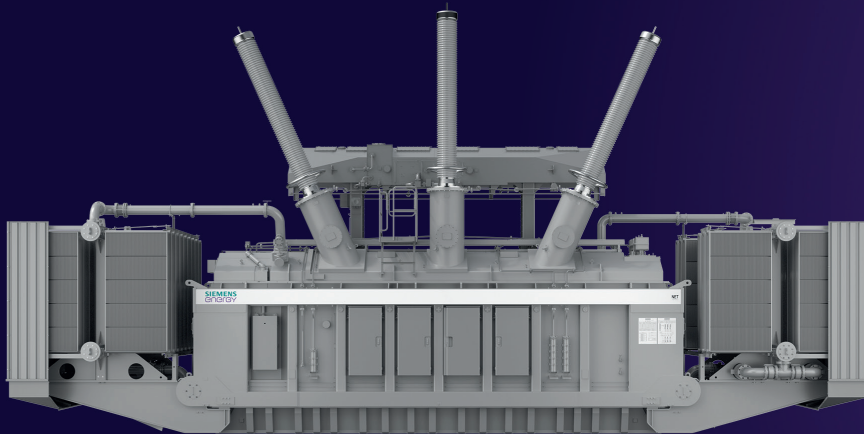




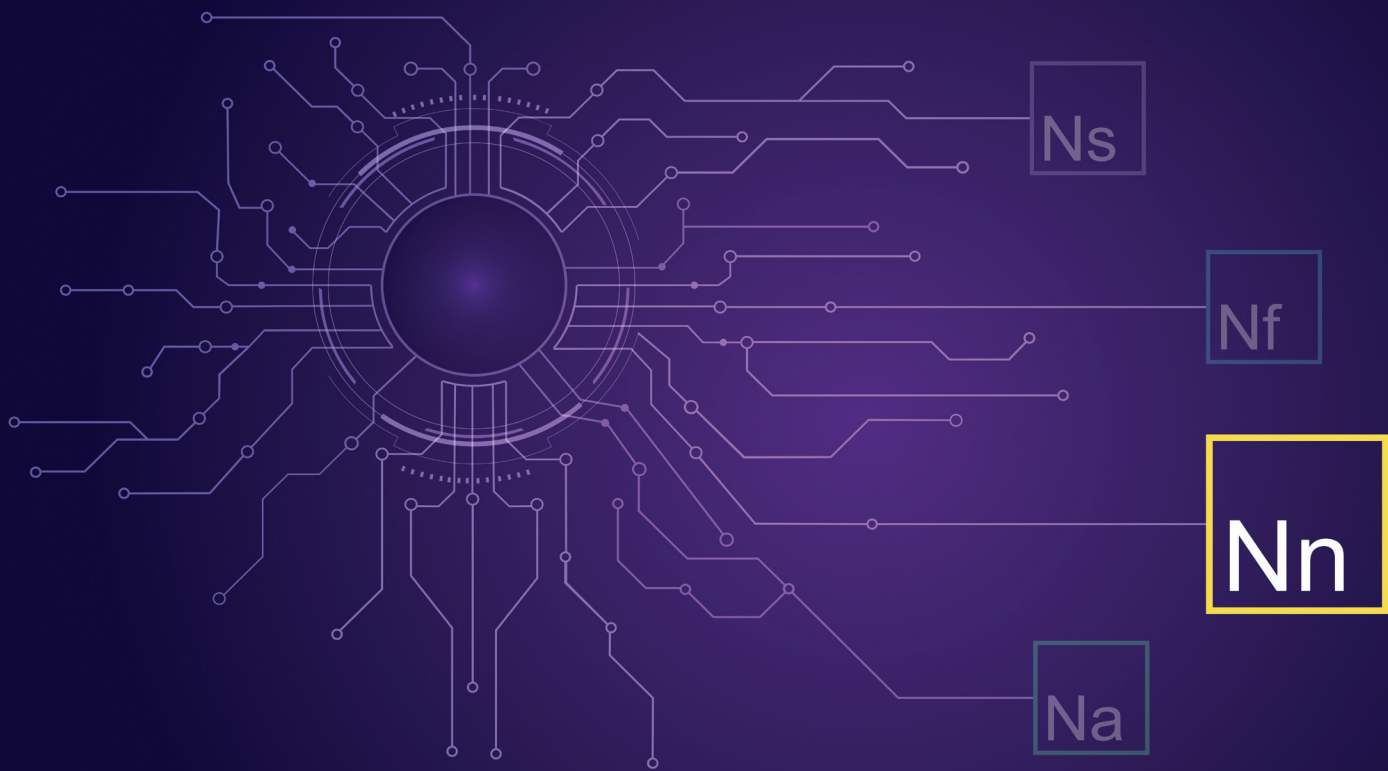
Transformers digitalization

Noedra Node suite for substation digitalization

Listen to the grid's heartbeat.



Noedra Node
Substation Digitalization



The Noedra framework

Noedra is Siemens Energy's digital framework — the Mind of the Grid — connecting Grid Technologies' intelligent solutions, from sensing and automation to software and consulting, into one coherent ecosystem.

By transforming data from across the grid into clarity, coordination, and confident action, Noedra enables operators to manage complexity with intelligence and control.

Each Noedra suite represents a specific way this intelligence acts across the grid.

Together, they protect, sense, connect, and foresee the grid of today and tomorrow.

Node suite - Intelligence inside the substation

The Node suite focuses on substation digitalization, integrating sensing, inspection, predictive analytics, protection, and automation into a coordinated layer of intelligence.

Connected with the other Noedra suites, Node transforms raw asset data into foresight — enabling substations to monitor their own condition, anticipate risks, and support confident operational decisions.



From transformer data to operational foresight

Substations are the backbone of the power grid, and transformers play a critical role in ensuring reliable energy transmission and distribution. The health and performance of these assets directly affect grid stability, safety, and efficiency.

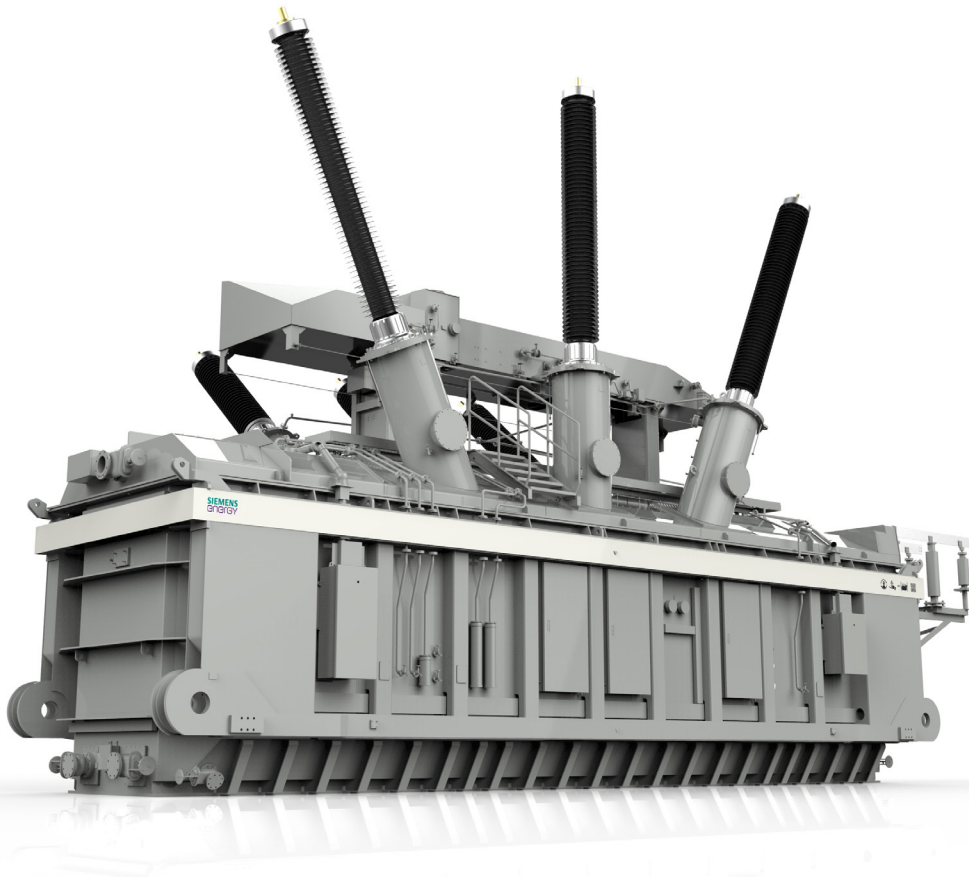
Today's operators face growing challenges:

- Ageing transformer fleets and infrastructure.
- Increasing load demands and operational stress.
- Integration of renewables and distributed energy resources.
- Higher expectations for reliability, safety, and transparency.
- Pressure to reduce unplanned outages, maintenance costs, and environmental impact.

Traditional inspection and maintenance approaches are no longer sufficient. Operators need continuous visibility into transformer condition, predictive analytics to anticipate failures, and actionable insights to intervene before issues escalate.

The Noedra Node suite for transformer digitalization delivers these capabilities - enabling a shift from reactive maintenance to predictive asset management, optimized transformer performance, and stronger grid resilience.

Our solutions



Power transformers are among the most robust assets in the grid, designed for decades of reliable service with relatively low maintenance requirements.

However, reliability does not occur by default. Throughout a transformer's lifecycle, operators must establish a proactive maintenance strategy to ensure optimal performance and avoid costly surprises.

Ageing is a critical concern as power system components deteriorate over time. Combined with increasing load demands and stringent power quality requirements, it becomes essential to gain real-time awareness of transformer health.

The Node Substation Digitalization Suite enables that awareness, delivering continuous monitoring, advanced diagnostics, and predictive analytics to help operators:

- Detect emerging issues before they escalate
- Optimize maintenance planning and extend asset life
- Ensure safe, efficient, and reliable operation under evolving grid conditions

Key features & benefits

Mechanical & Thermal

Cooling control: Provides real-time visibility of the cooling system by tracking the operation and run-time of fans and pumps. Ensures transformers remain within their specified temperature range, dissipating heat effectively to prevent overheating and maintain stable performance.

Ageing analysis: Digital-twin-based ageing analysis using thermal modeling and data from existing sensors to estimate transformer life consumption. Supports safe overload management, optimized loading, and long-term life-extension decisions through a deeper understanding of thermal behavior.

Gas

Gas analysis – 1 gas: Enables fleet-wide transformer monitoring by continuously tracking hydrogen levels—the most sensitive indicator of electrical faults. Provides early warning of issues such as partial discharge, high-energy discharge (arcing), and thermal faults in oil or cellulose.

Comprehensive Gas analysis – 4 gases + moisture: Offers a broader diagnostic view by monitoring four key gases plus moisture. Detects evolving faults early, pinpoints their origin, and offers a comprehensive warning of issues such as partial discharge, high-energy discharge (arcing), thermal faults in oil or cellulose, and oil leaks.

Complete Gas analysis - 8 gases + moisture: Supports early fault detection and diagnostics using proven methods like duval and Rogers Ratio. Identifies issues such as partial discharge, high-energy discharge (arcing), thermal faults in oil or cellulose, and oil leaks.

Electrical

Partial discharge (PD) monitoring: Partial discharge is an early indicator of insulation deterioration caused by defects, movement of energized parts, or design flaws. Provides early warning of harmful PD activity, enabling timely intervention to prevent catastrophic failures, reduce downtime, and extend transformer life. GIC tracking adds extra protection against geomagnetic disturbances.

OLTC monitoring: Ensures stable and optimal voltage supply by tracking tap changer operations, motor performance, and position - the only moving part inside the transformer. Enables early detection of wear or abnormal behavior, ensuring reliable voltage regulation and preventing switching-related failures.

Bushing monitoring: Combines multiple analysis methods to assess bushing condition. Monitors power factor, dissipation factor, and capacitance at nominal voltage, with high-precision measurements using parallel monitoring of up to six leakage currents. Detects early degradation of insulation and internal layer breakdown to prevent failures.

Technical highlights

Real-time monitoring

Continuously tracks oil level and temperature, winding current and temperature, and ambient conditions. Integrates dissolved gas analysis (single or multi gas), insulation moisture measurement, and bushing/OLTC health indicators - providing a complete, real time picture of transformer condition.

Analytics

Thermal modeling and digital twin for hot-spot calculation, ageing index, overload guidance. Includes PD pattern recognition, dynamic loading assessment, insulation moisture analysis, and fleet-wide family-based evaluation and comparison.

Data processing

Local or cloud-based processing and storage via the transformer-mounted panel. Performs trending and diagnostics for incipient failures without the need for third party software - ensuring higher reliability, faster insights, and fewer false alarms.

Connectivity & security

Encrypted data transfer to web/mobile dashboards with read-only gateways for safe remote access. Offers API integration with asset and SCADA systems, supporting Modbus-RTU, Modbus-TCP, IEC 61850, OPC UA (optional via gateway: DNP3, IEC60870-5-104). Optional intranet only access enhances cyber security and deployment flexibility.



Why Siemens Energy

Choosing Siemens Energy means partnering with a global leader committed to powering progress and shaping a sustainable energy future. More than a technology provider, we bring vision, reliability, and long term partnership—helping you navigate the evolving energy landscape with confidence.

Proven expertise:

Benefit from decades of experience in power systems and grid modernization, ensuring reliable and forward-thinking solutions.

Global reach:

Leverage our worldwide presence and deep industry knowledge to address local requirements while meeting global standards.

Tailored solution:

Our teams collaborate closely with customers to deliver solutions customized to your unique operational needs.

Trusted partnership:

Rely on Siemens Energy as your advisor, dedicated to building long-term relationships and supporting your journey toward a reliable, secure, and sustainable energy future.

Continuous innovation:

Experience ongoing support and innovation, ensuring your organization stays ahead in a rapidly evolving energy landscape.

Turn transformer visibility into foresight.

Modernize transformer health management and strengthen substation performance with Noedra Node.

Discover Siemens Energy's integrated solutions for digital substations.



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