

# How is North America's Largest Utility Ensuring Sustainability & Resilience Using GenCell's Substation Backup Power Solution?



## GENCELL'S HYDROGEN2POWER™ TECHNOLOGY + GEMS™ ENERGY MANAGEMENT SOFTWARE OPTIMIZE SUBSTATION PERFORMANCE & INTEROPERABILITY

As the guardians of the gates to the grid, substations play a critical role in avoiding outages, ensuring reliable flow of power to customers and preventing costly, damaging black starts. To do their strategic job of managing voltage levels and evenly redistributing loads, isolating faults and facilitating restoration of power when any part of a network is down – as well as to serve as the key control and monitoring centers for grid reliability – substations **MUST** be supplied with uninterrupted backup power.

Today power utilities are challenged to withstand increasingly frequent and severe climate and weather incidents while at the same time incorporating volatile renewable resources into the grid and meeting ever-increasing power demands, challenges that together exponentially increase the risks of outages. Given the heavy economic impact of power outages on substations – [one such](https://eta-publications.lbl.gov/sites/default/files/erss_manuscript_preprint_0.pdf) study estimating a 24 hour outage at a single substation to reach \$35.1 million – power utilities recognize the importance of hardening substations with resilient backup power. Working to improve their SAIFI (outage frequency) and SAIDI (outage duration) scores, smart utilities are

investing in innovative climate-resilient substation backup power solutions that both increase visibility into and accurate monitoring of substation operations while extending auxiliary power duration by **days to weeks** with robust, reliable and weather-resistant Hydrogen2Power™ fuel cell solutions.

**To meet these tough challenges, the largest North American power utility, operating thousands of substations across a vast territory vulnerable to increasingly frequent and extreme inclement weather and climate disasters, has deployed several hundred GenCell REX™ resilient, zero-emission and uninterrupted extended duration ( 72+ hours) and weather-resistant auxiliary DC substation power units at critical substation sites. The units were installed with proprietary GenCell GEMS™ cross-organizational energy management software to both enhance control of and maximize substation resilience across their transmission and distribution network.**

## CLIMATE BACKGROUND

Operating in diverse regions, from mountains to coastlines, and facing extreme weather events—hurricanes, earthquakes, tropical cyclones, floods, droughts, and heatwaves, this major power utility supplies over 300 terawatts of electric capacity, serving a vast and expanding customer base. In recent years, earthquakes have caused widespread outages, affecting millions. In response to the growing impact of climate on its operations, and to meet sustainability goals and international commitments to reduce greenhouse gas emissions, the utility now sources over 25% of its energy mix from renewables. But this reliance on renewables brings volatility, which when combined with challenging weather and terrain threatens to negatively impact energy reliability. To withstand these combined climate-related challenges and ensure energy reliability and resilience, the utility places highest priority on long-duration substation backup power.

## THE CHALLENGE ENSURE SUBSTATION CONTINUITY

**When severe weather threatens power outages, traditional DC auxiliary power backups at substations only last 4 to 8 hours, and their reliability is often uncertain. Expanding battery capacity isn't feasible, especially at urban sites where space is tight. Diesel backup, while an option, comes with its own set of problems: it's not failsafe, requires frequent servicing and maintenance and emits pollutants.**

These limitations add pressure to operational teams, making it harder to plan and reach decisions effectively. Unpredictable energy capacity and lack of real-time operational insight put pressure on maintenance crews that hinders optimal decision-making.

To maintain grid stability during extreme weather, reliable backup power is essential. The DC auxiliary control panel systems that support circuit breakers, transformers, and switchgear - the heart of substation operations - depend on an efficient, uninterrupted and stable 130 VDC grid. At the same time, the utility also needs backup for the communication and control networks that keep personnel connected during power restoration efforts, especially in the aftermath of disasters.

### Estimated Economic Impact of a 24-Hour Power Outage at a Single Substation: A Comprehensive Analysis Across Key Sectors

Food Spoilage	\$1 .0 million
Wages Lost	\$5 .0 million
Manufacturing Industry	\$5 .0 million
Banking Industry	\$3 .0 million
Restoration Costs	\$10 .0 million
Overtime Payments	\$2 .0 million
Transportation Revenue Losses	\$2.6 million
Labor Costs	\$6.5 million
<b>Total</b>	<b>\$35.1 million</b>

Evaluating economic impact of disruptions enables resilience-based preparedness planning. Above estimation based on research across multiple sources including [Source](#)



## TECHNOLOGY EVOLUTION THROUGH MULTI-PHASE PROJECT DELIVERY

After thorough product evaluations and testing, the utility rolled out the GenCell solution in the first phase of the project, using it to both back up and charge substation batteries. GenCell's software was integrated to centrally monitor and optimize equipment performance across multiple substations, enabling preventative maintenance and maximizing uptime.

During this initial phase, an earthquake measuring 0.30 PGA hit the region, causing outages in many substations. However, those backed by the GenCell units remained operational throughout the quake, demonstrating the system's resilience.

The utility then moved forward with a multi-phase delivery program. In the first phase, 37 GenCell units were installed at the most critical substations, followed by another 37 in the second phase. Of these, 50 units power 130 VDC control panels, while 20 support 48 VDC communication nodes and SCADA hubs to ensure continuous connectivity. Additionally, 8 units were deployed to back up 12 VDC radio equipment for disaster recovery at remote substations in hurricane-prone areas.

Following the success of these phases, the utility ordered two more batches of over 50 units each. These new units were upgraded for flexible configuration, allowing them to support 130, 48, or 12 VDC loads as needed.

## KEY BENEFITS



Extended duration backup power of 72+ hours - for as long as hydrogen fuel is available - mitigates impact of weather incidents, supporting emergency response, preventing black starts and reducing threat of costly substation power outages.



Flexible configuration interchangeably supports 130, 48 and 12VDC load capacities.



Compliance with latest cybersecurity threat protection (OWASP Top 10) following strictest penetration testing.



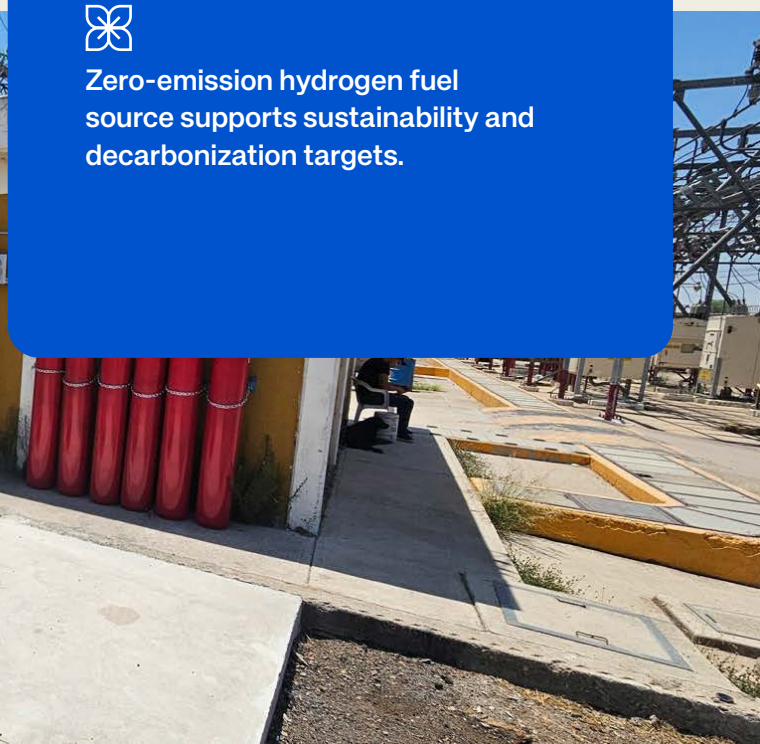
Integrated proprietary GEMS Community software for remote multiple device management, monitoring & control of the digital substation.



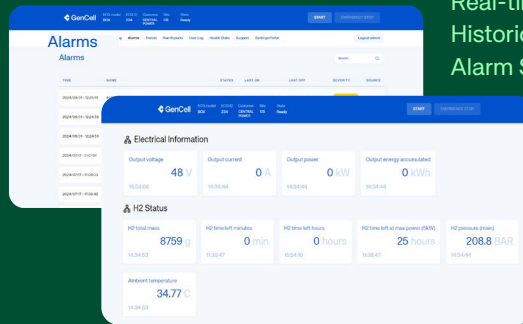
Interoperability and connectivity with substation SCADA & multilayer alarm system for alerts at the national, regional, and local levels using common protocols (Modbus, DNP3, MQTT and SNMP).



Zero-emission hydrogen fuel source supports sustainability and decarbonization targets.



## GENCELL GEMS™ SOFTWARE OPTIMIZES SUBSTATION POWER MANAGEMENT



Real-time Data,  
Historical Trends and  
Alarm Sequences

The proprietary GenCell GEMS™ energy management software monitors, controls and manages the equipment with embedded operational intelligence, executing system self-checks, CO2 footprint monitoring, State of Health monitoring, sophisticated multilevel alarms, fault management and test procedures to analyze and improve equipment performance.

The GenCell GEMS COMMUNITY software component manages this utility's multi-site, multi-unit deployment. The system integrates with the

utility's SCADA system for maximum visibility of broad substation performance. Recognizing the importance of interoperability and cross-platform integration, going forward the utility is working with GenCell on customized software enhancements to expand the project's functional and operational scope.

Following the gradual advancement and expansion of the deployment, the utility operates today a broad sustainable power network significantly enhancing the resilience and reliability of the company's critical transmission and distribution infrastructure.

Prior to being familiar with the technology, the customer initially categorized the system as **Tier Two** backup supplementary to the previously installed flooded battery backup. **After the successful deployment of multiple GenCell units that resiliently withstood tough weather conditions, the GenCell units were then designated as Tier One to replace the flooded batteries.**

### Lessons Learned & Next Steps:

#### LEVERAGING HYDROGEN TO MAXIMIZE SUBSTATION RESILIENCE & SUSTAINABILITY

To date the utility has deployed several hundred systems at 150 substations, all incorporating the GEMS software for optimal substation power management.

“The successful requisition of GenCell systems is in our estimation an important step towards a more reliable power network based on hydrogen technology; the successful integration of GenCell's systems into our power network and critical transmission infrastructure will contribute already in the immediate future to a more reliable, advanced and sustainable power network,” commented a key member of the implementation team.

Going forward the utility's growth plan focuses on implementing the technology in every new substation and to replace equipment at existing substations on an as-needed basis.

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