

# Huawei: Advanced Network Solutions for the Electric Power Industry

As supply and demand issues in the electric power industry have become increasingly contentious and complex, the efficient and secure use of these resources has become essential. The electric power industry today requires more Information and Communication Technologies (ICT), which have become an important technical foundation for the smart grids being vigorously promoted worldwide.

Advanced combinations of communications, information, sensor and metering, and automated control technologies with power grid technologies are required to build real-time intelligent, high-speed communications and information systems that support flexible access and interaction of multiple services. This trend is the future direction of ICT development or the electric power industry.

Huawei provides three major network solutions for the electric power industry, as shown in the figures below:



Among these three solutions, the Power Transmission and Transformation Communications Solution and Power Distribution Communications Solution comprise more than 90 percent of Huawei electric power sales revenues.



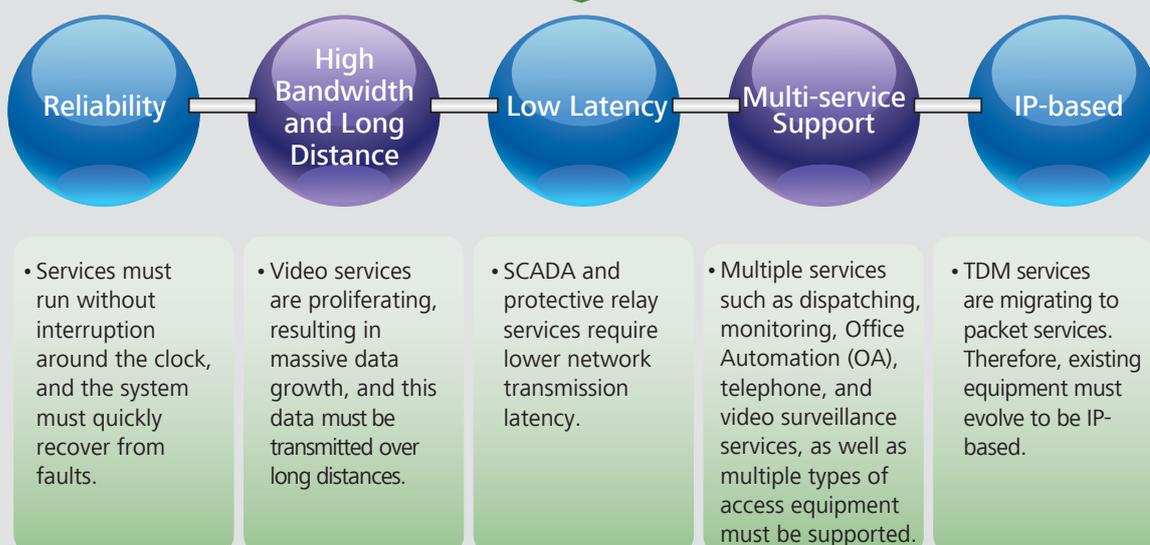
# Power Transmission and Transformation Communications Solution

## Scenario Introduction

This solution incorporates two types of services:

- Production control services, such as Supervisory Control and Data Acquisition (SCADA), Energy Management System (EMS), and Remote Terminal Unit (RTU).
- Management information services, such as OA, Enterprise Resource Planning (ERP), Management Information System (MIS), and video surveillance.

The development of IT-enabled and smart grids poses new challenges for the power transmission and transformation communications network.



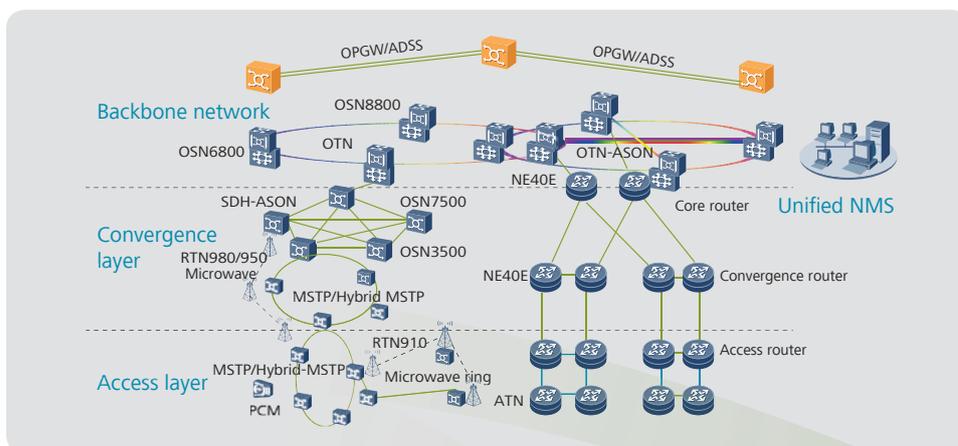
# Power Transmission and Transformation Communications Solution

## Solution Overview

This solution uses a three-layer structure, as follows:

- **Backbone layer:** On the transmission side, this feature uses Optical Transport Network (OTN) technology to support large-granularity services (such as video surveillance and HD conferencing) and enables Automatically Switched Optical Network (ASON) functions to ensure security and reliability. In addition, it supports ultra-long-distance transmission, which reduces the number of electrical generators and lowers operating costs. On the data side, core routers are used to build an IP/MPLS network and support BFD and quick route convergence technologies to ensure system security, reliability, and redundancy backup.
- **Convergence layer:** On the transmission side, this feature uses ASON-capable MSTP/Hybrid MSTP equipment to seamlessly interconnect with conventional networks and improve network reliability and efficiency. In addition, it uses microwave for emergency backup, which further enhances network reliability. On the data side, convergence routers are deployed to form an MPLS/IP network and converge data from the access layer. In addition, VPN technologies are used for security isolation and service assurance.
- **Access layer:** On the transmission side, ASON-capable MSTP/Hybrid MSTP equipment and embedded cards or external PCM equipment provide abundant interfaces (including E1, V.21, RS232, and FE/GE) to support simultaneous IP and TDM access. In addition, microwave is deployed as a supplementary network to cover areas not covered by optical fibers. On the data side, access routers support different IP services and DiffServ and HQoS technologies are deployed to implement secure service isolation.
- **Routing of optical cables:** OPGW and ADSS optical cables are specifically designed for the electric power industry.

## Typical Network Structure and Equipment



- **Backbone layer:** OSN8800/6800, OSN7500/3500 and NE40E-X16/X8
- **Convergence layer:** OSN8800/6800/1800, OSN3500/1500, NE40E-X8/X3 and RTN950/980
- **Access layer:** OSN1500/550, NE40E-X3, ATN950/910, RTN910, and UA5000
- **NMS:** iManager U2000

## Success Stories

### Power Transmission Communications Network for Powerlink Queensland in Australia



#### Customer Requirements

- Stable long-distance transmission
- Low latency and high reliability
- Sufficient bandwidth

#### Huawei Solution

- Conducted unified planning and deployed 186 DWDM devices to build a backbone ring network that provides large capacity and supports ultra-long-distance transmission.
- Used more than 100 MSTP devices to build a transmission ring network at the convergence layer or access layer to support multiple types of electric power services (e.g., 64 kbit/s low-speed service).

#### Customer Benefits

- Unified management and centralized scheduling of DWDM and MSTP devices
- Improved network reliability, reduced equipment running risks, and increased ROI
- Increased network bandwidth to support service expansion and new service provisioning

# Power Transmission and Transformation Communications Solution

## Success Stories

### Intelligent ASON Network for KEPCO

#### Customer Requirements

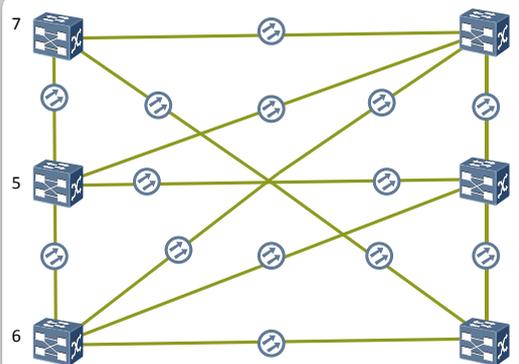
- KEPCO is the only electric power company in South Korea and provides power services to 17 million users. By the end of 2010, KEPCO had a total power transmission distance of 29,526 kilometers and a power capacity of up to 231,624.7 MVA.
- As its network expanded, KEPCO required higher system reliability and lower protection switching time.
- The previous STM-1 communications network did not meet capacity requirements; therefore, KEPCO wanted to optimize this network.

#### Huawei Solution

- Used 400 OSN3500 devices to build a convergence-layer network.
- Built an ASON-based mesh network to prevent the impact caused by multiple fiber cuts.
- Used the MDS6600 tool to carry out scientific planning, simulate the live network, and enhance network reliability.

#### Customer Benefits

- Smooth upgrade from STM-1 to STM-4/16
- Improved network reliability through redundancy protection for key components and ASON transmission
- Protection switching within 50 ms to ensure that electric power services are stable



## Success Stories

### Hybrid OTN and MSTP Network for EVN

#### Customer Requirements

- Electricity Vietnam (EVN) has a power generation capacity of 8,860 MW and a total power distribution length of 19,396 kilometers. It has seven major subsidiaries.
- The customer intended to provide ultra-long-distance communications transmission for its 24 Ultra-High Voltage (UHV) substations.
- The customer also required measures to prevent GPS failures from devastating the power grid.

#### Huawei Solution

- Used OSN6800 and OSN7500 devices to build a backbone 10 G ring network.
- Deployed Background Intelligent Transfer Service (BITS) equipment to support high-precision clock synchronization and provided an MSTP-based optical time transport solution for GPS backup.
- Provided equipment-level and network-level protection to enhance network reliability.

#### Customer Benefits

- A high-reliability, large-capacity backbone power transmission, and transformation communications network, which can scale to 40 G in the future
- Flexible service access (GE, FE, STM-16, and STM-64)
- Reduced operation and maintenance costs through the use of the U2000





# Power Transmission and Transformation Communications Solution

## Success Stories

### Integrated Data Network for COPEL in Brazil

#### Customer Requirements

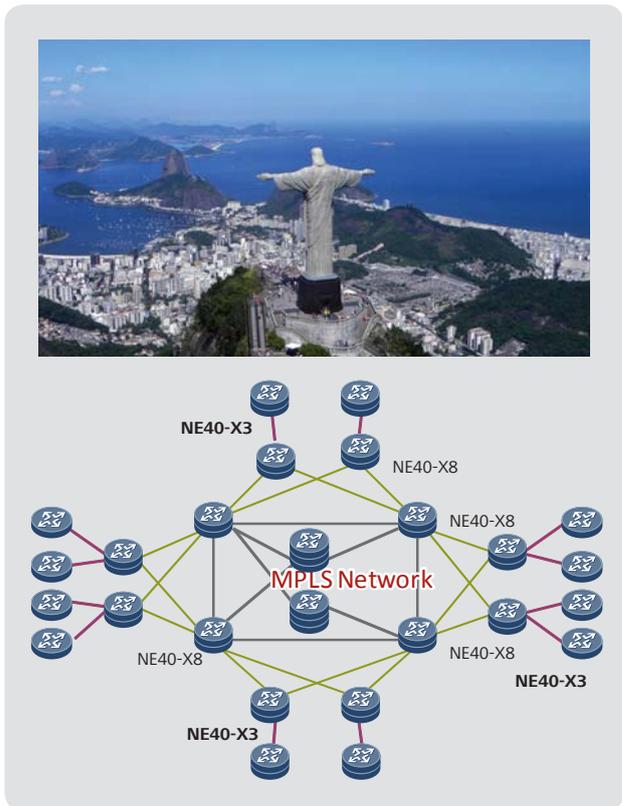
- COPEL has nearly 100 percent of the power generation, transmission, transformation, and distribution systems at the local marketplace It also focuses on the telecom business.
- With the development of its power grid, and increasing demands for video surveillance and video conferencing services, COPEL was in urgent need of a large-bandwidth and a flexible IP MPLS network to carry comprehensive data services.

#### Huawei Solution

- Defined the network into three layers and deployed NE40E-X8 devices at the core and backbone nodes and NE40E-X3 devices at the access nodes.
- Adopted partial-mesh network structure for core nodes and connected backbone nodes to adjacent core nodes through two links to ensure node reliability.
- Used MPLS technology to build the entire data network.

#### Customer Benefits

- Service interconnection for electric power companies with a complex structure
- Abundant reliability and QoS features, which help provision more video and voice services
- Greatly improved network security and reliability through a mesh/partial-mesh network topology



## Success Stories

### Power Transmission and Transformation Communications Network for Sonelgaz in Algeria

#### Customer Requirements

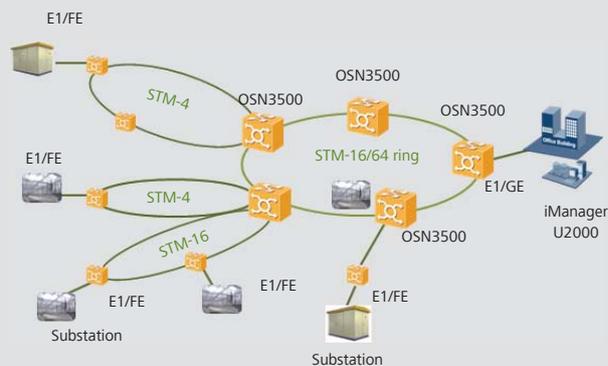
- Sonelgaz is a state-owned electric power and gas company in Algeria, which monopolizes the electricity generation, transmission, distribution, and export and import. In 2003, its annual power generation amount reached 2.9 billion kWh.
- Sonelgaz intended to build a highly reliable transmission network to carry its electric power services.

#### Huawei Solution

- Used OSN1500, OSN2500 and OSN3500 devices to build a transmission network.
- Used the MDS6600 tool to carry out scientific planning, simulate the live network, and enhance network reliability.
- Adopted ring network protection to ensure that electric power services are reliably transmitted.

#### Customer Benefits

- A stable and reliable transport platform for key electric power data
- Better bandwidth utilization and system scalability, and stronger system survivability
- More flexible service scheduling and easier network maintenance
- Reduced costs in purchasing spare parts because equipment cards can be universally used



# Power Transmission and Transformation Communications Solution

## Success Stories

### UHV Transmission Network from Qinghai to Tibet

#### Customer Requirements

- High altitude and harsh environment
- Ultra-long-distance power transmission (200 kilometers to 300 kilometers)
- Tremendous difficulties in construction and maintenance and strict requirements for equipment reliability

#### Huawei Solution

- Deployed the OSN3500 and OSN7500 across the entire network.
- Provided 250 kilometers per span without Raman (FEC+BA+BA).
- Provided 300 kilometers per span with Raman (FEC+BA+BA+RA).

#### Customer Benefits

- A reliable and stable ultra-long-distance transmission network
- Unified NMS for built-in and external optical amplifiers, resulting in easy maintenance
- Easy system scalability to a 10 G system to meet future service needs



## Success Stories

### Dispatch Data Network (DDN) for SGCC

#### Customer Requirements

- SGCC required a real-time, highly reliable nationwide DDN network to support services within their production control areas.
- The existing network structure and capacity needed to be improved to support fast growing services.
- The entire network required improvement, including the national central nodes, five major regional nodes (North China, Northeast China, East China, Middle China, and Northwest China) and 25 provincial nodes.

#### Huawei Solution

- Used a dual-plane network structure, with each plane designed with redundant route backup.
- Deployed MPLS, BFD and FRR technologies across the entire network.
- Used NE40E routers to build a two-node network and deployed three-level RR to greatly improve network reliability.

#### Customer Benefits

- Stable operation since 2003
- Improved network reliability, reduced equipment running risks, and increased ROI
- Reliable operation of electric power services



# Power Transmission and Transformation Communications Solution

## Success Stories

### 2M Optical Port Trial Project for China Southern Power Grid's Guangzhou Branch

#### Customer Requirements

- Eliminate security risks of protocol converters and direct connection between the protective relay devices and transport devices.
- Seamless interoperability with mainstream protective relay devices
- Stable and reliable interfaces

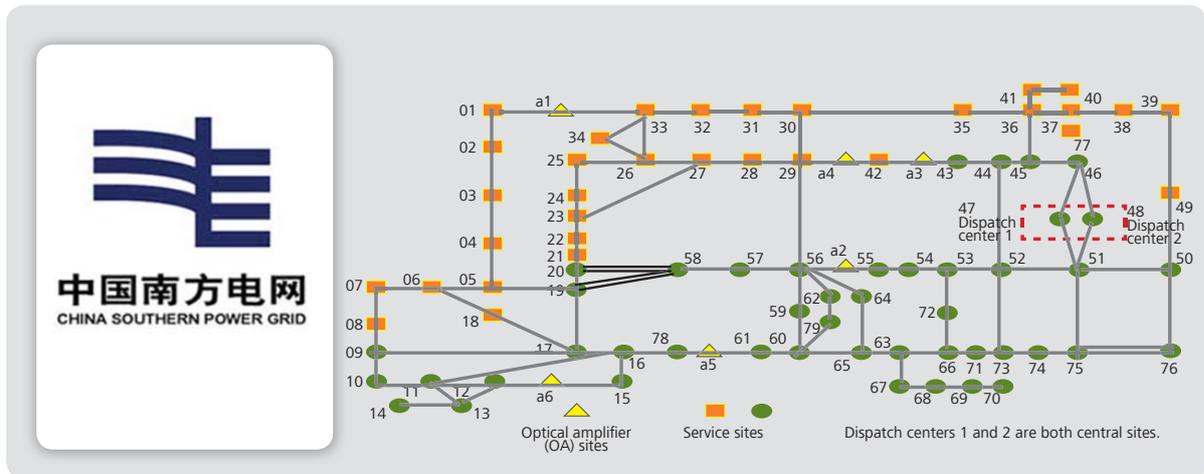
#### Huawei Solution

- Used OSN series products to build a 2.5 G ring network and installed 2M optical interface boards to directly connect to protective relay devices.

- Completed interoperability testing with multiple protective relay equipment vendors such as Naritech, Sifang Group, XJ Group, and ABB, achieving good results.
- Smoothly upgraded the existing equipment, without adding additional hardware.

#### Customer Benefits

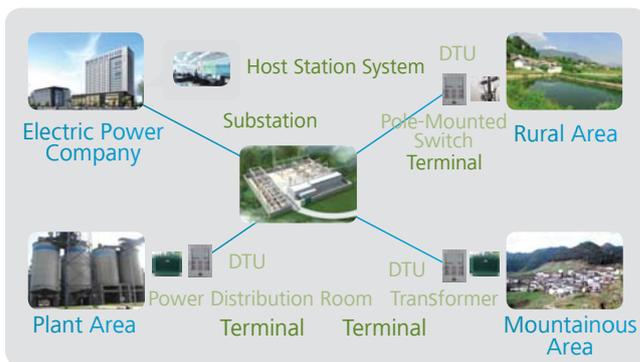
- Reduced service conversion links, decreased fault points, and improved service reliability
- Lower construction costs
- Improved service monitoring



# Power Distribution Communications Solution

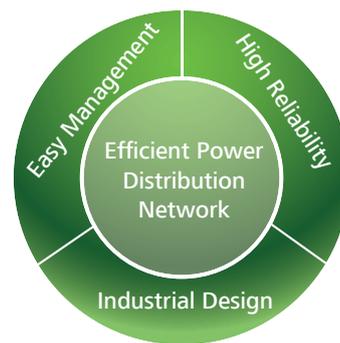
## Scenario Introduction

- The Distribution Automation (DA) system consists of a host station, substations, terminals, and a communications network.
- The communications network serves as the nerve of the DA system. Its functions include transmitting the detection and control information and reporting the fault status.



## Key to Building an Efficient Communications Network

- High reliability: Communications equipment must run stably around the clock and provide backup links to prevent service interruption.
- Easy management: Communications links must be easy to configure, and the network must be monitored in real time.
- Industrial design: The system must be protected against lightning strikes, high temperatures and humidity, strong electromagnetic fields, and other harsh environmental conditions.



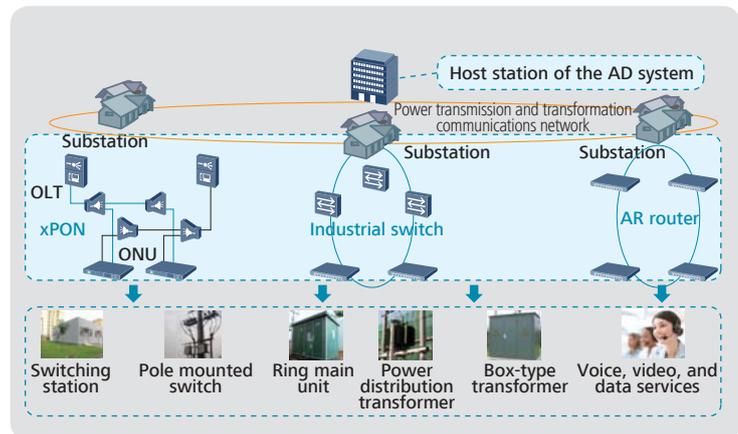
## Solution Overview

Network Mode	Advantages	Disadvantages
xPON Network	This network consists of three parts: OLT, ODN, and ONU. It is well suited for power distribution networks' tree, ring, and chain topologies. Services on the backbone links are not interrupted, and the hand-in-hand and two-uplink design prevents impact caused by multiple failures. In addition, this network provides high bandwidth and is easy to scale. Its industrial performance can withstand high or low temperatures. This network is also designed with an IP65 protection class and a high EMC level.	Heavy workload required for routing optical cables
Industrial Switch Network	High bandwidth, support for RSTP and MSTP ring protection, and industrial design	Active network and unable to guard against multiple failures
AR Router Network	Support for RS232 low-speed interfaces and multiple services, such as routing and voice	Low industrial level

# Power Distribution Communications Solution

## Typical Network Structure and Equipment

- xPON network: MA5680T/5683T and MA5621/5621A
- Industrial switch network: (planned go-to-market in August 2012)
- AR router network: AR1200



## Success Stories

### PON Access Project for Qingdao Electric Power Company

#### Customer Requirements

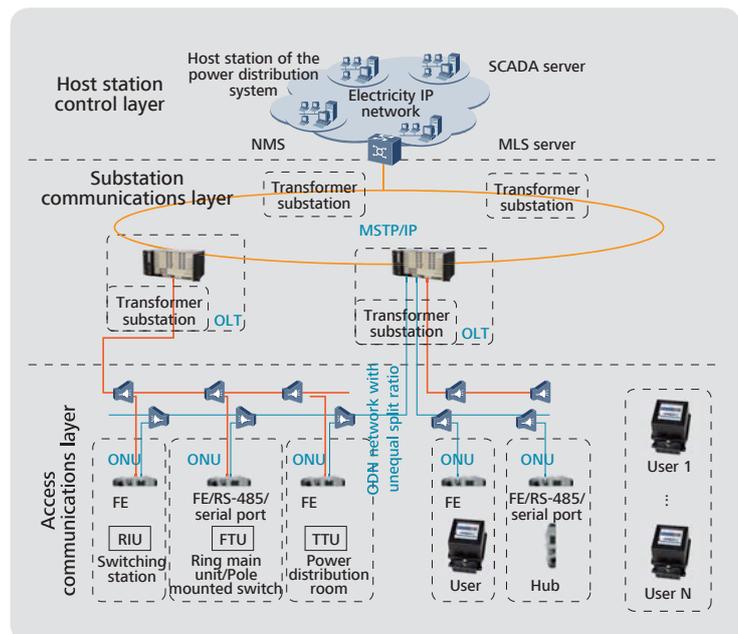
- Qingdao Electric Company needed their power distribution communications network to comply with wide coverage characteristics.
- The client wanted good interoperability with associated systems and smooth system evolution.
- The client needed high security and strong NMS capability.

#### Huawei Solution

- Used xPON series products that support both GPON and EPON.
- Connected ONUs to upstream devices using two PON ports and adopted a hand-in-hand network to ensure system protection and prevent single point of failure.
- Leverages ONU's offline deployment and automated batch upgrade functions to accelerate the project progress.
- Provided a convenient and unified NMS.

#### Customer Benefits

- Solid foundation for future service expansion
- Unified management, good interoperability, and easy operation and maintenance



## Success Stories

### Centralized Metering and xPON Project for Beijing Electric Power Corporation

#### Customer Requirements

- Beijing Electric Power Corporation is a leading electric power company in China, operating a power grid business for the entire Beijing area (16,800 square kilometers) and providing premium, reliable, and affordable electric power services to 4.8 million users.
- Beijing Electric Power Corporation planned to provide centralized metering and Fiber to the Home (FTTH) services to residents in the Zhonghong community.

#### Huawei Solution

- Provided centralized metering and FTTH services to 4,703 households in the Zhonghong community.
- Used one OLT (MA5683T) to connect to all ONUs (MA5621) in 10 buildings (16 or 17 ONUs per building), with each ONU providing an RS-485 interface that connects 30 electric meters.
- Used MA5680T and HG8247/850e devices to provide FTTH services.

#### Customer Benefits

- Simultaneous electric power service and broadband service for households
- Large bandwidth at both upstream and downstream directions and support for multi-network and multi-service convergence
- Remote management of ONUs and HGW devices through a unified NMS



# Power Distribution Communications Solution

## Success Stories

### xPON Communications Network for Zhejiang Electric Power Corporation'S Hangzhou Branch

#### Customer Requirements

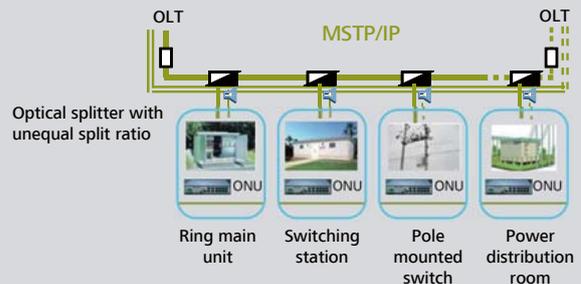
- Remote control and real-time monitoring of electric power operations
- Shift from passive response to proactive maintenance
- Build a highly reliable and environment-hardening power distribution network throughout the city

#### Huawei Solution

- Deployed an xPON access solution where the OLT was installed at 110 kV or 35 kV substations and ONUs were deployed at outdoor electric power equipment cabinets.
- Set up a hand-in-hand two-fiber self-healing ring network to ensure high bandwidth and strong reliability.
- Used ODN equipment to improve user experience.
- Provided a visualized and unified NMS.

#### Customer Benefits

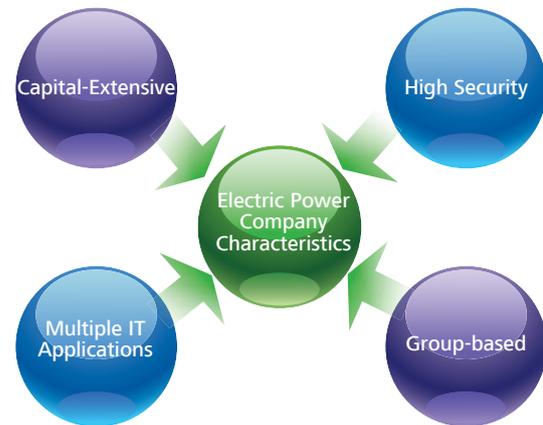
- Enhanced network coverage, conserved fiber resources, and lowered network costs
- Strong adaptation to environments (high and low temperatures, electromagnetic interference, and lightning strikes) through the use of industrial ONUs
- Real-time and highly reliable network, improving user experience



# Huawei Integrated Campus Solution: Scalable, Reliable and Secure

## Scenario Introduction

- The campus network for the electric power industry consists of a production control area and an integrated OA area, with Huawei participating in the latter.
- The campus network deals with multiple services, such as IP telephone, OA, video conferencing, video surveillance, production data management, external user access, and network security. The campus network has elevated requirements for network manageability, scalability, reliability, and security.
- Huawei's Integrated Campus Solution for the electric power industry is similar to other Huawei enterprise campus solutions (see the Huawei Enterprise Campus Solution for details).



## Success Stories

### Intelligent Campus Network for Yellow River Substations in Jiaozuo, Henan Province, China

#### Customer Requirements

- More bandwidth and better quality of power grids
- Unified network interfaces
- Automated detection of substation environments and equipment operation status

#### Huawei Solution

- Deployed Huawei switches to work stably at low/high temperatures and against severe electromagnetic interference.
- Provided self-healing design to ensure switchover protection within 20 ms.
- Integrated a power and environment monitoring system to intuitively monitor the equipment room.
- Set up a substation video surveillance system to remotely monitor substations and give early warnings upon danger detection.

#### Customer Benefits

- Easily maintained unified network platform
- Improved network quality, without service interruptions
- Minimized engineering and operations management costs
- Reduced labor costs due to unmanned substations

