



Powering the New Digital Utility

Cisco smart grid and network solutions help enable security, resilience, and operational efficiency

From rising security threats and tightening regulations to aging grids and more demanding customers, utilities are grappling with a volatile new operating environment. Cisco's solutions for digital utilities help leading power companies adapt to the changing landscape and fuel continued growth and innovation.

Power on

- Utilities are facing unprecedented challenges to growth and profitability
- To thrive in the new era, utilities need to connect and modernize grid operations end to end
- Leading utilities are turning to Cisco for a full range of solutions, including grid security, WAN modernization, substation and distribution automation, smart meters, mobile workforce collaboration, and more



Challenges

- Rising security threats—both cyber and physical
- Tougher industry regulations
- Rising costs, shrinking margins
- Growing demand for renewables



Solution

- Modernize and automate grid using converged IP networking technologies
- Deploy proven end-to-end security systems
- Empower workforce with unified collaboration platform



Why Cisco

- Unrivaled security expertise
- Comprehensive grid management capabilities
- Leadership in IoT
- Commitment to interoperability and open standards
- Strong customer and partner ecosystem

The evolving utilities landscape

After what seemed like decades of stability and predictability, utilities have entered a new era of change and uncertainty. Security threats are growing, regulations are tightening, and new technologies—from smart meters to microgrids—are disrupting longstanding business models. Meanwhile, consumers are demanding more from their power company, including flexible pricing and sustainable energy options. These trends have changed the game for utilities, forcing them to evolve or face diminishing growth and profitability.

Recent security incidents—both cyber and physical—have sent shock waves through the industry, spurring new regulations to avert crippling attacks on critical energy infrastructure. Yet most utilities have a long way to go to protect their grids. Isolating the network is no longer an option. The reality is that utilities need to be connected to increase grid efficiencies, improve resilience and—ultimately—deliver the next generation of services to an increasingly digitized and mobile customer base.

The growing adoption of solar, wind, and other renewables has also challenged utilities to adapt by integrating these distributed energy

resources into the grid.¹ This is not a simple integration, given the challenges of implementing bi-directional flows. Meanwhile, consumers themselves are driving change by demanding more choice and flexibility from their energy providers.

To thrive in the new era, utilities will need to invest in more efficient, automated, and resilient energy grids. The industry's infamous aging infrastructure—and graying workforce—complicates the task. Strategy-minded utilities are increasingly planning for a future based on IT and smart grid applications that require advanced telecommunications systems. IP-based, packet-switched networks will form the backbone of these new systems, providing system interoperability and enabling a spectrum of new applications that improve grid security, control, and automation.

For instance, by harnessing connected-grid technologies, utilities can continuously monitor traffic anomalies and neutralize cyber threats before they occur. Secure wireless connectivity can help workers troubleshoot outages faster. Distribution automation—enabled by IP networks—can curb power losses. And new multiservice networks can rein in costs by consolidating a mix of legacy services and protocols on a single highly efficient communications network. These are just a few examples of what's possible for the new digital utility.

¹2016 marked the first year ever that solar generation topped all other fuel types in new capacity additions.

Perhaps most promising (and exciting): Connected-grid technologies will offer utilities a broad platform for innovation, helping unlock the power in the latest iterations of the Internet of Things (IoT), artificial intelligence, and predictive analytics. Considering that utilities are estimated to have the largest collection of intelligent devices in operation, the potential for capitalizing on this built-in IoT network—and the terabytes of data it holds—is enormous.

The logic of the new era is clear: If utilities are going to reverse flat or declining revenues, cope with an aging infrastructure, improve workforce efficiency, and address new customer expectations, then they must place digital transformation at the top of their business agenda.

Modernizing the grid with Cisco

The challenges for utilities are huge, but so are the opportunities. More and more utilities are partnering with Cisco and harnessing new technologies to enable a range of modern capabilities that accelerate business transformation.

Cisco Connected Grid™ solutions address every aspect of the modern utility's network operations—from the control centers and wide area networks (WANs) that provide oversight and management of the entire grid; to the increasingly complex and automated substations that form the backbone of energy distribution, and the field area networks (FAN) that link the “last mile” of the network to residential and business consumers.



Control Centers/Wide Area Network



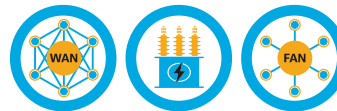
Substations



Field Area Network (distribution automation, remote asset management, smart metering, and remote workforce automation)

6 critical capabilities

Our research shows that modern utilities need to focus on mastering six critical capabilities—spanning the range of network places—to drive market leadership and profitable growth in the decade ahead:



Grid security

Cisco offers utilities the broadest portfolio of security solutions, countering both cyber and physical threats and protecting every part of the network—from the control center to substations to field area networks and mobile workers. Cisco Grid Security solutions deliver an integrated, converged approach to security that:

- Provides critical infrastructure-grade security to grid systems, data, and assets
- Monitors the network while mitigating threats
- Helps utilities meet regulatory requirements

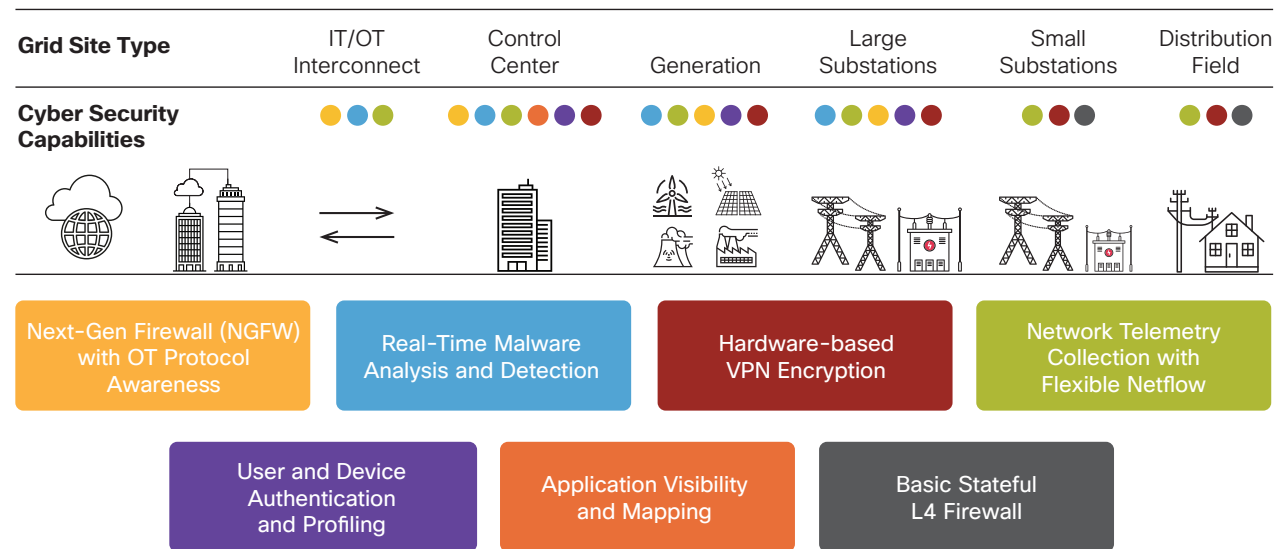
What utilities care about today

- Physical security and cyber security
- Grid modernization
- Integrating new distributed energy resources (solar, microgrids, etc.)
- Complying with new regulations
- Accommodating rising consumer empowerment
- Integrating new energy sources and consumption models
- Improving safety, security, and reliability
- Retaining and acquiring customers
- Exploring unregulated market opportunities
- Mergers and acquisitions

Cisco’s solutions for cyber security give network operators visibility into every device, and allow continuous monitoring of the network for anomalous traffic and malware. The solutions provide secure remote access to the network—boosting efficiency and worker productivity—and ensure the latest patches and updates are installed, further strengthening the network against cybercrime and data loss.

Physical security is no less critical—a fact starkly highlighted by the well-documented incident at PG&E’s Metcalf substation, where gunmen knocked out 17 transformers that help power Silicon Valley; a blackout was narrowly averted. Cisco leads the market in providing physical video surveillance, access control, alarms, and tamper-prevention solutions to safeguard power plants, transmission lines, substations, smart meters, and more.

Grid cyber security



Cisco solutions for grid security

Cyber security products

Cisco Identity Services Engine, Cisco Adaptive Security Appliance, Cisco Intrusion Prevention System, Cisco Industrial Security Appliance, Cisco Connected Grid Routers, Cisco Industrial Routers, Cisco Integrated Services Routers, Cisco Aggregation Services Routers, Cisco Industrial Ethernet Switches

Physical security products

Cisco Video Surveillance Manager, Cisco Identity Services Engine, Cisco Video Surveillance IP Cameras, Physical Access Gateway, alarms for industrial and Ethernet routers, tamper protection for connected grid routers



Utility WAN

Cisco is defining the future of utility WANs with solutions that help companies unite disparate networks and manage assets more efficiently and securely across the grid. Cisco's portfolio of IP and Multiprotocol Label Switching (MPLS) networking solutions simplifies and streamlines utility WAN operations. The solutions empower utilities to move toward a modern, full-mesh matrix linking the distribution grid, substations, control center, data center, and corporate offices.

With Cisco's industry-leading WAN solutions, utilities can:

- Converge multiple proprietary systems onto a single IP network and extend IT infrastructure from corporate offices to substations
- Increase system availability, safety, and performance for large-scale networks
- Move from reactive to active network management
- More easily comply with NERC CIP, IEC 61850-3 and IEEE 1613



Substation automation

Traditional substation designs—often dependent on a jumble of leased lines and siloed applications—lack the functionality and scalability needed to meet today's operating standards and security requirements. Cisco helps utility operators modernize the grid with next-generation

substation automation products and services. These provide the foundation for advanced protection and control, remote diagnostics, and predictive maintenance capabilities.

Featuring ruggedized switches and routers, Cisco's open standards-based substation automation solutions enable utilities to:

- Improve remote monitoring of substation equipment and sensors for better visibility
- Reduce service disruptions with more timely equipment maintenance
- Improve productivity and lower costs by reducing multiple lease-line charges
- Manage existing legacy infrastructure while complying with new security mandates and industry standards



Distribution automation

Last-mile data communications networks are essential to realizing the full potential of the smart grid. Field area networks powered by Cisco support all the capabilities that drive the competitive edge of modern utilities—including high-efficiency distribution automation (DA), remote asset management, smart metering, and mobile workforce automation. Cisco multiservice networks are the foundation for enabling distributed power generation and energy storage, electric vehicle (EV) charging, microgrids, and more.

Cisco solutions for utility WANs

Teleprotection

Cisco's deterministic, multiservice WAN provides industry-leading performance, low-latency, reliability, and flexible transport options.

Products: Cisco Aggregation Services Routers, Cisco Evolved Programmable Network Manager

Synchrophasors/PMUs

Cisco offers carrier-class precise timing for the WAN and power-profile support for the LAN. **Products:** Cisco Aggregation Services Routers, Cisco Connected Grid Routers, Cisco Industrial Ethernet Switches, Cisco Evolved Programmable Network Manager

Supervisory Control and Data Acquisition (SCADA)

Cisco's broad portfolio features flexible transport options and full support for legacy protocols. **Products:** Cisco Aggregation Services Routers, Cisco Connected Grid Routers, Cisco Industrial Routers, Raw Socket and Pseudowire transport, Cisco Evolved Programmable Network Manager, Cisco IoT Field Network Director

Cisco solutions for substation automation

Cisco offers an unmatched portfolio of solutions purpose-built for utility substations with deterministic LAN, low latency, reliability, and total security. **Products:** Cisco Industrial Ethernet Switches, Cisco Industrial Network Director

Based on a flexible two-tier architecture, Cisco's field area network solutions enable utilities to:

- Seamlessly connect field devices to control centers
- Increase operational reliability through self-healing grids
- Reduce feeder losses
- Improve system performance using power-quality monitoring and distribution-level sensing
- Continue to leverage legacy assets rather than upgrading



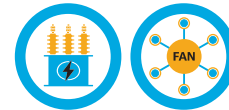
Advanced metering infrastructure

Advanced metering infrastructure (AMI) is a critical part of any smart grid initiative, enabling utilities to obtain real-time power consumption data and allowing customers to make informed choices about energy usage. Unlike legacy electricity meters, AMI-based smart meters are capable of two-way communication with the utility network.

Cisco leads in the design and deployment of communications networks that drive smart metering systems. Neighborhood area networks powered by Cisco interconnect smart meters—as well as streetlights and distributed energy resources—using power-line communications, Ethernet, and other networking technologies. Cisco's flexible AMI solutions enable utilities to:

- Scale to connect millions of smart meters
- Provide over-the-air meter firmware upgrades

- Remotely connect and disconnect power from meter to load
- Deliver power outage and restoration notifications
- Receive alerts when meters have been damaged



Mobile workforce

A highly mobile workforce is critical to quickly finding and fixing power outages—and keeping customers happy. That's why more utilities are adopting Cisco's utility fleet management solution which provides a secure, always-on mobile network in and around the maintenance vehicle. Field workers can now collaborate more easily and optimize their safety, reliability, and efficiency. Here are some of the benefits utilities have realized with the Cisco utility fleet management solution:

- Faster customer response time and reduced carbon footprint with location-aware dispatching
- Increased employee safety with wearable health monitors
- Lower fuel costs (by as much as 30 percent) and fewer speeding citations with real-time location, speed, and idle time tracking
- Improved crew communications using text, voice, and video with the Cisco Spark™ Collaboration solution

Cisco solutions for distribution automation

Cisco stands out with the breadth of its DA portfolio, including integrated cellular and RF mesh, small form-factor, low-power gateways, Wi-Fi for private backhaul, and comprehensive security and multiservice capabilities. **Products:** Cisco Connected Grid Routers; Cisco Industrial Integrated Services Routers, Cisco Industrial Routers, Cisco IOx, Cisco IoT Field Network Director

Cisco solutions for advanced metering infrastructure

Cisco stands out with industry-leading network management, security, and multiservice capabilities. **Products:** Cisco Resilient Mesh, Cisco IoT Field Network Director; Cisco Connected Grid Routers, Cisco Industrial Routers

The Cisco difference

Cisco's smart grid and networking solutions form a unified portfolio of solutions that help utilities modernize, reduce risk, and innovate. But what makes Cisco the first choice for digitizing utilities? Consider the following:

Unrivalled security expertise

Cisco is the clear industry leader in network security. No other solution provider can match Cisco's technology firsts, the breadth and depth of its product portfolio, and the continuing commitment to innovation. Cisco takes an integrated approach to security, intelligently connecting each part of the utility value chain—and every network asset—to create a unified, centrally managed whole. And Cisco keeps innovating, pushing the envelope of what's possible in the field of physical and cyber security. The new Cisco IOS® NetFlow and Stealthwatch® solutions, for example, are setting new standards for anomaly detection and risk reduction.

Comprehensive grid management capabilities

Cisco is breaking new ground in distributed control and real-time management of energy grids. Cisco's Evolved Programmable Network Manager, for instance, provides simplified, converged, end-to-end lifecycle management for carrier-grade networks of all sizes. Cisco's real-time management capabilities allow utilities to achieve new levels of customer service—for instance, by adjusting the grid, and prices, in response to changing consumer demand. Furthermore, Cisco's multiservice network

architecture delivers high levels of availability and resiliency while keeping capital costs under control.

Setting the pace in IoT

As digital utilities connect to larger numbers of distributed assets, data volumes are exploding and networks are becoming overloaded. Cisco leads in technologies that intelligently shift data processing and analytics to the network edge, speeding performance and decision-making. Cisco's IOx and Fog capabilities, for example, offer utilities and ecosystem partners the ability to transform IoT sensor data to actionable information and perform control functions within the distributed network infrastructure. Examples of deployed fog applications include site asset management, energy monitoring, and protocol translation and streetlighting.

Commitment to interoperability and open standards

With Cisco, utilities are never locked into closed, proprietary technologies and protocols that support only a single service. Cisco has long been committed to network vendor interoperability, as evidenced by its support for standards organizations such as the Wireless Smart Utility Alliance (WiSUN). The effort is helping drive the development of interoperable utility applications that take advantage of decades of networking expertise available within the IP suite. This commitment helps utilities simplify systems, lower costs, and improve uptime.

Cisco solutions for mobile workforce

Cisco offers a total solution with fixed-mobile integration and full network-to-application coverage. **Products:** Cisco Industrial Wireless Access Points, Cisco Industrial Routers, Cisco Jabber, Cisco WebEx, Cisco Spark, Cisco Instant Connect

Cisco solutions for AMI

Cisco stands out with industry-leading network management, security, and multiservice capabilities. **Products:** Cisco Resilient Mesh, Cisco IoT Field Network Director; Cisco Connected Grid Routers, Cisco Industrial Routers

Backed by loyal customers and partners worldwide

Utilities that invest in Cisco Connected Grid solutions take advantage of a deep network of resources, including:

- **Strong partner ecosystem:** Leverage more than a thousand technology and consulting companies dedicated to supporting Cisco products and services.
- **End-to-end support:** Access strategy, design, deployment, and managed services provided by Cisco Advanced Services.
- **Global installed base:** Harness the expertise of tens of thousands of customers and end-users running industry-leading Cisco solutions worldwide.

Innovating with Cisco

Many of the world's leading utilities are modernizing and automating their grids with Cisco technologies.

Duke Energy: Modernizing cost effectively

One of the largest electric power companies in the North America, Duke Energy, based in Charlotte, North Carolina, has been steadily expanding its substation and distribution networks. Aging equipment, however, made it hard to get real-time telemetry data from the grid while budget constraints prevented expensive upgrades.

Duke found a solution in Cisco's smart-grid technologies, deploying Cisco 2010 Connected Grid and CGS-2520-24TC Connected Grid Switches as the foundation for a modern integrated power grid network. The cost-effective new architecture extended Duke's corporate IP infrastructure to substation operations and allowed implementation of centralized security and automated management systems. As a result, Duke Energy:

- Created a flexible, intelligent foundation for cross-company applications
- Improved substation security and visibility
- Implemented better monitoring and logging of telemetry data

"To fully leverage the benefits of digital technology, Duke Energy is taking an end-to-end approach with smart grid that includes digital technologies on substations such as Cisco's Connected Grid solutions," said Mark Wyatt, vice president of Duke Energy's smart grid and energy systems program.

BC Hydro: Transforming into a digital utility

Canadian electric utility BC Hydro is British Columbia's main electric distributor, serving 1.8 million customers through a network of hydroelectric, natural gas, and thermal-powered facilities. BC Hydro has been a leader in digital transformation, launching a series of initiatives to enable remote grid automation and monitoring, and to connect applications over a common networking infrastructure.



Recently the energy leader designed a smart grid infrastructure based on the Cisco Field Area Network architecture with advanced metering infrastructure. To bolster security, it deployed Cisco Identity Services Engine and firewalls. And to lay the groundwork for future innovation, BC Hydro has engaged Cisco Advanced Services to explore IoT and network optimization opportunities. To date, the company has:

- Increased data collection from once every two months to twice a day
- Effectively managed power outages
- Improved visibility for remote devices across the grid

SDEE Muntenia Nord: Building a secure, stable, and predictable network

Protecting market share and boosting IT and operational security were top priorities for SDEE Muntenia Nord, a leading electrical utility in Romania's mountainous north region. Equally important was reducing the number of planned and unplanned interruptions to satisfy an increasingly demanding customer base. Since investing in Cisco smart grid and networking solutions, the utility has been hitting its marks. It leveraged Cisco 809 Industrial ISRs and network-embedded microservices to automate electrical distribution. Then it deployed an innovative Cisco IoT Secured Gateway architecture to centralize security for applications, data, the network, and user access.

As a result, SDEE Muntenia Nord:

- Gained real-time visibility into the business for quick response to what is happening in the field
- Significantly reduced the risk of service disruptions and security threats—both cyber and physical
- Created a secure, stable and predictable network with a predictable cost structure

Next steps

Faced with a rapidly changing market and technology landscape, utilities and energy companies are under pressure to adapt and innovate. But for companies and critical infrastructure providers that embrace the new environment, opportunities abound to increase consumer satisfaction and propel growth and profitability. Cisco's digital solutions and industry-specific validated designs for utilities are engineered to help these utilities thrive as the industry continues to evolve in the years ahead.

For more information, visit:
<http://www.cisco.com/go/smartgrid>.

