

How Ukraine Unplugged from Russia and Joined Europe's Power Grid with Unprecedented Speed

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Анотація

Тут розповідається, як інженери виконали «річну роботу за два тижні», що допомогло Україні уникнути режиму ізоляції, який був би неймовірно небезпечним з точки зору енергопостачання.

Ключові слова: Україна, Укренерго, ENTSO-E, синхронізація, вторгнення, енергосистема, інтеграція.

Abstract

It tells how engineers performed "a year's work in two weeks" which helped Ukraine avoid isolation mode which would be incredibly dangerous from a power supply perspective.

Keywords: Ukraine, Ukrenergo, ENTSO-E, synchronizing, invasion, power system, integration.

Introduction

On February 24 Ukraine's electric grid operator disconnected the country's power system from the larger Russian-operated network to which it had always been linked. The long-planned disconnection was meant to be a 72-hour trial proving that Ukraine could operate on its own. The test was a requirement for eventually linking with the European grid, which Ukraine had been working toward since 2017. But four hours after the exercise started, Russia invaded. Ukraine's connection to Europe—which was not supposed to occur until 2023—became urgent, and engineers aimed to safely achieve it in just a matter of weeks. On March 16 they reached the key milestone of synchronizing the two systems.

Process

Ukraine initiated the process of joining Europe's grid in 2005 and began working toward that goal in earnest in 2017, as did Moldova. It was part of an ongoing effort to align with Europe and decrease reliance on Russia, which had repeatedly threatened Ukraine's sovereignty.

After the late February trial period, Ukrenergo, the Ukrainian grid operator, had intended to temporarily rejoin the system that powers Russia and Belarus. But the Russian invasion made that untenable. Three days after the invasion, Ukrenergo sent a letter to the European Network of Transmission System Operators for Electricity (ENTSO-E) requesting authorization to connect to the European grid early. While European operators wanted to support Ukraine, they had to protect their own grids, so the emergency connection process had to be done carefully.

One of the primary challenges of interconnecting grids is synchronizing them, which is what Ukrenergo, and ENTSO-E accomplished last week. Synchronization is essential for sharing electricity. The task involves aligning the frequencies of every energy-generation facility in the connecting systems. Frequency is like the heartbeat of the electric grid. Across Europe, energy-generating turbines spin 50 times per second in near-perfect unison. For Ukraine to join in, their systems had to be adjusted to match that rhythm.

ENTSO-E, which represents 35 countries, had numerous concerns about adding Ukraine to its grid. Those concerns related not only to grid stability but also to market, regulatory, cybersecurity and legal issues. Taken together, these factors were a major reason for the project's original six-year timeline.

One safeguard against grid instability is inherent to many of Ukraine's assets: rotational inertia. Once heavy turbines, such as those in the nuclear plants that comprise much of Ukraine's energy supply, are

spinning at a certain frequency, it takes a substantial, sustained change in power to alter their rotation. They are unaffected by minor blips in the power generated to spin them, so their frequency remains stable.

This inertia helps power plants dampen slight variations in power instead of transferring them to the rest of the grid. In the case of a major failure, it buys a few precious seconds for response systems to kick in.

Ukraine planned to address ENTSO-E's remaining concerns throughout 2022. "The only reason that that year can be chopped off is because so much has already been done to confirm all of the technical specifications," Jayanti says. This month's emergency authorization to synchronize enables Ukraine to purchase power, but the country cannot yet sell it. To do so, Ukraine is required to install devices called static synchronous compensators, which enhance power stability. It may be many months before Ukraine can obtain them because of supply chain issues and geopolitical obstacles, Jayanti says. In the meantime, to connect Ukraine at all, ENTSO-E adopted additional safeguards to protect the European grid.

Conclusion

Even with the emergency synchronization, it is important to manage expectations, experts say. "This level of interconnection is relatively small," Deane says. "It's helpful, but it's not going to replace all the power in Ukraine if the power plants go down." For now, electricity in Ukraine is still moving from power stations to the country's broader distribution network. Should that change, Ukraine can import some electricity from ENTSO-E.

Full integration with the European grid will likely take until the war is over and Ukraine can rebuild. "This is the first step in a long journey. That journey is really about integrating Ukraine into the wider [European] system with a view to integrating more renewables and sharing resources," Deane says. But those plans "won't go anywhere until peace returns to the region. It's just too risky, too dangerous."

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