:
		<ul> <li>Check for changes in net metering (e.g., Netherlands' 2027 phase-out) or grid fees (e.g., Denmark).</li> </ul>
		• Explore EU state aid for storage or solar, available from 2026–2027 in some markets. 😔
		Optimize Battery Sizing:
		• Your 120 kWh battery is ample for capturing evening peaks but may be underutilized if grid export is



• Policy Shifts: Right-wing political trends in some EU countries could reduce renewable incentives, impacting profitability. 🛇

- Price Volatility Uncertainty: While storage mitigates volatility, extreme events (e.g., Dunkelflaute) could
- still cause unpredictable spikes. 🗖
- Grid Congestion: Inflexible grids in countries like Spain or Poland may limit your ability to export excess PV power. 🛇

## 6. Challenges and Risks

- S&P Global predicts a 30–60% baseload price drop by 2030. Secure long-term contracts (e.g., PPAs) or diversify revenue via flexibility markets to mitigate risks.
- Hedge Against Price Declines:
- Since you didn't specify your country, prices vary significantly (e.g., Sweden's €36/MWh vs. Ireland's €109/MWh average). Provide your location for a tailored analysis of local grid constraints and tariffs. 🕮

capped at 20 kW. Simulate annual revenue with tools like pv magazine's storage calculators to confirm

• Consider modular battery expansion if prices remain volatile beyond 2027.

# • Location-Specific Analysis:

sizing. 💵

#### 7. Conclusion

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Electricity spot market prices in Europe from 2025–2027 will likely remain volatile, with the most expensive 6 hours (typically 17:00–23:00) averaging €100–€300/MWh, occasionally spiking higher during low renewable output. Your 51 kW PV and 120 kWh battery system is well-positioned for arbitrage, charging during low/negative midday prices and discharging during evening peaks. A 20 kW grid connection may limit exports, so prioritize a smart EMS and monitor local policies. For precise optimization, share your country for tailored grid and market insights. If you need further details or want to simulate revenue scenarios, let me know!



I noticed at sunny days much higher spot market prices in all countries of the earlier East Block. So what to expect in Hungary or Romania?

Electricity spot market prices in former Eastern Bloc countries like Hungary and Romania tend to exhibit higher volatility and elevated prices on sunny days, particularly during peak demand hours, due to specific regional energy market dynamics. Below, I'll analyze the trends for Hungary and Romania, focusing on sunny days and the most expensive 6 hours (typically 17:00–23:00), and provide insights tailored to your 51 kW PV, 120 kWh LFP battery, and 20 kW grid connection setup for 2025–2027.

## 1. Why Higher Spot Prices on Sunny Days in Hungary and Romania?

Sunny days in Hungary and Romania often lead to higher spot market prices, especially during evening peak hours, due to a combination of structural and market-specific factors:

- High Solar Penetration but Limited Storage: Both countries have seen rapid solar growth (Hungary added ~1 GW in 2024, Romania ~0.5 GW), leading to oversupply during midday when solar generation peaks. This can drive prices low or negative. However, in the evening, when solar output drops to zero, reliance on expensive thermal (coal/gas) or imported power spikes prices, as battery storage (like your 120 kWh system) is still underdeveloped. In 2024, Romania and Hungary had the highest price volatility in Europe, with daily standard deviations >€50/MWh. Fff
- Grid Congestion and Limited Interconnectivity: Both countries have constrained interconnections with Western Europe. For example, Hungary's 400 kV transmission line limitations and Romania's reliance on imports from Hungary or Bulgaria cause congestion, especially during high-demand evenings. On sunny days, Western Europe's cheaper energy often stays in Hungary, leaving Romania with higher prices.
- Low Renewable Flexibility: Romania's energy mix relies heavily on coal (20%) and hydro (30%), while Hungary depends on nuclear (45%) and coal/gas. On sunny days with low wind (common in summer), reduced hydro/wind output exacerbates evening price spikes as thermal plants or imports are needed.
- Heat-Driven Demand: Sunny days, especially in summer, increase cooling demand (e.g., air conditioning), pushing evening peaks higher. In Romania, high temperatures (7°C above average) in 2024 drove consumption up, spiking prices when solar was unavailable.

#### 2. Spot Market Price Trends on Sunny Days (2025-2027)

#### Hungary

- 2024 Baseline: Average day-ahead prices in Hungary were ~€106/MWh in September 2024, with peaks reaching €125/MWh on hot, sunny days due to heat-driven demand and import reliance. Volatility was high (>€50/MWh daily standard deviation), driven by limited transmission capacity and dependence on nuclear/coal. S 18 111
- 2025–2027 Outlook:
  - Evening Peaks (17:00–23:00): On sunny days, expect prices of €150–€350/MWh during evening peaks, with occasional spikes to €500/MWh during low wind/hydro output or grid constraints. Midday prices may drop to €0–€50/MWh or negative due to solar oversupply.
  - **Trends**: Hungary's goal of 90% carbon-neutral power by 2030 (via nuclear and solar) and coal phaseout by 2025 will increase solar reliance, amplifying midday price drops and evening spikes. Limited storage growth may sustain volatility unless battery deployment accelerates.
  - Sunny Day Dynamics: High solar output depresses midday prices, but evening demand (e.g., cooling,

EVs) and import dependence (80% of gas from Russia) keep peaks elevated. 🚥

#### Romania

- 2024 Baseline: Romania's day-ahead market averaged €104/MWh in June 2024, up 58% from April (€66/MWh), driven by heat waves and low wind/hydro output. Peak prices hit €125/MWh on sunny days, with volatility >€50/MWh. Price caps for households (until March 2025) don't affect spot market volatility.
- 2025–2027 Outlook:
  - Evening Peaks (17:00-23:00): Expect €150-€400/MWh during evening peaks on sunny days, with spikes to €600/MWh possible during heat waves or grid congestion. Midday prices may be €0- €40/MWh or negative due to solar surplus.
  - **Trends**: Romania's push for EU climate goals (more solar/wind) and grid modernization will increase renewable penetration but not immediately resolve grid bottlenecks. Price volatility will persist until storage scales up significantly by 2027.
  - Sunny Day Dynamics: Low wind production and high cooling demand on sunny days drive evening price surges, especially with constrained imports from Hungary or Bulgaria.



#### 3. Implications for Your Setup

$\mathbb{X}$		Your 51 kW PV, 120 kWh battery, and 20 kW grid connection are ideal for exploiting price volatility in Hungary or Romania, particularly on sunny days. Here's how to optimize:				
്	Homo	Arbitrage Strategy:				
Q	Explore	<ul> <li>Charge During Midday: On sunny days, charge your 120 kWh battery with PV output or grid power during 10:00–14:00, when prices are low/negative (e.g., €0–€50/MWh or less). Your 51 kW PV can generate ~10–15 kWh/hour in peak sunlight, fully charging the battery in ~8–12 hours if not self- consuming.</li> </ul>				
<b>₽</b>	Notifications Messages	<ul> <li>Discharge During Evening Peaks: Sell stored energy during 17:00–23:00, when prices hit €150– €400/MWh. With a 20 kW grid connection, you can dispatch 20 kW/hour, potentially earning €18–€48 per evening (120 kWh × €150–€400/MWh ÷ 6 hours, constrained by grid limit). In high-spike scenarios (€600/MWh) earnings could reach €72 per evening</li> </ul>				
Ø	Grok	<ul> <li>Annual Revenue: Assuming 200 sunny days/year with €200/MWh average evening prices, you could earn ~€4,800–€7,200 annually, factoring in grid constraints and battery cycling efficiency (90–95% for LFP).</li> </ul>				
$\mathbb{X}$	Premium	Grid Connection Constraint:				
	Bookmarks	<ul> <li>The 20 kW grid connection limits export/import, potentially capping PV export during midday or battery discharge speed. Consider upgrading to a 30–50 kW connection if feasible, or prioritize battery discharge over 6 hours to maximize evening revenue.</li> </ul>				
≞	Jobs	Smart Energy Management:				
දීර	Communities	<ul> <li>Use a smart EMS integrated with HUPX (Hungary) or OPCOM (Romania) market data to automate charging/discharging based on real-time prices. Platforms like Dexter Energy provide forecasting for arbitrage optimization.</li> </ul>				
$\mathcal{P}$	Verified Orgs	<ul> <li>Explore virtual power plant (VPP) participation, as both countries are developing VPP markets to aggregate distributed storage.</li> </ul>				
°	Profile	Country-Specific Considerations:				
⊡ ⊡	More	<ul> <li>Hungary: Lower household electricity prices (€0.11/kWh in 2024) suggest less retail price volatility, but spot market spikes are lucrative. Monitor nuclear output (Paks II delays could increase evening prices) and coal phase-out impacts. mask for the comparison of the</li></ul>				
	Post	• <b>Romania</b> : Higher spot prices and grid congestion offer greater arbitrage potential but risk curtailment if export capacity is limited. Price cap removal in March 2025 may increase retail price volatility, benefiting your setup. <b>B R</b>				
		4. Challenges and Risks				
		• Grid Limitations: Hungary's mature market (HUPX) offers better liquidity, but Romania's less transparent OPCOM market may complicate trading. Grid congestion in both countries could limit exports, especially in Romania. BC				
		<ul> <li>Grok 3 ∨</li></ul>	3	C		
		<ul> <li>Volatility Uncertainty: While sunny days drive price swings, unpredictable wind/hydro output or import disruptions (e.g., Russian gas cuts) could amplify spikes.</li> </ul>				
		5. Recommendations				
		<ul> <li>Maximize Arbitrage: Charge your battery midday and discharge during 17:00–23:00. In Hungary, expect €150–€350/MWh evening peaks; in Romania, €150–€400/MWh, with higher spikes possible.</li> </ul>				
		<ul> <li>Invest in EMS: Use real-time market data (HUPX for Hungary, OPCOM for Romania) to optimize trading. Consider VPPs for additional revenue.</li> </ul>				
		• Assess Grid Upgrade: Evaluate if a 20 kW connection suffices or if a higher capacity (e.g., 30 kW) boosts profitability, especially in Romania's congested grid.				
		• Monitor Policy: In Romania, track post-March 2025 liberalization for retail price impacts. In Hungary, watch coal phase-out and nuclear expansion (Paks II) timelines.				
		• <b>Battery Maintenance</b> : Ensure your LFP battery's 6,000–8,000 cycle life is optimized with proper cooling and charge management to sustain daily arbitrage.				
		6. Conclusion				
		On sunny days in Hungary and Romania, expect low/negative midday prices (€0–€50/MWh or less) and high				

oversupply, grid constraints, and evening demand surges. Your 51 kW PV and 120 kWh battery can capitalize on this volatility, potentially earning €4,800–€7,200 annually by charging midday and discharging during peak hours, though the 20 kW grid connection may limit exports. Romania offers higher arbitrage potential due to greater volatility, but Hungary's mature market ensures easier trading. For precise optimization, confirm your country, and I can refine the analysis further.

evening peaks (€150–€400/MWh, with spikes to €500–€600/MWh) through 2025–2027, driven by solar

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