Belden’s Solutions for the Energy industry

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Agenda

BELDEN'S SOLUTIONS FOR ENERGY

Section 1	Introduction to Belden's World
Section 2	Energy industry – main challenges
Section 3	Belden's solutions for the energy industry

Introduction to Belden's World

WHO WE ARE

What We Do

Delivering advanced signal transmission and networking solutions for mission-critical applications across a diverse set of global markets

Key Markets

Enterprise

- Data Centers
- Government
- Healthcare
- Hospitality
- Professional Broadcast
- Stadiums & Venues
- Telcos/Cable Providers

Industrial

- Discrete Manufacturing
- Process Facilities
- Transportation
- **Energy**

Applications

Video

Audio

Data

Solutions

Industrial Automation

Smart Buildings

Broadband & 5G

Cybersecurity

A Rich Heritage

Since our earliest days as a manufacturer, Belden has remained steadily focused on customers and building a reputation for High Quality, Ingenuity and Value

Founded by Joseph Belden in 1902

Radio Broadcasting in the 1920s

Computer Networking in 1980s-90s

Early customers include Thomas Edison

TV in the 1950s

Belden Today

- HQ in St. Louis, Missouri, USA
- Established presence worldwide - Americas, Europe, Middle East, Africa, Asia Pacific
- 5 Customer Innovation centers – Europe, US, Asia, *MEA**
- 8000+ associates
- 2022 Revenue: $2.7B USD (2019 – ca. $2.1B)
- 25+ manufacturing facilities worldwide
- 1,100+ patents associated globally

Trusted Brands

Connectivity

AlphaWire

BELDEN
SENDING ALL THE RIGHT SIGNALS

lumbergautomation
A BELDEN BRAND

PPC
A BELDEN BRAND

POLIRON
A BELDEN BRAND

thinklogical
A BELDEN BRAND

WEST PENN WIRE Since 1971
AV, SECURITY & NETWORKING SOLUTIONS

Cybersecurity

GarrettCom
A BELDEN BRAND

HIRSCHMANN
A BELDEN BRAND

TOFINO SECURITY
A BELDEN BRAND

Networking

BELDEN
SENDING ALL THE RIGHT SIGNALS

GarrettCom
A BELDEN BRAND

HIRSCHMANN
A BELDEN BRAND

lumbergautomation
A BELDEN BRAND

ProSoft TECHNOLOGY

thinklogical
A BELDEN BRAND

OTN Systems

NET MODULE

Customers Define Our Success

Organizations worldwide depend on Belden to solve their most complex infrastructure, connectivity & networking challenges

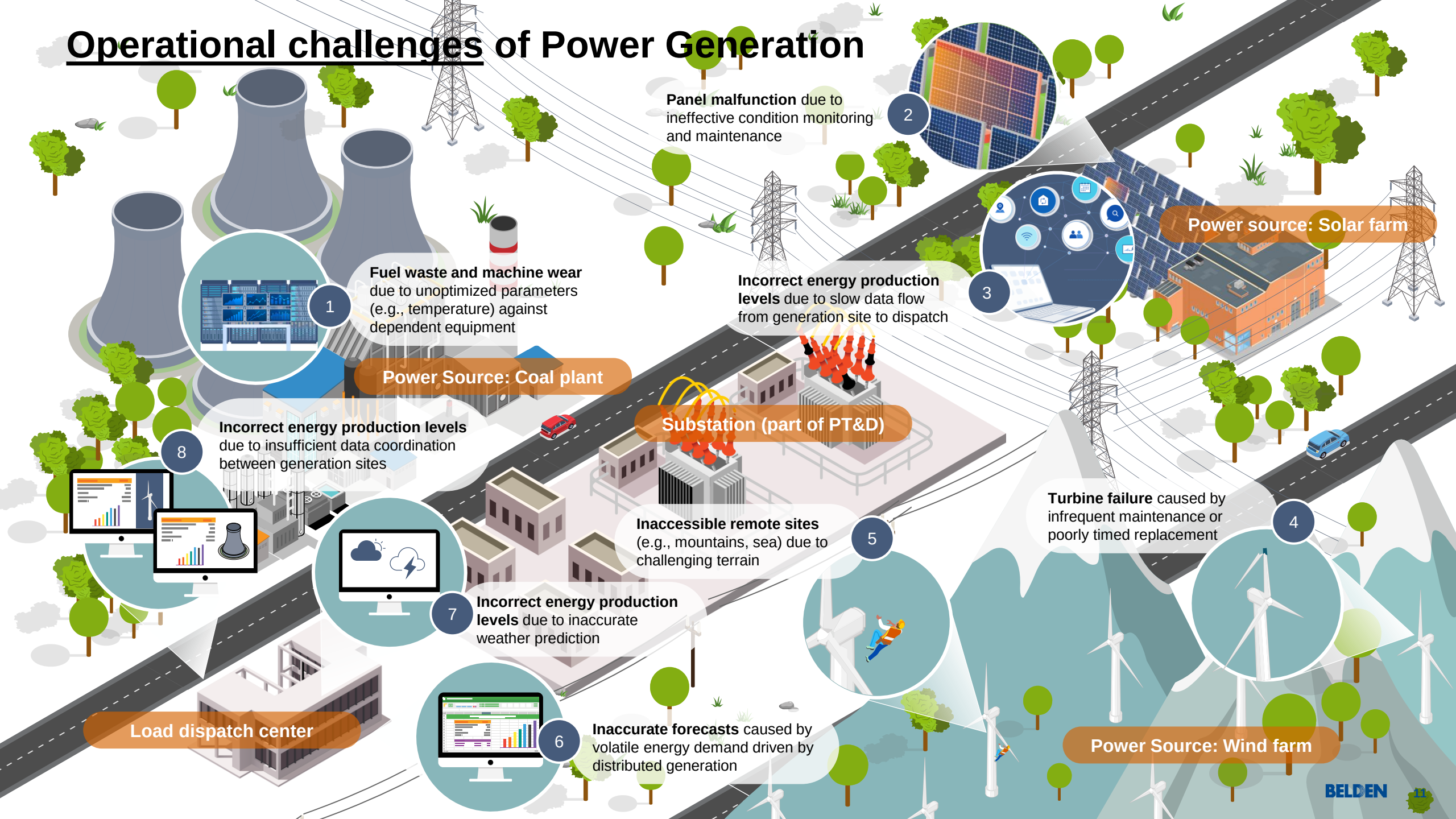
Product Portfolio

Energy industry – main challenges

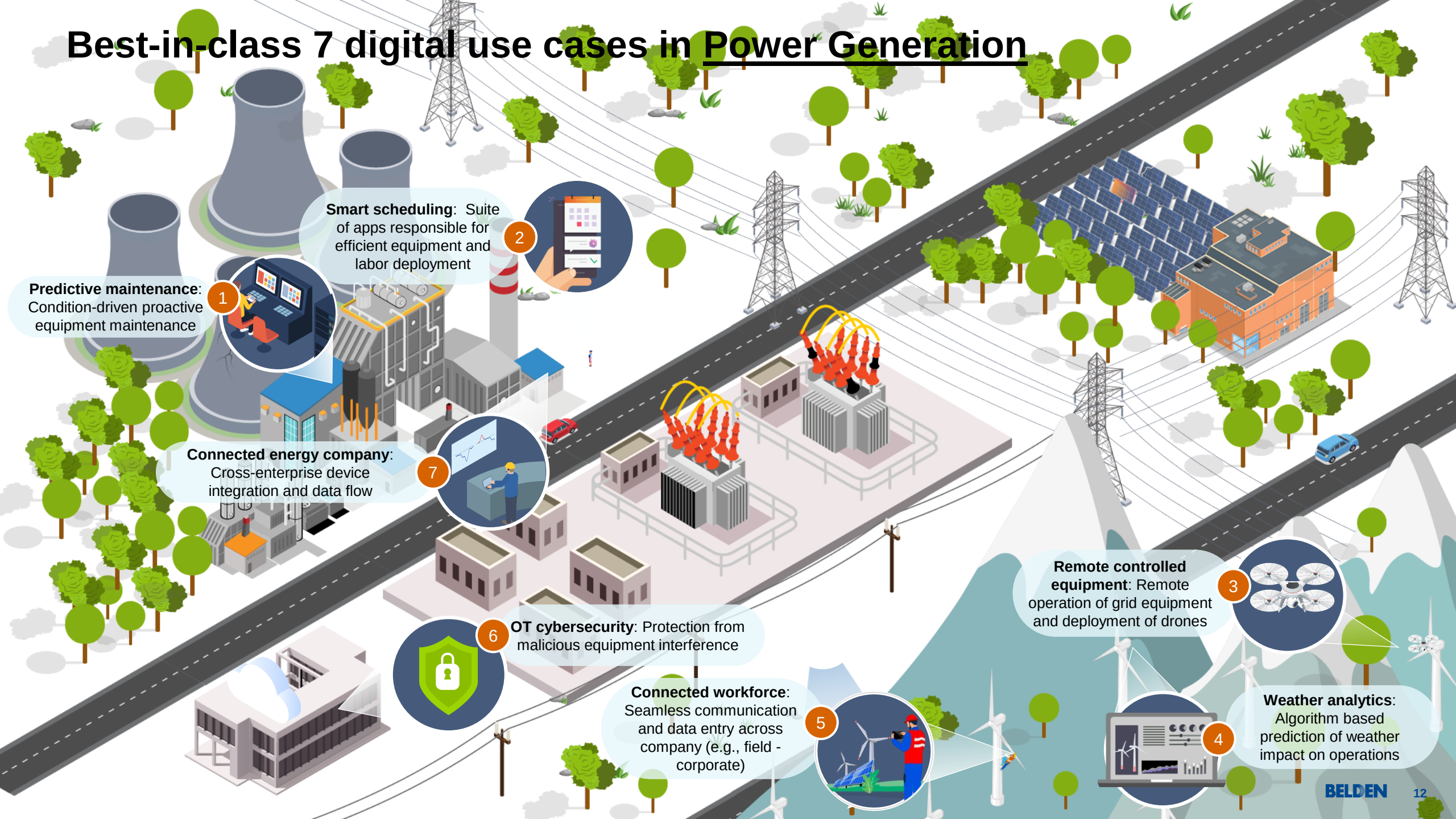
AT A GLANCE

Power Generation

Operational challenges of Power Generation



Best-in-class 7 digital use cases in Power Generation



Predictive maintenance: Condition-driven proactive equipment maintenance

1

Smart scheduling: Suite of apps responsible for efficient equipment and labor deployment

2

Remote controlled equipment: Remote operation of grid equipment and deployment of drones

3

Weather analytics: Algorithm based prediction of weather impact on operations

4

Connected workforce: Seamless communication and data entry across company (e.g., field - corporate)

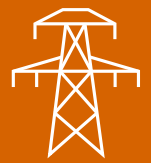
5

OT cybersecurity: Protection from malicious equipment interference

6

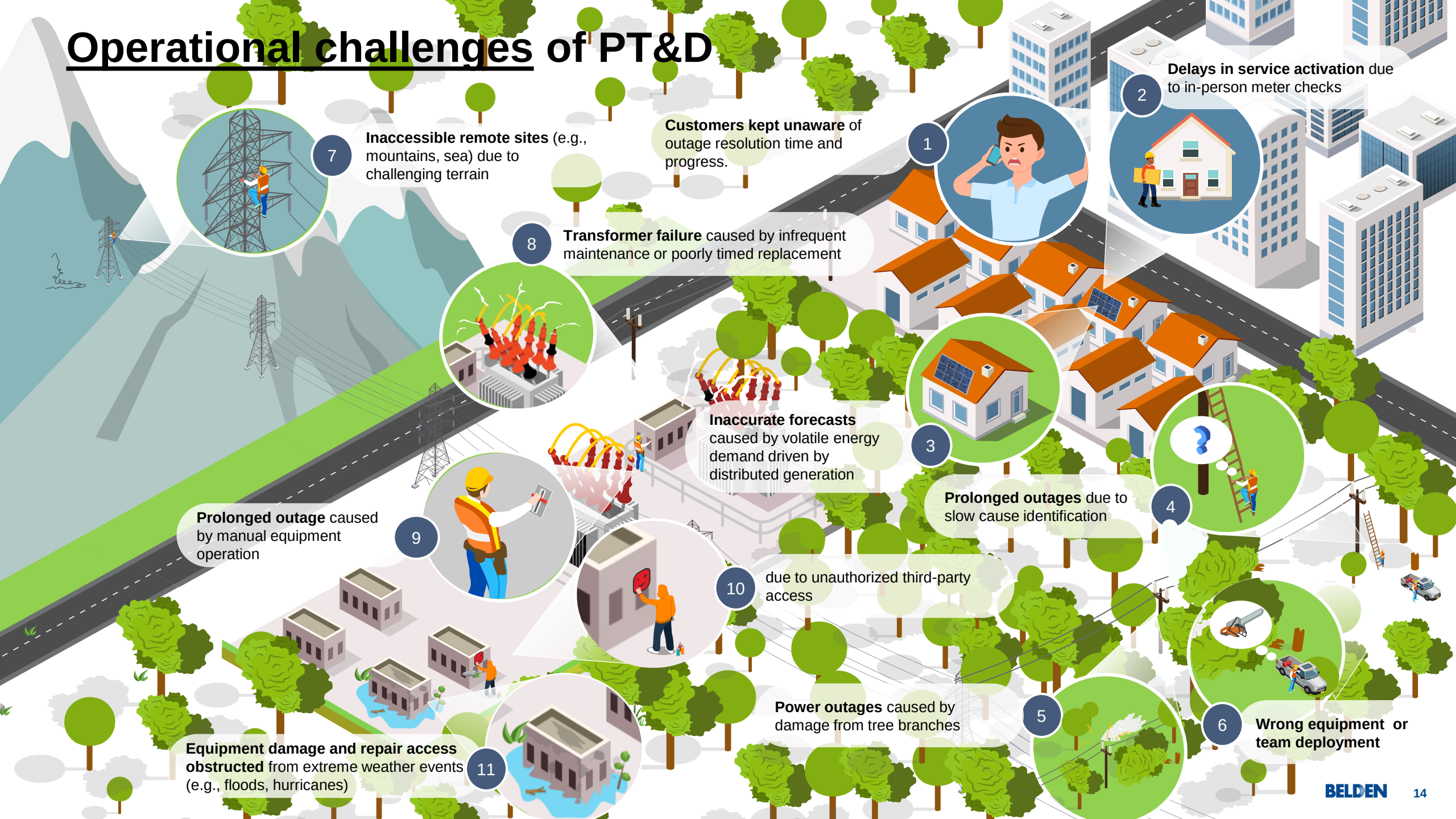
Connected energy company: Cross-enterprise device integration and data flow

7



Power transmission and distribution (PT&D)

Operational challenges of PT&D



1 **Customers kept unaware** of outage resolution time and progress.

2 **Delays in service activation** due to in-person meter checks

3 **Inaccurate forecasts** caused by volatile energy demand driven by distributed generation

4 **Prolonged outages** due to slow cause identification

5 **Power outages** caused by damage from tree branches

6 **Wrong equipment or team deployment**

7 **Inaccessible remote sites** (e.g., mountains, sea) due to challenging terrain

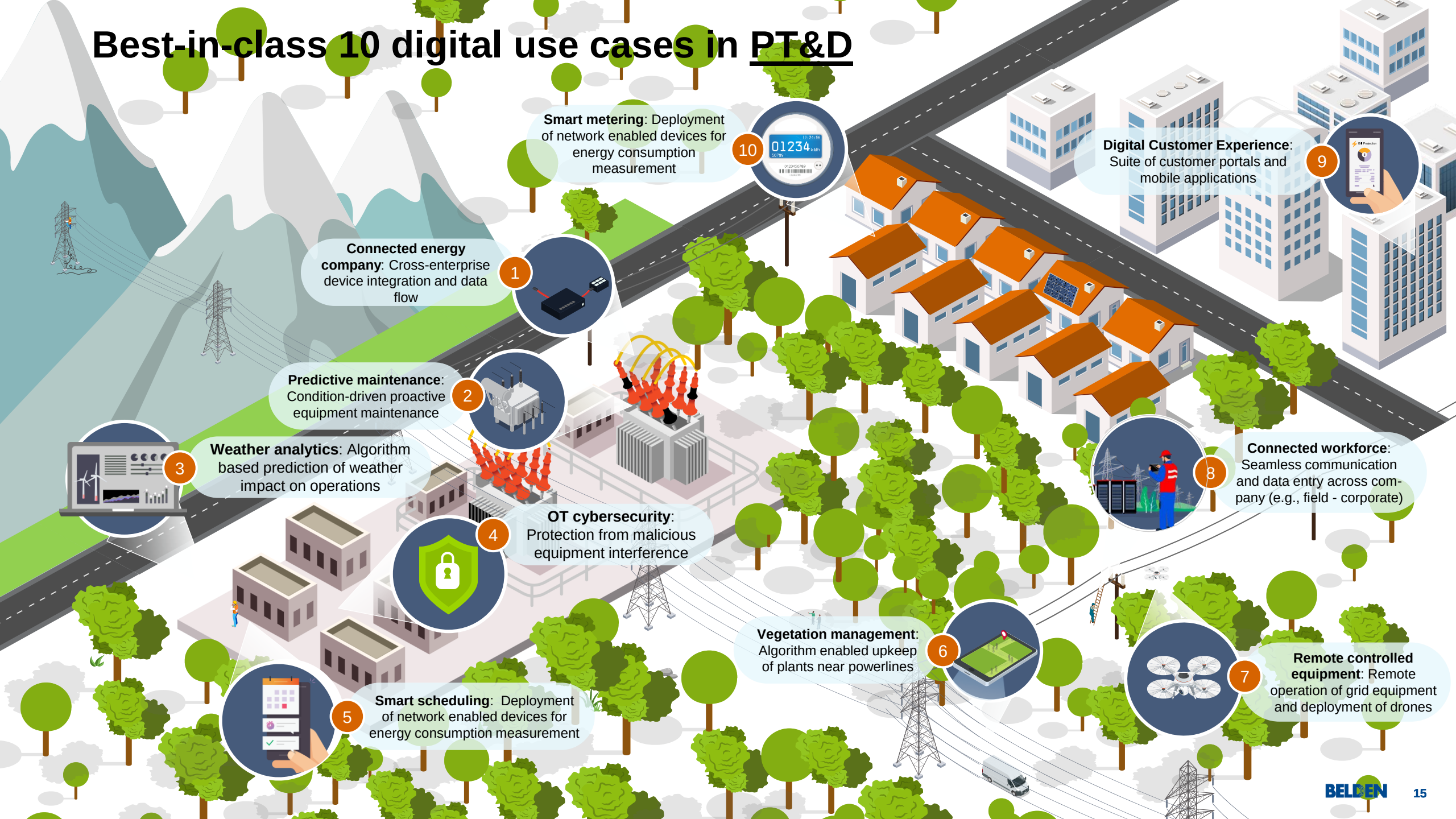
8 **Transformer failure** caused by infrequent maintenance or poorly timed replacement

9 **Prolonged outage** caused by manual equipment operation

10 due to unauthorized third-party access

11 **Equipment damage and repair access obstructed** from extreme weather events (e.g., floods, hurricanes)

Best-in-class 10 digital use cases in PT&D



Smart metering: Deployment of network enabled devices for energy consumption measurement

10

Digital Customer Experience: Suite of customer portals and mobile applications

9

Connected energy company: Cross-enterprise device integration and data flow

1

Predictive maintenance: Condition-driven proactive equipment maintenance

2

3

Weather analytics: Algorithm based prediction of weather impact on operations

OT cybersecurity: Protection from malicious equipment interference

4

8

Connected workforce: Seamless communication and data entry across company (e.g., field - corporate)

Vegetation management: Algorithm enabled upkeep of plants near powerlines

6

7

Remote controlled equipment: Remote operation of grid equipment and deployment of drones

5

Smart scheduling: Deployment of network enabled devices for energy consumption measurement

Belden’s solutions for Energy industry

Belden solutions span all areas of Energy industry

Products **comply with international standards** as IEC61850-3, IEEE1588v2 (PTP v2), IEEE1613, IEEE1686, IEC60870-5-104, DNP3, NERC-CIP, ISA/IEC 62443

Belden solutions can be implemented at:

1. **Power Generation**
   - 1a Power plants
   - 1b Solar Farms
   - 1c Wind Farms
2. **Smart Grid Operational Telecom for PT&D**
3. **Substation Automation Systems (SAS) Levels:**
   - 3a Station Level
   - 3b Bay level
   - 3c Process Level
4. **Load Dispatch Center**

1a. Power Generation: Power plants

Belden Key Benefits:

Connected Grid: Connection enabled through networks supervision, real time monitoring, and interconnected substations

Resilient Operations: Network connection secured through bump-less, standardized, non-Proprietary Redundancy Protocols (MRP, HSR, PRP). Seamless network interconnection through layer 2/3 Backbone Switches with, FE, 1GB or up to 10G high bandwidth design

Connected Workers: Wireless solutions for remote data acquisition and mobility

Secured Automation OT Network: Distributed Security Solution based on Port level, deep packet inspection family for Intrusion Detection and Traffic Filtering

Belden Solution

- Secured Wireless Communications
- Backbone Switches, Rack 19” Control Center Cabinets Multi-Port (DMZ level) Cyber Security Devices
- Plant Wide Fiber Optic Network
- DIN-Rail Next Gen Ruggedized Switches
- DIN-Rail or Rack 19” Ruggedized Switches for harsh environments Instrumentation and Control Cable
- Complete Substation Automation System Networks

1b. Power Generation: Solar Farm

Solutions enabled at:

- Solar Plant SCADA
- SCADA on Wireless
- Remote Monitoring Solutions
- Transmission Energy Management
- Distribution Management System

Belden Key Benefits

Secure, redundant, mission critical networking solution that performs in extended temperature from -40C to +85C

Remote monitoring to ensure proper energy production and overall function

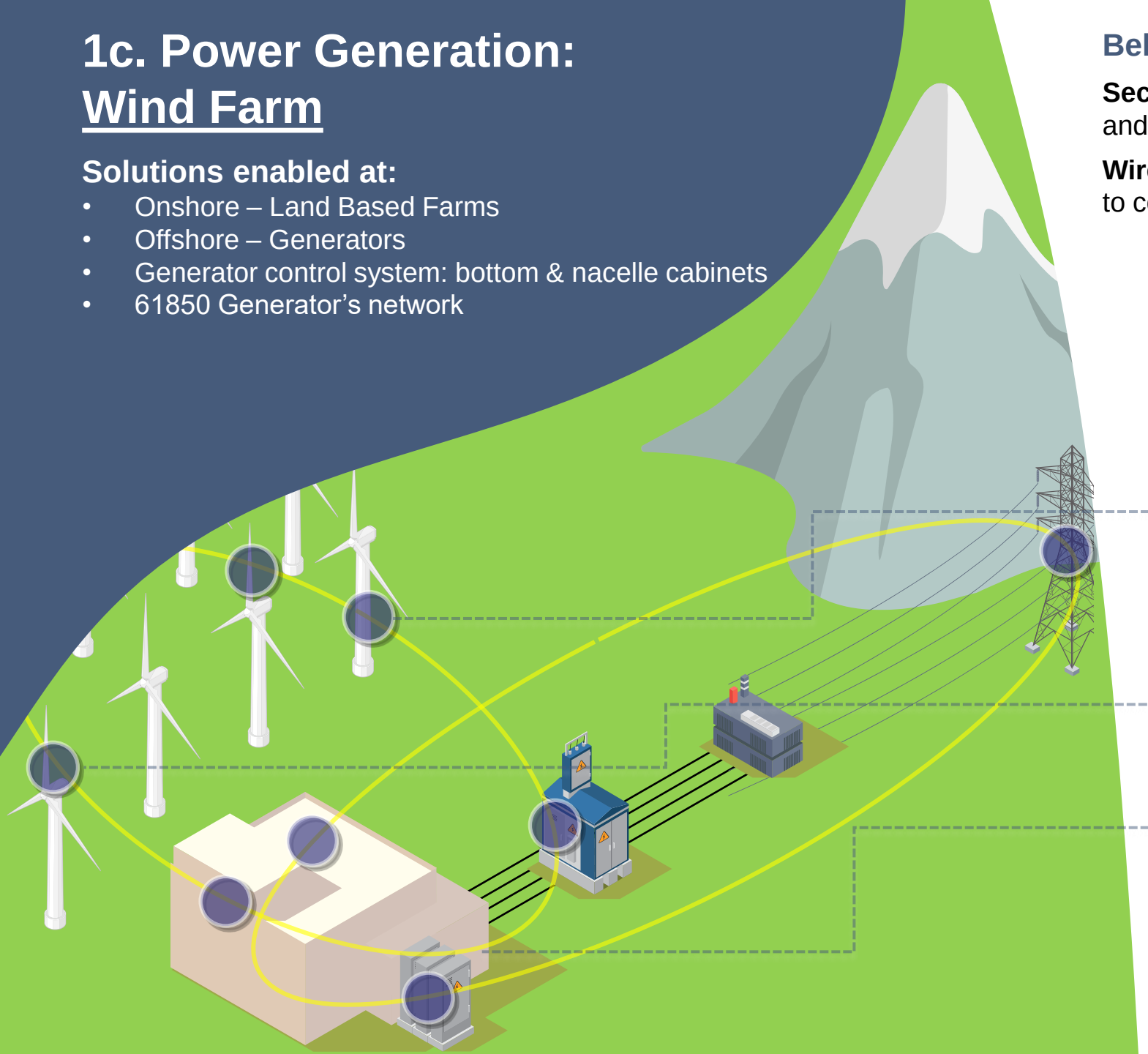
Belden Solution

- Backbone Switches, Rack 19” Control Center Cabinets Multi-Port (DMZ level) Cyber Security Devices
- DIN-Rail or Rack 19” Ruggedized Switches Fiber SFPs
  Battery Storge/24 vdc Power Supplies Fiber Patch Panels
  Resilient Fiber Ring Redundancy
  Cat5e, Cat6 Patch Cords
- Secure Remote Access (Prosoft)
- Wireless
- Optional: Secure Wireless

1c. Power Generation: Wind Farm

Solutions enabled at:

- Onshore – Land Based Farms
- Offshore – Generators
- Generator control system: bottom & nacelle cabinets
- 61850 Generator's network



Belden Key Benefits

Secure remote monitoring to control energy generation and provide predictive maintenance

Wireless connectivity for maintenance personnel to connect from vehicles

Belden Solution

DIN-Rail or Rack 19" Ruggedized Switches
Fiber SFPs
24 vdc Power Supplies
Fiber Patch Panels
Resilient Fiber Ring Redundancy
Cat5e, Cat6 Patch Cords

Secure Remote Access (Prosoft)

Backbone Switch
Fiber Patch Panel
Cyber Security/Firewall
Optional: Cellular Gateway

2. Interconnected Grid Operational Telecom

Belden Key Benefits:

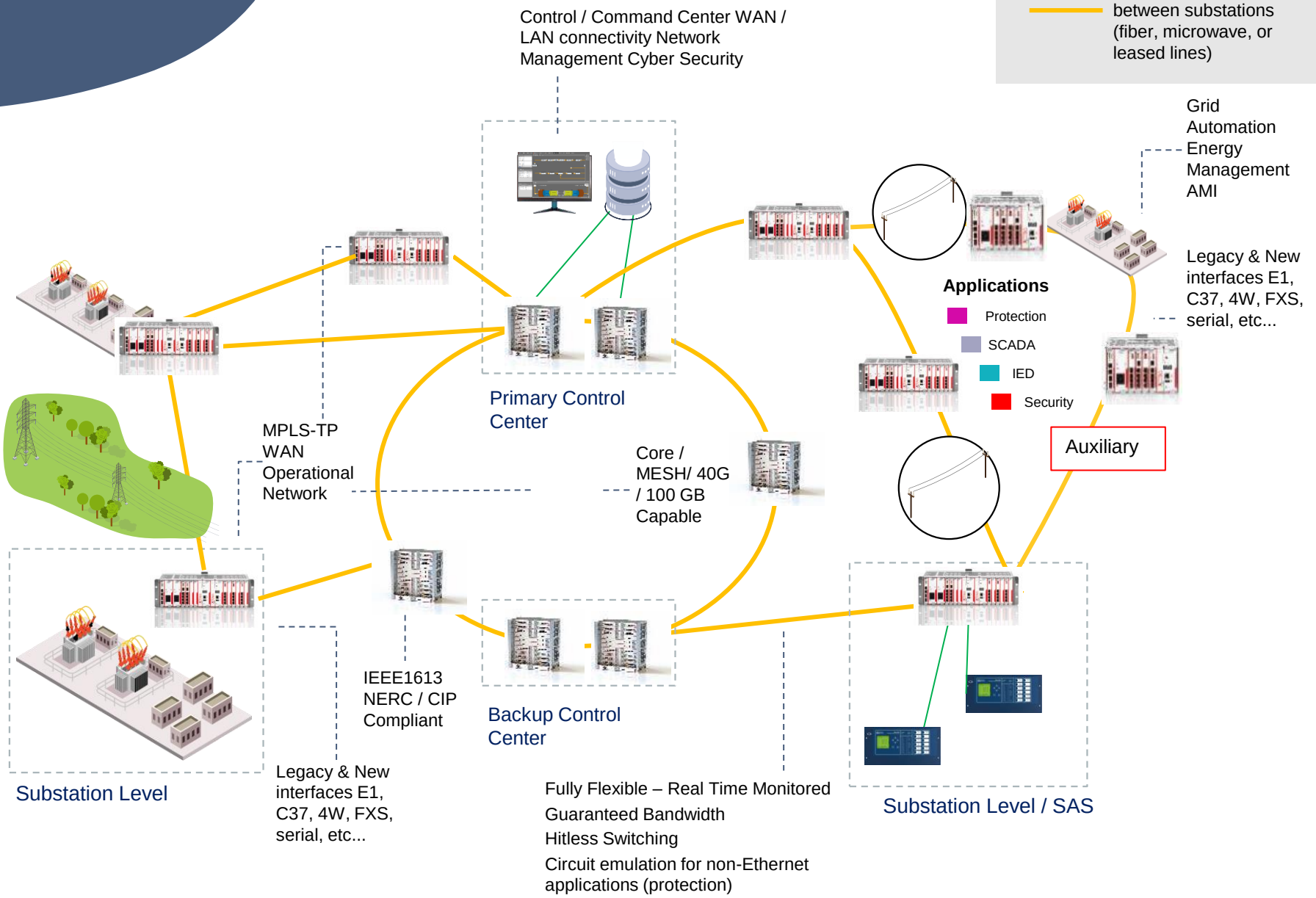
Comprehensive open vendor agnostic solution for operational telecoms among substations

Incorporating legacy and next gen devices for maximum protection control

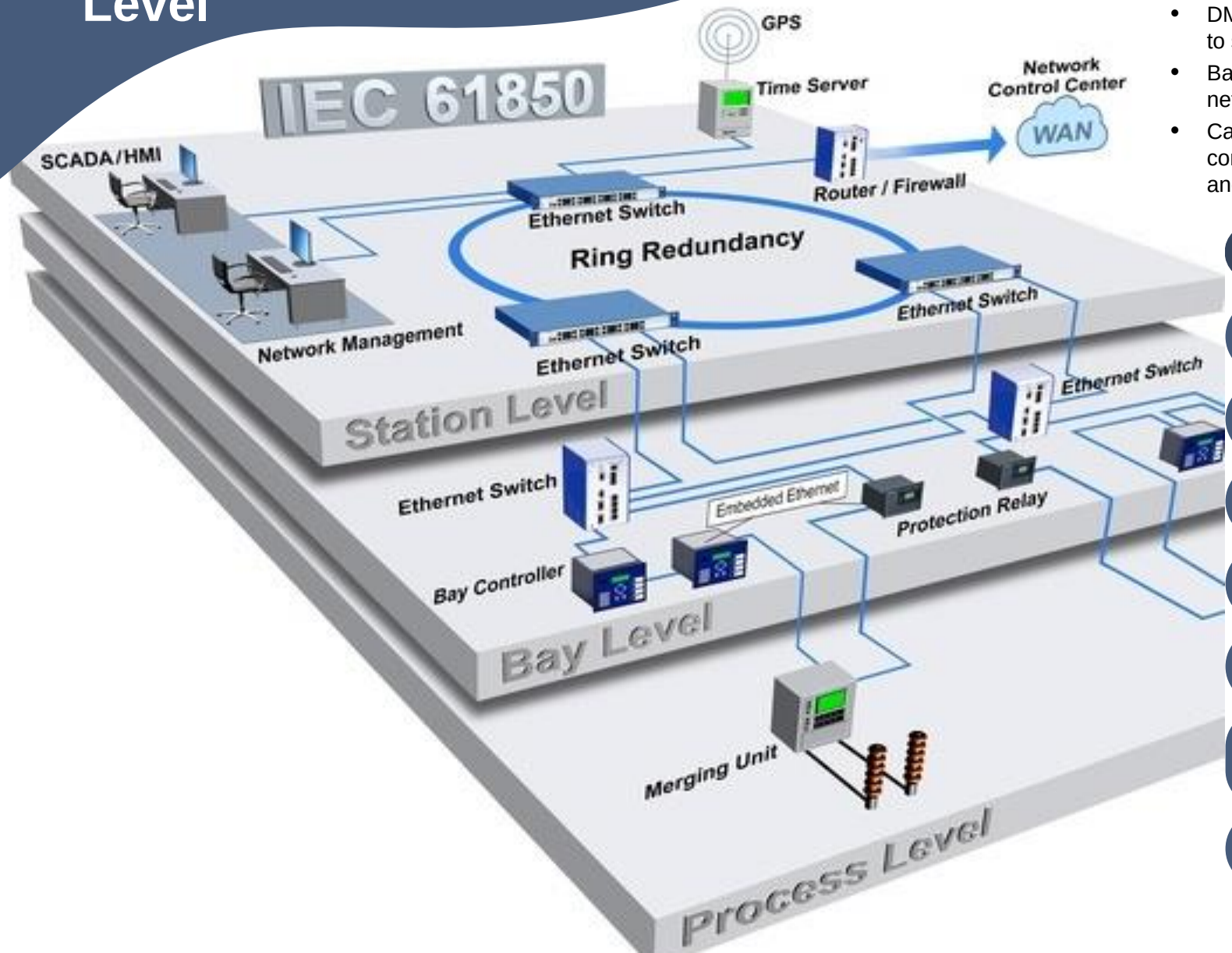
Redundant communications and centralized management and monitoring.

Solutions enabled at:

Control Center
Asset Management Center
IEC61850-3, IEEE1613, IEEE1588v2 PTP, IEC62443-4-2 and NERC-CIP compliant
Flexible, Scalable and Resilient Networks
Line rate bandwidth with zero-packet loss capability
HSR/PRP/MRP/RSTP for redundancy and network recovery
TXCare NMS for setup, monitoring and management of your network



3a. Substation: Substation Automation Systems (SAS) Level



Solutions Enabled at:

LAN

- Station Level Ethernet redundancy
- DMZ Redundant Firewall hardware to segregate and filter traffic with DPI
- Bay / Process Level redundant failure tolerant networking with Fiber and Copper connectivity
- Cabinets with copper and fiber connectivity for control rooms and Central management areas

WAN

- Substations Interconnect using MPLS-TP
- Fiber optic long distance links

Belden Solution

- MPLS-TP WAN Operational Network (1G - 100G)
- Secure Substation Multiport Firewalls
- GRS or MACH, RSP(E) – Layer 2 switches
- Redundancy Zero-failover Protocols: MRP, PRP, HSR
- IEC 61850, IEEE1613, NERC/CIP compliance
- Field Connectivity, Fiber SFPs, Fiber Patch Panels F.O. Patch Cords, Redundancy ,CAT5e, CAT6 (a) Substation Rated cabling
- Resilient Fiber Ring Layer 2/3 DIN-Rail or Rack 19” Cyber Secure Substation Switches

3b. Substation:
Station (control room) level

Belden Key Benefits:

Maximize uptime: low failure rates guaranteed by GOOSE protocol handling, redundant ring topology and fan-less design

Maximum cost efficiency: single fiber cable is needed to connect the cabinets in the control room and in the outdoor switchyard

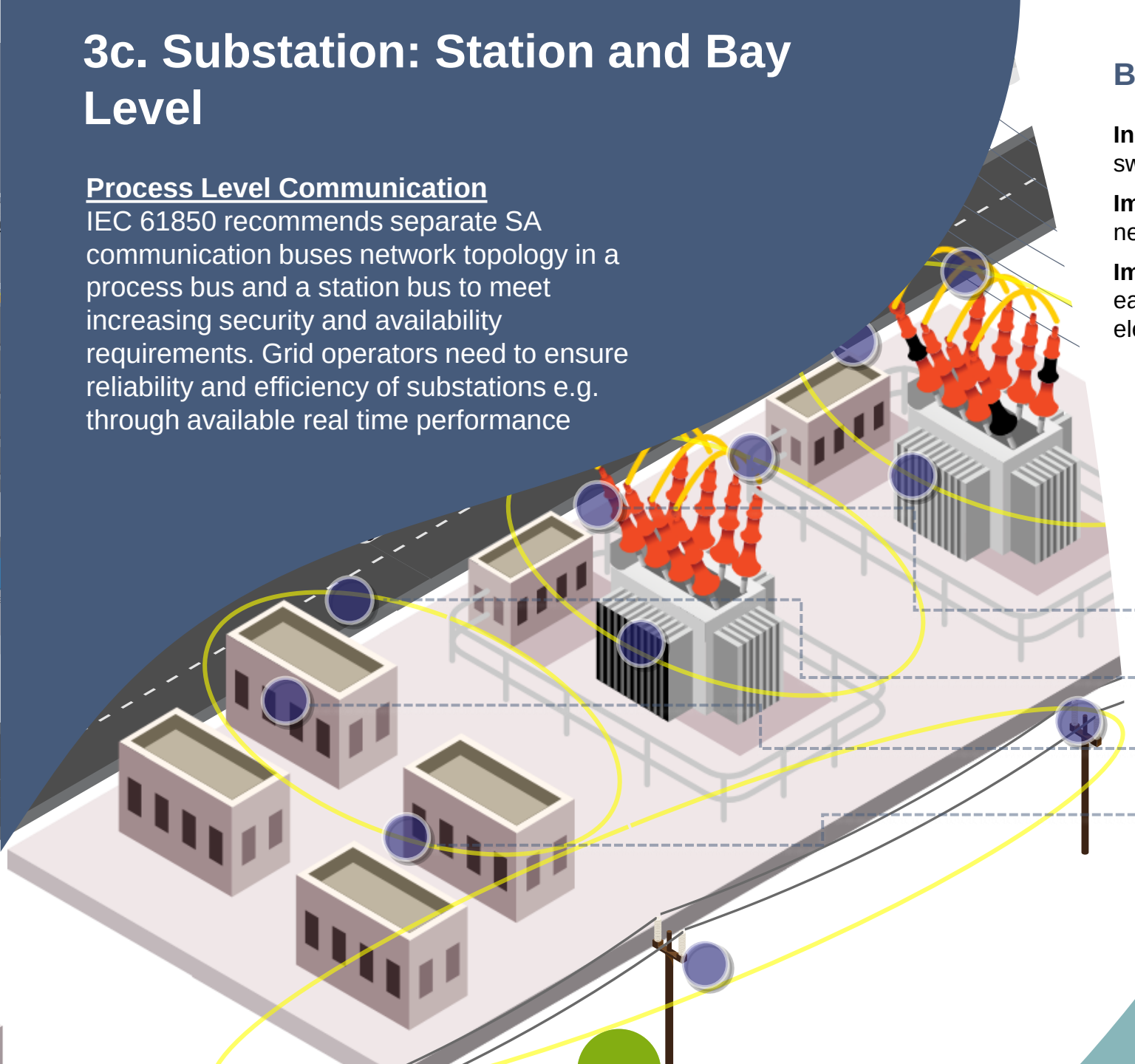
Reduced operation costs: distributed security solution can be operated remotely reducing travel time and cost

Belden Solution

- CyberSecurity Monitoring & Management (Macmon / Tripwire)
- Backbone switches – XTran family (industrial MPLS-TP 1G-100G), MACH and Greyhound / GRS (1G-10G Ethernet)
- Universal Fibre Cable – Fibre cable range
  All types of UTP/STP - Customized Cabinets
- Network Supervision through HiVision and TXCare NMS
- DMZ - The Multi-Port Cyber Security Devices – EAGLE40

3c. Substation: Station and Bay Level

Process Level Communication
IEC 61850 recommends separate SA communication buses network topology in a process bus and a station bus to meet increasing security and availability requirements. Grid operators need to ensure reliability and efficiency of substations e.g. through available real time performance



Belden Key Benefits:

Increased reliability: IEC 61850 conformance redundancy switching from 0 milliseconds

Improved security: ensuring a complete defense against network attacks

Improved security: universal optical cables do not require earthing, as they are metal free and immune to lightning and electromagnetic interference

Belden Solution

- GRS19” Rack Mounted = Ruggedized substation versions
- RSP or BOBCATS – IEC61850 and IEEE1613 approved
- Industrial Ethernet cable – All types of UTP/STP
- Universal Fibre Cable – Industrial Fibre cable range

3c. Substation: Process Level

Process Level Communication
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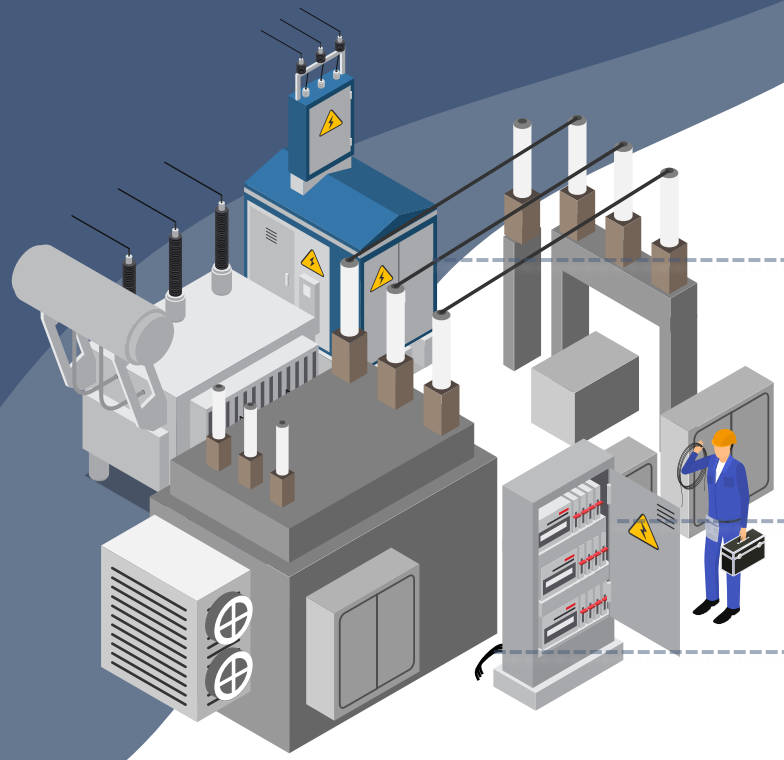

Belden Key Benefits:

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Improved security: ensuring a complete defense against network attacks

Improved security: universal optical cables do not require earthing, as they are metal free and immune to lightning and electromagnetic interference

Belden Solution

- EAGLE40 / Tofino Firewal; - DPI for endpoints and upper levels
- Edge appliances – Hirschmann (Docker / containers / etc.)
- MIPP – Modular Industrial Patch Panel
- Universal Fibre Cable – Industrial Fibre cable range

4. Load Dispatch Center

Belden Key Benefits:

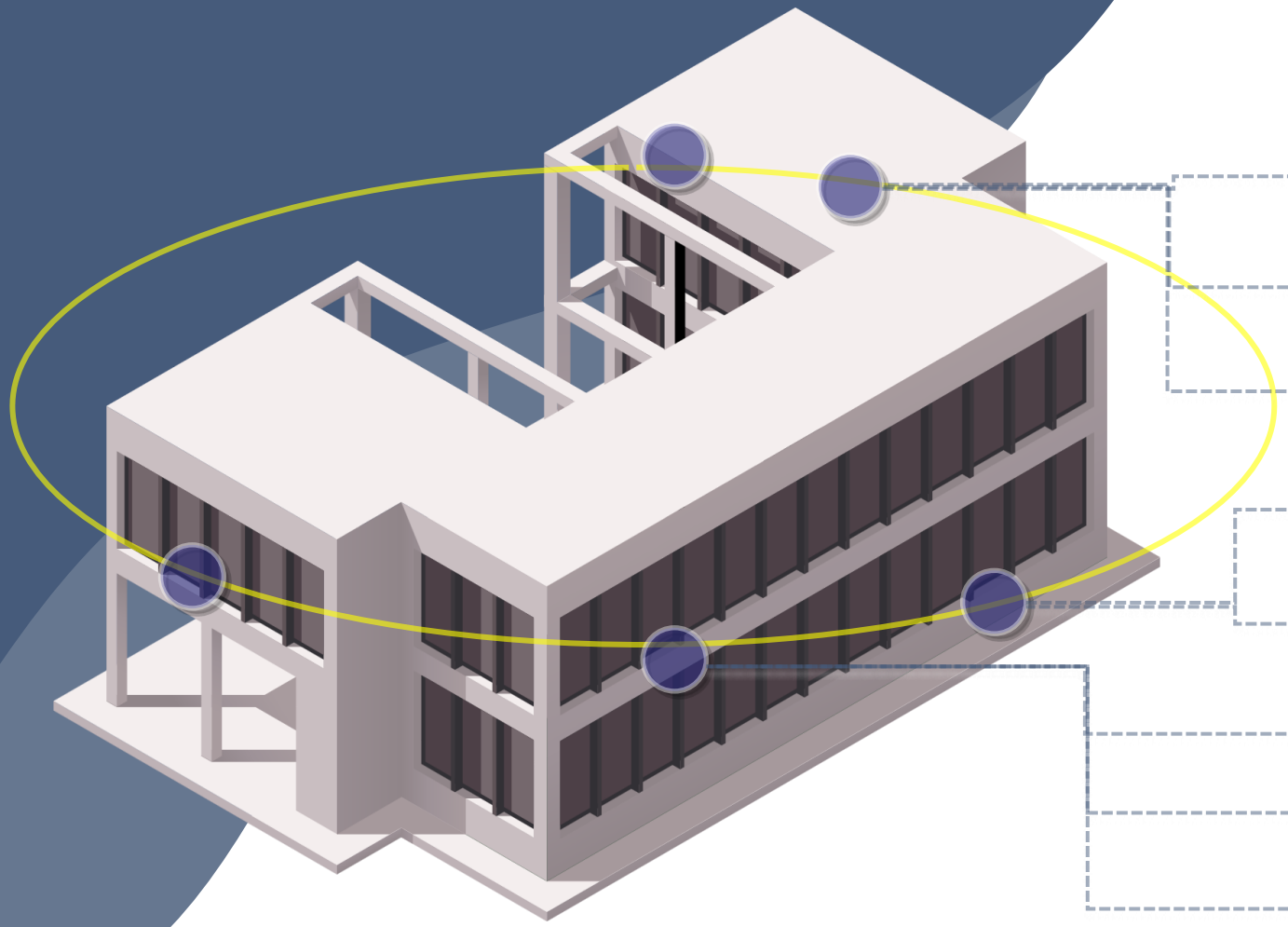
High availability for OT / substation grid network

Centralized Network Management

Cyber Secure ruggedized networking infrastructure

Deterministic communications: Hitless switching

Comprehensive fiber optic and copper cable management solution



Belden Solution

- Network Management (Network Operation Center - NOC)
- Cyber Security (Security Operations Center - SOC)
- WAN / LAN hardware Customized cabinets Fiber and copper connectivity Structured Cabling 10G solution
- Operational Telecom Networking Hardware & Software
- Grid Control and Network Management
- Cyber Security
- MPLS-TP solutions for data acquisition and enhanced Grid control
- End-to-end L2 and L3 network solutions

Thank You !

Any Questions?