

The Hidden Risk of the Energy Transition, and why Bitcoin Mining might be the answer.

In 2021, a rare winter storm hit the usually warm state of Texas. Millions switched on electric heating, dramatically increasing the load on the grid. As power plants failed, the grid frequency dropped. For 4 minutes and 23 seconds, **the system remained below critical levels, coming dangerously close to total collapse.**[#]



Although a full blackout was narrowly avoided, 246 people still died.⁵³ Experts warned that a total collapse could have claimed **tens of thousands** of lives.⁵³

So... what exactly happened?

In the years leading up to the storm. Texas rapidly expanded its renewable energy capacity. However, by replacing traditional generators (which are connected to the grid through large spinning turbines), they inadvertently phased out a crucial safeguard: inertia, the hidden stabilizer of the old grid.

Traditional turbines spin at 3000 RPM to maintain Europe's 50 Hz grid frequency.





2016 2017 2018 2019 2020 2021 2022 2023 Ceneration by renewables in the Netherlands. (CBS, 2023)⁽²⁾

As solar and wind supply a larger share of our energy, [#] the resulting lack of inertia makes the grid increasingly susceptible to rapid fluctuations.[#] In the Netherlands, operators are expected to invest significantly in flexible systems capable of quickly adjusting power output to maintain grid stability.[#]



Anticipated Growth of Grid Flexibility Needs (TenneT, 2024)¹³

According to TenneT, the Netherlands must scale up its flexible capacity from 11.1 GW in 2022 to 30.9 GW by 2033.³⁷ However, achieving this with **7.2 GW of batterybased flexibility is hugely inefficient.** As it would not only cost billions of euros in investment, but would only support the grid for a limited duration.

The turbines mass and rotational speed provide this inertia, **slowing responses to sudden imbalances** and **buying operators valuable reaction time.** By contrast, solar and wind generate direct current, requiring an inverter for grid connection, **thus providing no inertia.**[®]

What are Flexible Units?

Based on key criteria from the central research question, the **Flexible Unit** was designed to deliver **fast-acting load capacity to the grid.** It uses **Bitcoin mining**, giving it **the unique ability to automatically respond to frequency imbalances within seconds, with virtually no limitations or production losses.**⁴⁴

Built for monthly transport over a 15-year

"How can we design a **cost-effective, scalable, energy-intensive unit** that can **rapidly respond to frequency imbalances** within a renewable energy system?"

lifespan, the unit features self-lifting legs that eliminate the need for cranes. **This highlights its focus on scalability**: by combining mining revenue, dynamic energy prices, and grid operator incentives, **widespread deployment becomes economically viable**.

All of this was proven during an even stronger winter storm in 2023. This time, Bitcoin miners helped stabilize the grid.^[7] What nearly caused catastrophe in 2021 became a non-event just two years later.^[4]

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