Flexible Mining, Flexible Grid : Why Governance Matters

Source: Montel News

Iberian takeaways and the MARA–EDF sovereignty question

Part I - Bitcoin Mining & Grid Security

What the Iberian blackout teaches us about flexible demand

On 28 April 2025, Spain and Portugal suffered a rare, over-voltage–driven blackout. The ENTSO-E factual report documents a cascade dominated by voltage phenomena; REE focuses on voltage control and generator behavior; and an IIT-Comillas study (reported by Montel) stresses that too little synchronous generation in southern Spain reduced stability margins. Properly operator-controlled and pre-qualified, flexible demand— such as Bitcoin mining—cannot replace inertia or reactive power, but it can reduce the risk and severity of cascading outages by delivering very fast demand response on the frequency side.

1) What happened on 28 April?

- ENTSO-E's Expert Panel released a comprehensive factual report: sequence of events, system conditions, restoration. It classifies the event as the first European blackout driven by over-voltage, with a final root-cause report due in 2026 [1].

- REE (Red Eléctrica), Spain's Transmission System Operator (TSO), published its own analysis and press note: it pointed to poor voltage-control performance at several units, along with mis-operations and a cascade of voltage-related events [2].

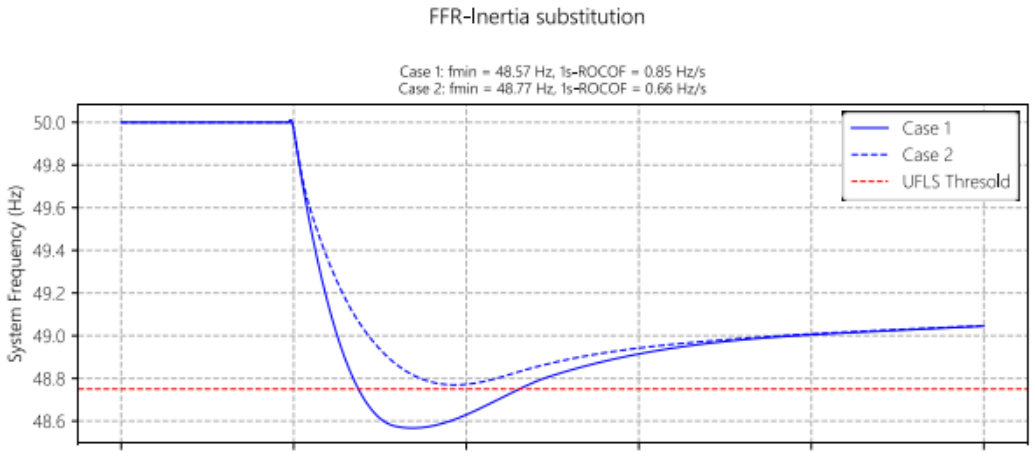
- IIT-Comillas (Rouco et al.)—as reported by Montel—argues that insufficient dispatch of synchronous generation with dynamic voltage control in southern Spain was a fundamental factor, alongside a weak network and pre-existing voltage oscillations [3].

  Takeaway for readers: all three sources converge on a voltage-driven cascade. The Comillas study adds that too little synchronous capacity reduced margins (less inertia and less dynamic voltage support), helping explain why the system was fragile.

2) What flexible demand *can* and *cannot* do

- **What it CAN do (frequency/active power):**
  When frequency starts to fall, curtailing a large, interruptible load within ~0.5–2 s lowers net demand, slows the frequency drop (RoCoF or Rate of Change of Frequency) and raises the nadir [4]. That gives control rooms precious seconds to deploy slower tools. Bitcoin mining, if pre-qualified and operator-controlled, is well-suited because it is highly interruptible with minimal production loss [5].

Fast demand response cushions a trip. When a large unit disconnects, frequency falls. A 0.5-s Fast Frequency Response (FFR)—for example, instant curtailment of a flexible load (such as mining)—slows the fall (lower RoCoF) and lifts the lowest point (the nadir), reducing the risk of under-frequency load shedding (UFLS).



AEMO, Contingency Frequency Response in the SWIS (Draft), ***Figure 14****, p. 25.*

- **What it CANNOT replace (voltage/reactive power):**

  Voltage stability is a different problem from frequency stability [6].
  Keeping voltage within limits requires reactive power — an electrical form of energy that supports or opposes voltage fluctuations — and devices that can provide it, such as synchronous condensers, STATCOMs, or inverters with “grid-forming” controls [7].

  When the grid is already facing over-voltage (too high voltage), disconnecting loads removes current that was helping to absorb power; the voltage can therefore rise even higher. In those moments, the right response is not to switch off everything, but to provide local reactive power or let the operator command which loads should stay online.

  Bitcoin mining helps on the frequency side — by cutting active power almost instantly — but voltage stability depends on reactive-power assets (VARs) and precise operator control [8].

3) Iberian blackout—what *operator-controlled* mining *might* have changed

- Based on the information available today, the Iberian blackout is classified as an over-voltage-driven event. The reports from ENTSO-E and REE do not indicate that the lack of frequency-responsive demand was a decisive factor.

- However, if future analyses (such as the final ENTSO-E root-cause report) confirm the shortfall of synchronous generation and dynamic voltage support identified by the IIT-Comillas study, it would be reasonable to conclude that a sufficiently large, well-distributed fleet of operator-controlled, pre-qualified flexible loads — such as Bitcoin mining — could have reduced the severity of the cascade by improving frequency stability (higher nadir, lower RoCoF).

- Regardless of the final root-cause analysis, the Iberian blackout has already highlighted a key lesson for Europe’s power systems:
  in an increasingly low-inertia, renewable-heavy grid [9], the ability to adjust demand within seconds is becoming crucial for system stability.

  Operator-controlled Bitcoin mining — when pre-qualified and integrated under the TSO’s authority [10] — can provide exactly that kind of fast, controllable flexibility.
  It cannot replace synchronous inertia or voltage-control assets, but it can buy precious time, limit the spread of disturbances, and help protect the European grid from cascading failures [11].

  This event, whatever its ultimate causes, reminds us that flexible demand is now part of grid security — and that mining, if properly governed, can be one of its most effective tools.

Part II — Who controls flexible mining controls a piece of grid security

Flexible demand at scale is not “just another load”: once operator-controlled and pre-qualified, it becomes a grid tool.

Against this backdrop, the proposed MARA–EDF transaction is strategically significant.

In the context of the trade war the U.S. has initiated against Europe, placing such a sub-second grid lever under U.S. corporate control is a sovereignty and security risk.

1) MARA’s bid for Exaion — why it matters

Facts. MARA has announced an agreement to acquire ~64% of Exaion (EDF’s digital subsidiary), subject to approvals [12].

Initially framed as an AI/HPC expansion, MARA’s subsequent communications underline that Bitcoin mining remains core to the strategy [13]

Why it matters. The strategic issue is the platform: a stake close to EDF that could enable operator-controlled, flexible mining to monetise France’s substantial nuclear surplus and deliver very fast demand response when instructed by the TSO.

This is not about liking or disliking Bitcoin; it’s about security and sovereignty [14].

2) Security & sovereignty risks

- Control-plane & jurisdiction risk. If the automatic curtailment logic and signing keys sit outside EU jurisdiction (or under a non-EU parent), the TSO cannot guarantee sub-second response and continuity under all conditions. This becomes not only engineering, but governance and jurisdiction.

- Chain-of-command certainty. In low-inertia systems, milliseconds matter. Curtailment must be executable locally on operator command (or frequency thresholds), with no remote override from a foreign parent and with fail-safe states defined by the TSO.

- Alignment by design. Priority to the TSO’s instructions must be hard-coded contractually and technically (telemetry, audit trails, pay-for-performance and penalties), so operational behaviour is not discretionary.

3) Why this is a European decision, not just a French one

Interdependence. Any country synchronous with France (and HVDC-linked neighbours) is exposed to the consequences of who controls fast, operator-triggered curtailment on the French grid. Grid risk travels across interconnectors; decisions in Paris can affect Madrid, Brussels, Berlin, Rome — and vice-versa.

Why EU Member States have a formal say. Under the EU FDI Screening Regulation (2019/452), other Member States and the European Commission can submit comments/opinions when an investment screened by France may affect security or public order in their territory [15]. France must take these into account before deciding. This is precisely such a case: a sub-second grid lever (flexible mining near EDF's surplus) with potential cross-border stability implications.

What they should say. EU Member States should formally urge France to refuse the MARA–EDF deal on sovereignty and security-of-supply grounds — especially in the context of the trade war the U.S. has initiated against Europe. Placing a fast frequency tool inside a non-EU corporate perimeter, subject to non-EU jurisdiction, is a risk Europe does not need to run.

Why now. The transaction is currently under France's IEF (foreign-investment) screening. It's a period of political vacuum in France. This makes timely, reasoned input from other EU capitals all the more relevant. They can help anchor the decision in security-of-supply first principles and avoid a rubber-stamp outcome.

Pragmatically: having someone finally deploy flexible mining at scale in Europe is better than leaving surplus energy unused. But better still is to have European actors mining in Europe, and in every case to keep it under EU operator control and EU law.

[1] ENTSO-E Expert Panel, “Iberian Peninsula Blackout (28 April 2025) — Factual Report,” 3 Oct 2025, factual report published; final root-cause report forthcoming. https://www.entsoe.eu/publications/blackout/28-april-2025-iberian-blackout/

[2] Red Eléctrica (REE), “Blackout in the Spanish Peninsular Electrical System — 28 April 2025: Incident Report & Recommendations,” 18 Jun 2025. Press release: https://www.ree.es/en/press-office/news/press-release/2025/06/red-electrica-presents-report-incident-28-april-and-proposes-recommendations — Full report (PDF): https://d1n1o4zeyfu21r.cloudfront.net/WEB_Incident_%2028A_SpanishPeninsularElectricalSystem_18june25.pdf

[3] Montel News, “Spanish blackout due to lack of synchronous capacity — expert,” 29 Sep 2025 (paywalled). https://www.montelnews.com/news/1615589/spanish-blackout-due-to-lack-of-synchronous-capacity-expert

[4] Fingrid & Statnett — Fast Frequency Reserve (FFR) market rules/specifications: Fingrid overview: https://www.fingrid.fi/en/electricity-market-information/reserve-market-information/fast-frequency-reserve/ ; Fingrid Terms & Conditions (EN): https://www.fingrid.fi/globalassets/dokumentit/en/electricity-market/reserves/terms-and-conditions-for-providers-of-fast-frequency-reserves-ffr.pdf ; Statnett background (Apr 2025): https://www.statnett.no/globalassets/for-aktorer-i-kraftsystemet/marked/reservemarkeder/nordic-tsos---batteries-in-the-nordic-reserve-markets-april-2025.pdf

[5] Cambridge Centre for Alternative Finance (CCAF), “Cambridge Digital Mining Industry Report: Global Operations, Sentiment, and Energy Use,” Apr 2025. Landing page (key takeaways #7 on curtailment): https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/cambridge-digital-mining-industry-report/ ; SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5236060

[6] ENTSO-E & EU DSO Entity, “Submission of the Joint Network Code on Demand Response,” 8 May 2024. https://www.entsoe.eu/news/2024/05/08/entso-e-and-eu-dso-entity-submit-the-joint-network-code-on-demand-response/

[7] IEA, “Integrating Solar and Wind: Global experience and emerging challenges,” 2024, pp. 63–64 (voltage/reactive power, synchronous condensers, STATCOMs, GFM). https://iea.blob.core.windows.net/assets/4e495603-7d8b-4f8b-8b60-896a5936a31d/IntegratingSolarandWind.pdf

[8] IEA 4E / EDNA, “Overview of Flexibility Platforms: Current Status and Future Outlook,” 9 Feb 2025. https://www.iea-4e.org/edna/publications/overview-of-flexibility-platforms/ ; PDF: https://www.iea-4e.org/wp-content/uploads/2025/01/Report-Flexibility-platforms-EDNA_01-FB.pdf

[9] RTE, “Bilan prévisionnel 2023–2035 — Principaux résultats,” 27 May 2024, p. 51 and p. 56 (flexibility indicators).
https://assets.rte-france.com/prod/public/2024-07/2024-05-27-principaux-resultats.pdf

[10] RTE, “Becoming a Balancing Service Provider (BSP) — process & Market Rules (MA/RE),” last updated 1 Apr 2024.
https://www.services-rte.com/en/learn-more-about-our-services/becoming-a-balancing-service-provider.html ;
https://www.services-rte.com/files/live/sites/services-rte/files/documentsLibrary/RM-2-MECANISME_D_AJUSTEMENT-V01-20240401_3550_fr

[11] Bitcoin Policy Institute, “How Bitcoin Mining Reduces Carbon Emissions,” Aug 2024.
https://www.btcpolicy.org/articles/bitcoin-mining-reduces-carbon-emissions

[12] MARA Holdings, “MARA and EDF Pulse Ventures Sign Investment Agreement in Subsidiary Exaion…,” 11 Aug 2025.
https://ir.mara.com/news-events/press-releases/detail/1407/mara-and-edf-pulse-ventures-sign-investment-agreement-in-subsidiary-exaion-to-expand-maras-global-aihpc-capabilities

[13] MARA, “Bitcoin Production and Mining Operation Updates for September 2025,” 3 Oct 2025.
https://ir.mara.com/news-events/press-releases/detail/1410/mara-announces-bitcoin-production-and-mining-operation-updates-forseptember-2025

[14] EnergyNews.pro, “France: The government asks EDF to reassess the sale of its subsidiary Exaion,” 25 Aug 2025.
https://energynews.pro/en/france-the-government-asks-edf-to-reassess-the-sale-of-its-subsidiary-exaion/

[15] Regulation (EU) 2019/452 (FDI Screening), 19 Mar 2019 (consolidated).
https://eur-lex.europa.eu/eli/reg/2019/452/eng

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