How tech developers are modernizing the power grid to fight the climate crisis

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Energy grids have undergone immense change in recent years with the introduction of smart devices, new hardware, and software solutions that enable communication and data exchange. While these shifts signal a positive trend toward widespread renewables adoption, utility companies struggle to analyze and improve the power grid's efficiency.

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Even with more connected devices and new methods to generate energy, outdated processes continue to force operators to create nonstandard solutions to solve challenges. Standards implementation usually vary between vendors' control systems and devices, and accessing grid data requires several different devices, each of which may involve different processes.

In addition, we've historically delivered electricity in one direction, preventing operators from controlling loads on a small scale. This leads to losses in efficiency when supply and demand aren't properly matched. With more devices such as batteries, solar panels, wind turbines and non-wired solutions at the edge, supply and demand are more unpredictable. The current infrastructure limits communication of information about energy and the creation of automated multidirectional intelligence across grids. This complexity will only increase, and we'll need to use AI and automation to facilitate transactions at microsecond intervals to remain safe and balanced.

Without the ability to extract grid data about energy use via a bidirectional grid, utility companies can't respond to changes in real time. With the increased demand for renewables that rely on weather conditions, we need a way to access and distribute grid data to respond to energy needs in a more precise manner. The Grid eXchange Fabric (GXF), an industrial Internet of Things (IoT) platform initially launched by Dutch energy operator Alliander as 'Open Smart Grid Protocol,' and subsequently contributed to LF Energy in early February, enables communication and removes barriers at the baseline, allowing grid operators to securely monitor and access data.

New technology, old grid

GXF serves as a gateway between various utilities as well as a gateway to the grid of the future.

Until now, the energy sector lacked urgency to implement major changes. Instead, many leaders believed we had time to gradually adopt new technology and passively

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transform. After all, the existing systems and strategies, while flawed, have served organizations for many years. But given the build-up of carbon dioxide in the atmosphere, we need solutions that help us reach decarbonization goals and achieve an unprecedented degree of global cooperation.

GXF contributes to cleaner grid creation by making it easier for developers to access a large volume of data across communication protocols and telecom technology, helping utilities make smarter predictions about loads and control smart devices on the grid. In the Netherlands, Alliander is already using GXF to create advanced business applications. Alliander controls over 200,000 public lighting poles in the Netherlands and will eventually deploy GXF across the entire 700,000-pole system. Controllable public lighting enables municipalities to manage lighting based on public safety requirements, and analyze performance and maintenance needs.

On a larger scale, GXF will allow utilities across the globe to collaboratively create a cleaner energy grid, enabling developers to manage microgrids and transform smart meter communication to become a generic connectivity layer for data across the grid.

Accessing energy grid data enables us to reach decarbonization goals

Many solutions to climate change require major policy decisions that transform companies and energy projects, making data access seem like a small problem to fix. But without data access as the baseline, larger changes, such as a complete transfer to renewables or the decarbonization of transportation, are impossible. Understanding data about energy quality and local conditions and constraints helps us reach decarbonization goals in a number of ways.

Open source environments allow for interoperability

In today’s closed environment, each utility company creates its own communication protocol to facilitate communication between pieces of hardware and software, creating a heterogenous grid with no standard technology or process. GXF gives vendors the ability to communicate across multiple protocols by serving as a translator, enabling data to move between continents and companies.

Interoperability and standardization through open source will become increasingly critical with the growing need to capture insights on grid behavior and control the grid. Instead of attempting to standardize smart technology and gather data from the source, we must create intermediate layers to gather data from a bidirectional grid.

Microgrid enablement helps match supply with demand

Because energy supply relies on forecasted demand, utilities make more accurate predictions based on the quality and specificity of their data. In bulk transactions determined by predictions made the day before, loads vary considerably depending on weather events and times of day, so during particularly high loads operators must turn to peaking power plants (peaker plants), plants designed to run only when demand is high, which, like typical generators, are dirtier than normal energy sources.

By moving in the direction of microtransactions, in which data is analyzed across a smaller area and in much shorter time increments, utility operators can make more exact predictions and even match supply with demand in real time, also eliminating the need for coal-powered peaker plants.

GXF creates opportunities for collaboration

Because utilities use different communication protocols within a closed infrastructure, energy leaders don’t have opportunities to share solutions. In an open source environment, anyone can use and contribute tools and data. In addition, open collaboration advances innovation because it curbs the tendency for many people across the world to continuously recreate the same solutions with small adjustments.

Instead, providers stand on the shoulders of peer-created tools to increase the features and functionality of existing solutions. In doing so, we can accelerate progress toward the decarbonization of all industries, from shifting data centers to the cloud to fueling transportation with green energy.

Utility companies are at a turning point as pressure mounts for them to become smarter grid operators. More and more, utilities like Alliander refer to themselves as ‘network operators,’ acknowledging a shift toward viewing the energy grid as a highly networked environment. The utility of the future resembles an IT company, with developers serving as operators to modulate energy via code instead of patchwork hardware solutions.

Like most other industries, the push to digitize the energy sector didn’t stop with introducing new hardware and software solutions. Instead, energy leaders must continuously adapt to the world’s changing needs, leading other industries toward a greener future.

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