Converging Communications, IT and OT

How it impacts ADMS deployment

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Xcel Energy - Strategic Priorities

Lead the Clean Energy Transition

- Investment in wind, solar and related transmission
- Carbon reduction:
  - Achieved 30% in 2016
  - Projected 45% by 2021
  - Projected 60%+ by 2030
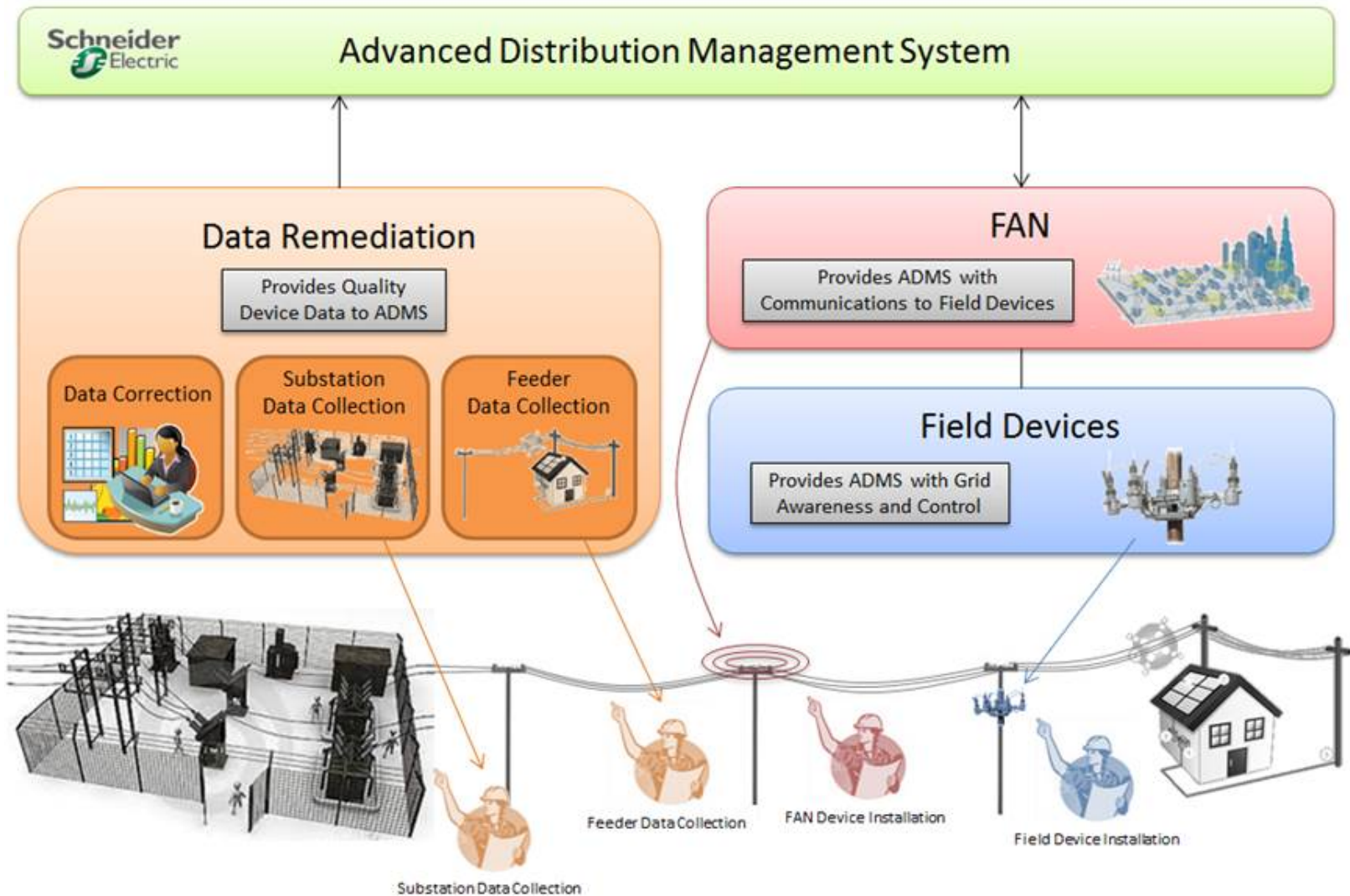
Enhance Customer Experience

- Investment in enhanced security, reliability, and automation
- Storage/EV enablement
- Lower SAIDI/SAIFI
- Top quartile satisfaction

Keep Bills Low

- Steel for fuel = savings
- Economic development
- Flat O&M
- Average bill increase at or below inflation

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Advanced Grid Intelligence and Security (AGIS)

Advanced Distribution Management System (ADMS)

- A Detailed Operational Model!
  - Intelligent, real-time impedance model of the distribution system
  - Enhanced visibility and control of field devices
  - Enables advanced applications
  - Used in the Distribution Control Centers and by Engineering

- Benefits
  - Enhanced reliability and power quality
  - Enhanced visibility and control
  - Improved worker efficiency and safety

- Go-Live in PSCo – 2019, NSP/SPS - 2020

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What is Informational Technology (IT)?

- IT is the use of computers to store, retrieve, transmit, and manipulate data, or information, often in the context of a business or other enterprise.[1]

- For an Electric Utility, IT is:
  - Infrastructure: Hardware / Data Centers
  - Communications Network: Corporate Network, WAN, ESB
  - Security – Cyber Security - Software and practices - Firewalls
  - Integrations allowing passage of data/files between systems
  - Head-end software systems
  - Databases and network drives
  - Email

1 - https://en.wikipedia.org/wiki/Information_technology - November,2018

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What is Operational Technology (OT)?

- OT is hardware and software that detects or causes a change through the direct monitoring and/or control of physical devices.

- For an Electric Utility, OT is:
    - Head-end systems which monitor and/or manage field devices (SCADA, EMS, ADMS, AMI, OMS, Sensor head-ends etc…)
    - Field Devices: Advanced meters, capacitor controls, switch and recloser controls, sensors, etc… and future tech…
- OT systems and devices have far different requirements and demands than IT systems!

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https://www.gartner.com/it-glossary/operational-technology-ot/, October,2018

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IT/OT Convergence

- IT/OT Convergence is viewed by many as a necessity, not a choice.
- Leverage the same platforms and 3rd party software for IT and OT applications (i.e. Cyber Security)
- Leverage technical talent to solve increasingly complex integrations and configurations
- Different from IT systems in the past, OT requires complex integration between many business areas which traditionally didn't interact
- Service Level Agreements
  - Different change windows, four-9's and five-9's down-time
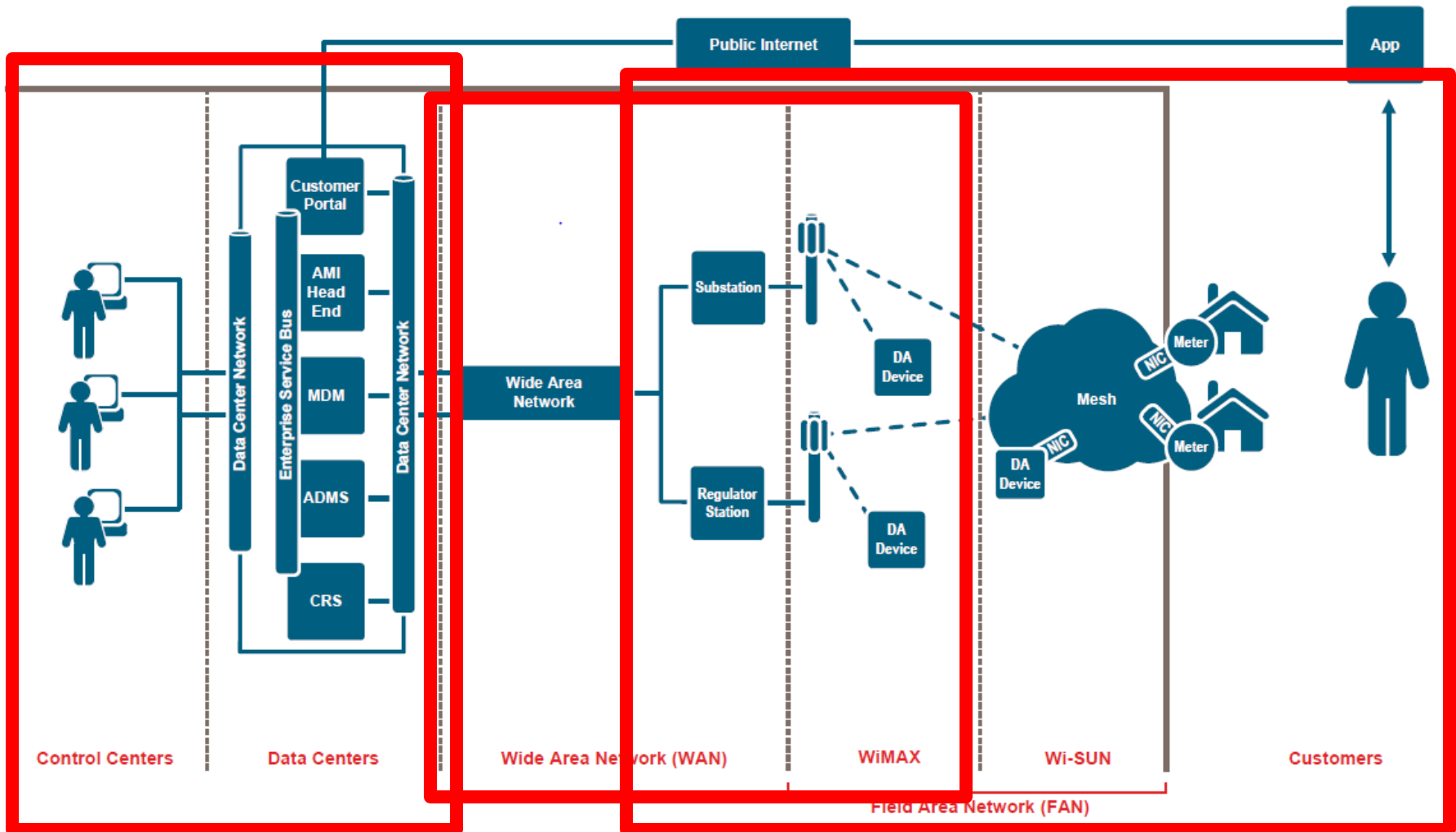 - External variables, e.g. weather and response times

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Drivers of IT/OT Convergence

Outage Management

The Evolving Grid

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What is OT/IT?

Customer Portal

AMI Head End

MDM

ADMS

CRS

Data Center Network

Enterprise Service Bus

Data Center Network
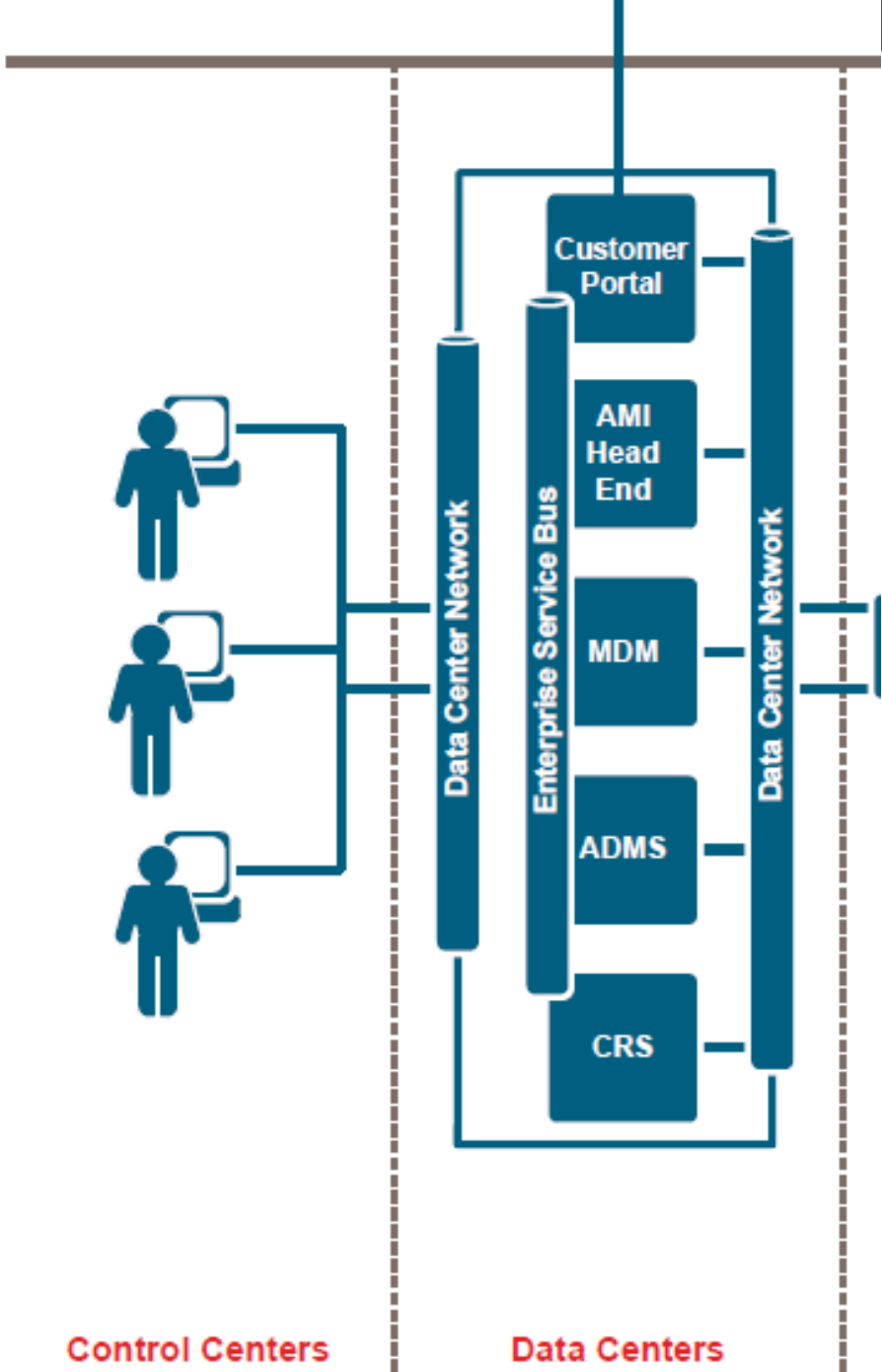
Control Centers

Data Centers

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Wide Area Network (WAN)

WiMAX

Field Area N

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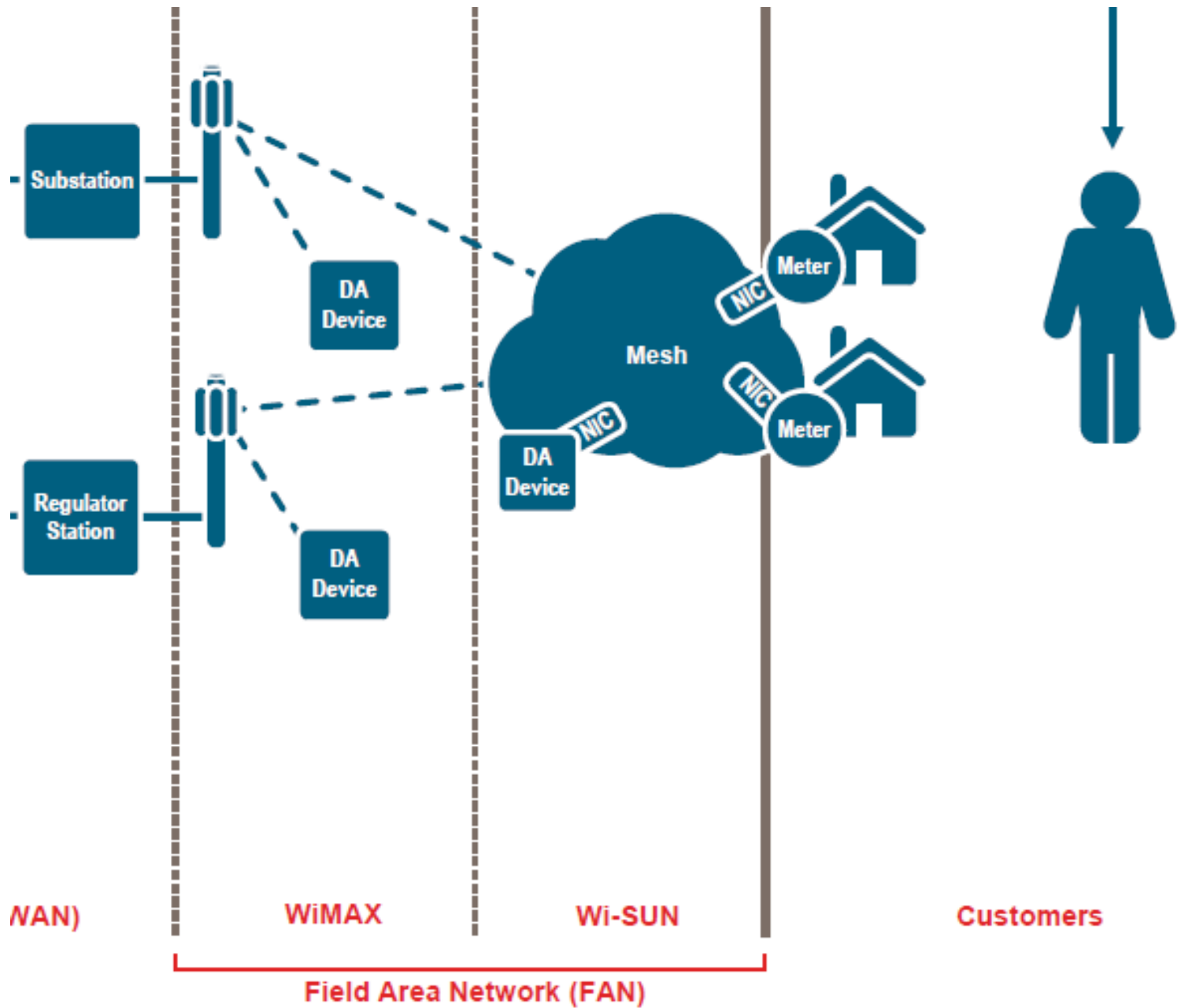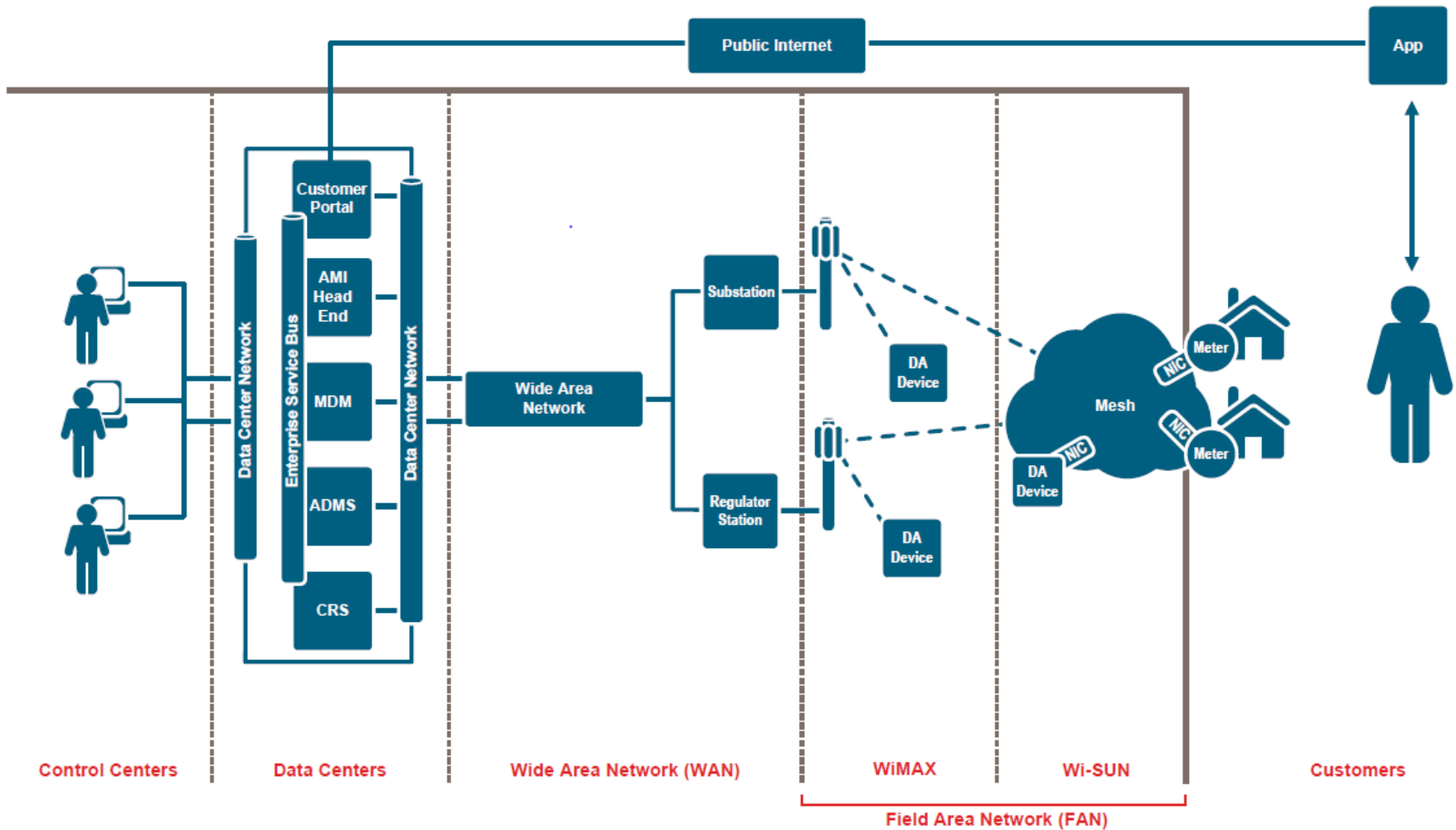
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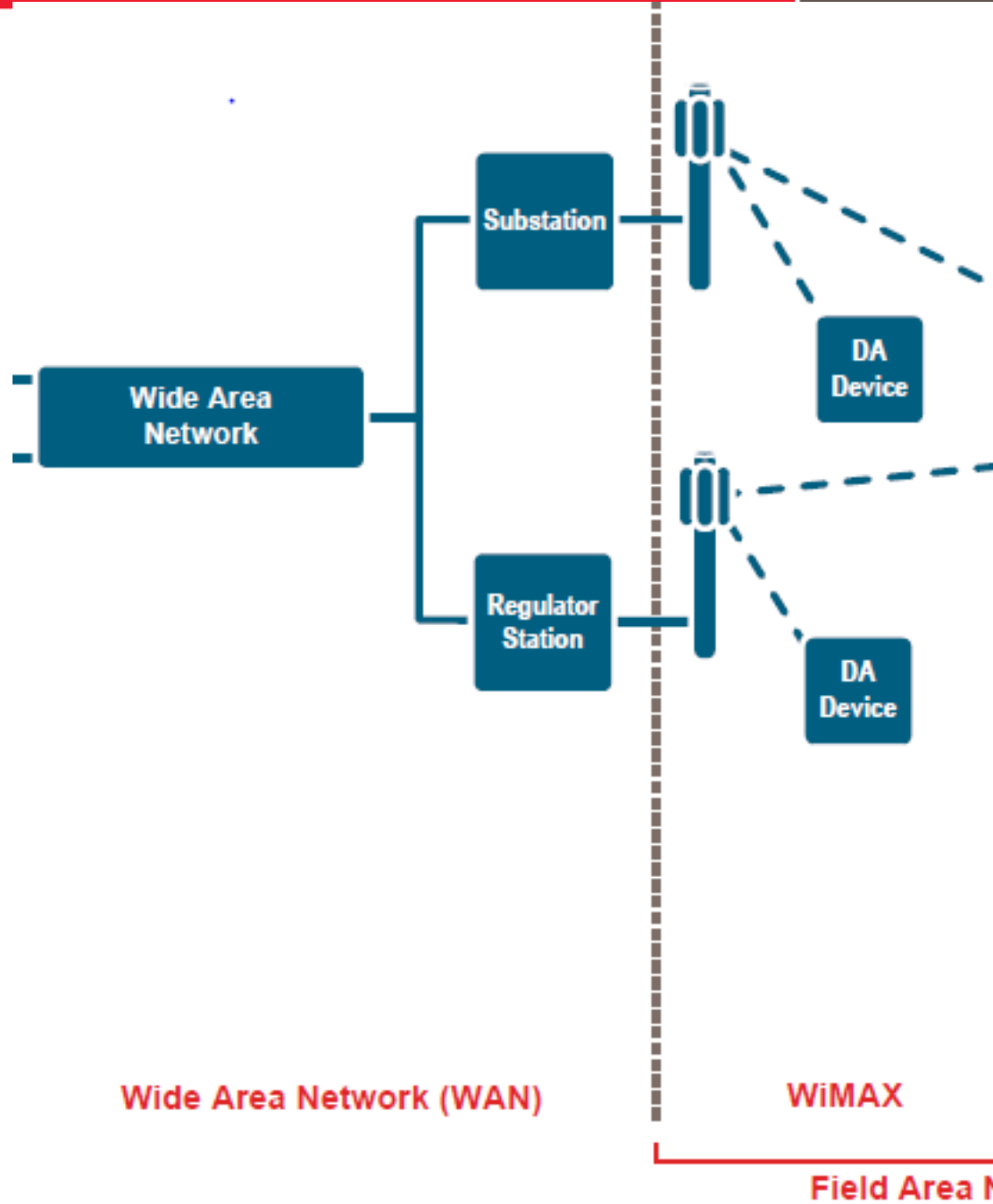
What is OT/IT? – AMI Example

Security Implications

- Firewall rules and VPN's everywhere!!

- Field employees (trouble techs) and Distribution Engineers are called on to set-up, test and troubleshoot (i.e. new skillsets)

- Different from most IT infrastructure, Physical security is also a concern

- OT devices historically have limited security functionality

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Remote Device Management

- We've been able to manage devices remotely for a while, but…
  - Directly on CORP network
  - Limited auditability
  - No user access control

- We need to have secure remote access for device management to be successful – challenge – 1,000's of devices!
  - Firmware update challenge / security update challenge

- These devices are now an entry point to our system – security threat!

- New security measures must be put in place to balance:
  - Functionality for the user
  - Operability of the grid
  - Security best-practices to secure our internal systems
  - It's not always an "and"!

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The three areas seen as key to IT/OT:
1 – Unplanned Outage Management

- Outage management – Huge scope! Spans many business areas

- Modern Outage Management
  - Predictive analytics
  - Workforce optimization
    - Find "Nested outages"
    - Avoided truck rolls
    - Better coordination of crew location and job needs

- Modern ADMS applications – FLISR
  - Reduced outage time and patrol time
  - Combination of intelligence in the field and intelligence in ADMS

- Goal = Improved estimated restoration times and customer experience

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2 – Advanced Asset Management

- Data gives us the ability to make informed decisions about asset life and health

- Reduced risk of asset failure during switching, outages or restoration
  - Accurate modeling of device name-plate rating and loads during switching with warnings and alerts for operations
  - Weather forecasting and modeling to predict future issues
  - All based on the as-operated state of the grid

- With the right analytical tools, investment can be more optimized, targeting the right type of maintenance rather than a 'run to fail' approach.
  - Change in utility philosophy (this is a challenge!)

- #1 and #2 will become more critical as regulatory incentives become more performance-based!

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3 – Distributed Generation Monitoring, Control and Analysis

- Hosting capacity studies are being required by our states. MN specifically, leveraging EPRI's DRIVE tool
  - Extends to other PUC requirements as they get more interested in distribution planning

- Enables future services, through a Distributed Energy Resource Management System (DERMS) or other aggregation service
  - Enables all the services Energy Storage offers

- Enables advanced capabilities, such as adaptive protection to change settings in real-time

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Challenges and Barriers

- Traditional power engineering is changing!
  - New skillsets are required in the distribution business:
    - Controls
    - Programming
    - IT security and Networking
    - Communications Networks
- Resource accountability, responsibility, and availability
- Who owns what?
  - Once a networking device is on a pole, who owns it?
  - Who makes the Quality of Service decisions
- Cultural barriers & organizational silos
  - New organization designs

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An Example of the Converged Network – Point to Point Checkout

Preparation for P2P:

- Security (Physical and IT)
- IT Infrastructure
- Engineer / Design / Build
- Communications Surveys
- ADMS Team (set-up & config)

IT / OT Network

Active P2P

- Field Techs
- SCADA Techs
- Communications Network
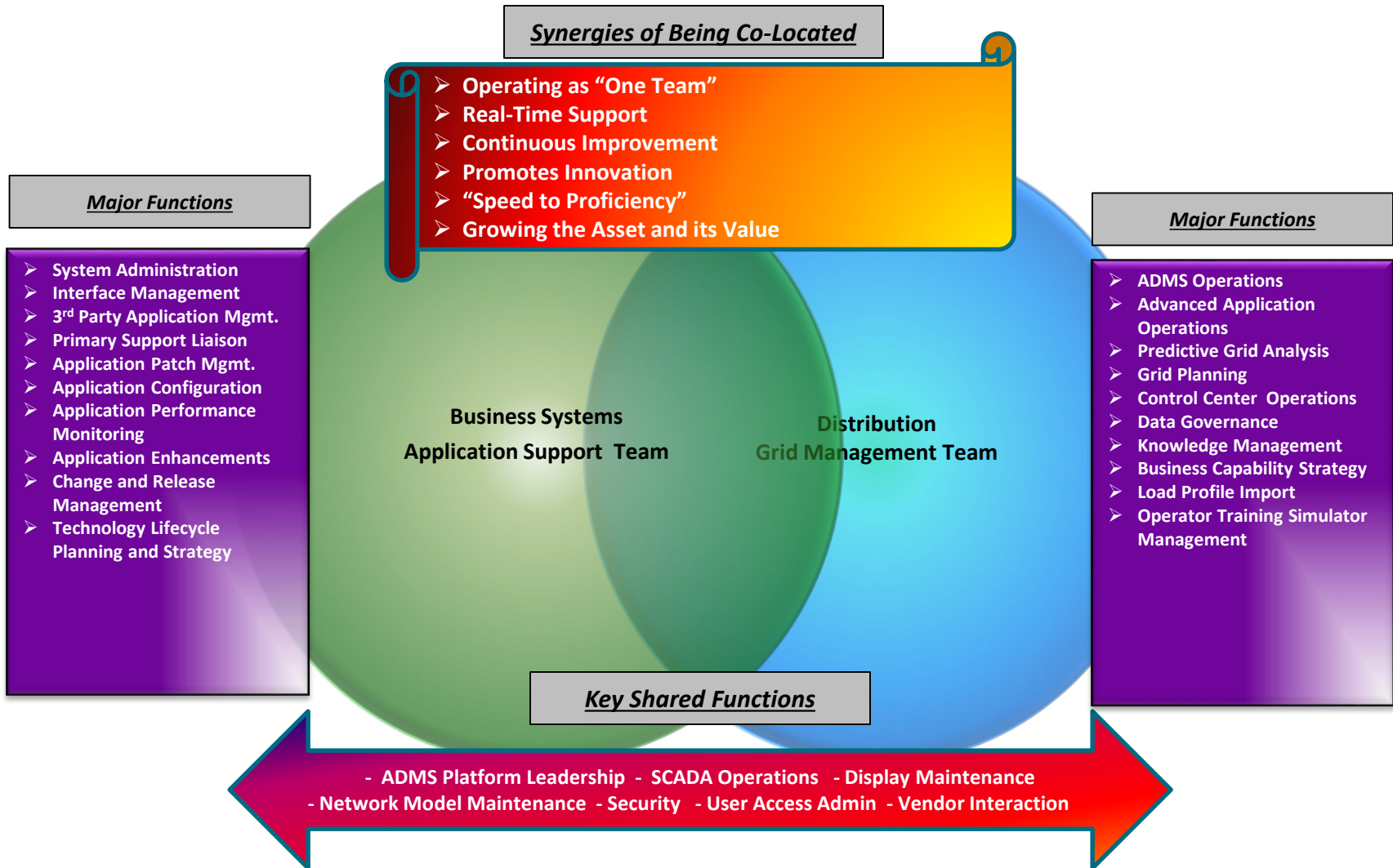- Control Center
- Grid Engineers / Controls Engineers

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Questions Welcome

Thank you

4 – Co-Located ADMS Support Team
The Grid Management Team – A "One-Team" Approach

Synergies of Being Co-Located

- Operating as "One Team"
- Real-Time Support
- Continuous Improvement
- Promotes Innovation
- "Speed to Proficiency"
- Growing the Asset and its Value

Major Functions

- System Administration
- Interface Management
- 3rd Party Application Mgmt.
- Primary Support Liaison
- Application Patch Mgmt.
- Application Configuration
- Application Performance Monitoring
- Application Enhancements
- Change and Release Management
- Technology Lifecycle Planning and Strategy

Business Systems
Application Support Team

Distribution
Grid Management Team

Major Functions

- ADMS Operations
- Advanced Application Operations
- Predictive Grid Analysis
- Grid Planning
- Control Center Operations
- Data Governance
- Knowledge Management
- Business Capability Strategy
- Load Profile Import
- Operator Training Simulator Management

Key Shared Functions

- ADMS Platform Leadership - SCADA Operations - Display Maintenance
- Network Model Maintenance - Security - User Access Admin - Vendor Interaction

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Keys to a Secure Grid

Defense in Depth

Zero Trust

Security by Design

Cyber Security

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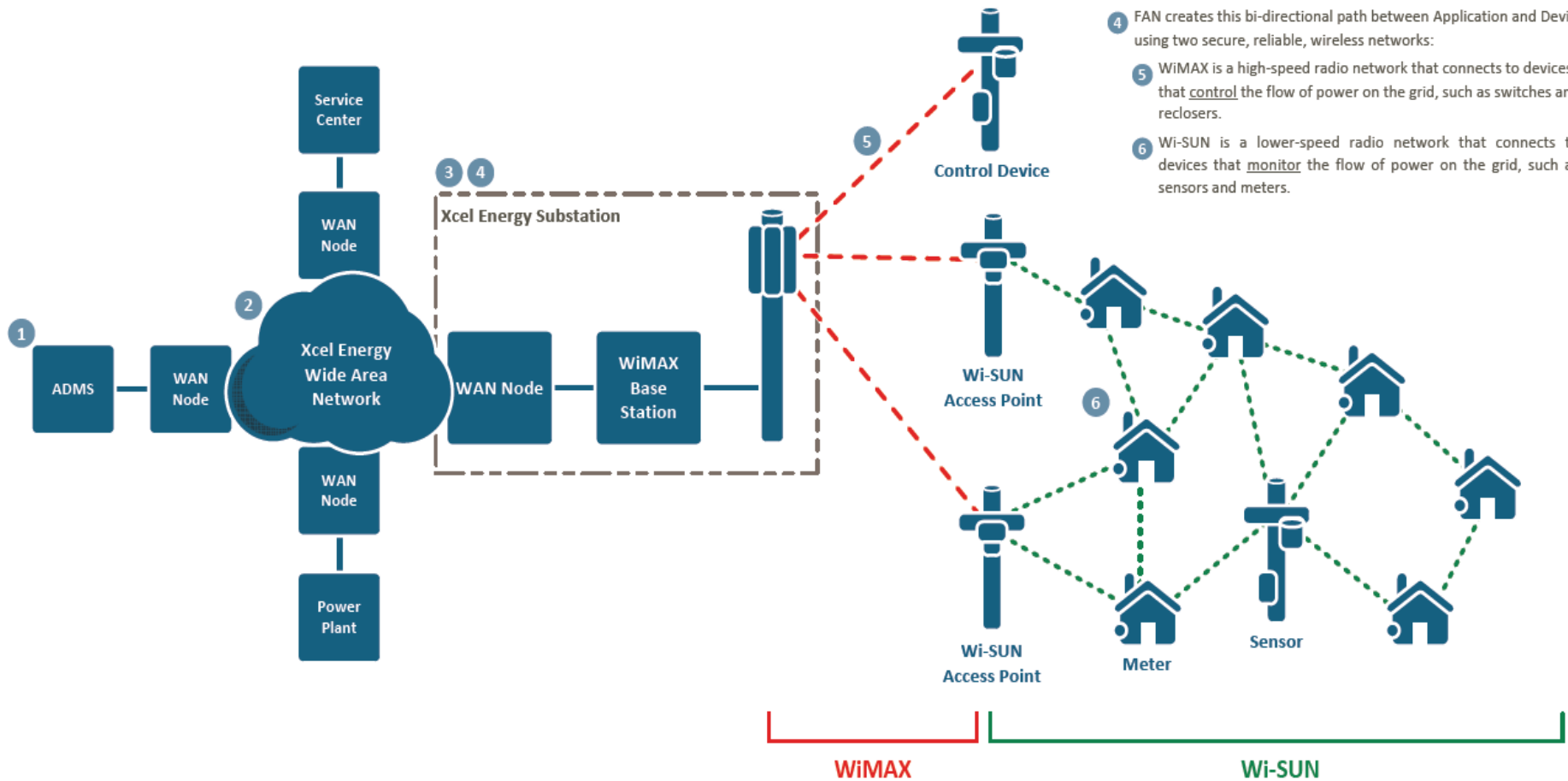
ADMS SCADA – The Importance of Templates

- Templatizing is key!
- Both the field device and the SCADA system should be templatable
- By maintaining templates, you minimize testing required to in-service devices and make processes replicable

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Field Area Network Overview

The Field Area Network (FAN) connects Intelligent Field Devices to Advanced Applications using tiers of secure, reliable wireless radio networks.

Description of the Field Area Network

1. The future Advanced Applications will operate within Xcel Energy Data Centers.

2. The Wide Area Network (WAN) connects Xcel Energy Facilities with these Advanced Applications.

3. The Field Area Network (FAN) enables the Advanced Applications to talk with intelligent devices that live on the grid.

4. FAN creates this bi-directional path between Application and Device using two secure, reliable, wireless networks:

5. WiMAX is a high-speed radio network that connects to devices that <u>control</u> the flow of power on the grid, such as switches and reclosers.

6. Wi-SUN is a lower-speed radio network that connects to devices that <u>monitor</u> the flow of power on the grid, such as sensors and meters.

Diagram components: Service Center, WAN Node, ADMS, WAN Node, Xcel Energy Wide Area Network, WAN Node, WAN Node, Power Plant, Xcel Energy Substation (WAN Node, WiMAX Base Station), Control Device, Wi-SUN Access Point, Wi-SUN Access Point, Meter, Sensor. Network bands: WiMAX, Wi-SUN.

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ADMS Business Context

ADMS is *foundational* for Xcel Energy to efficiently monitor and control the electric distribution grid of the future.
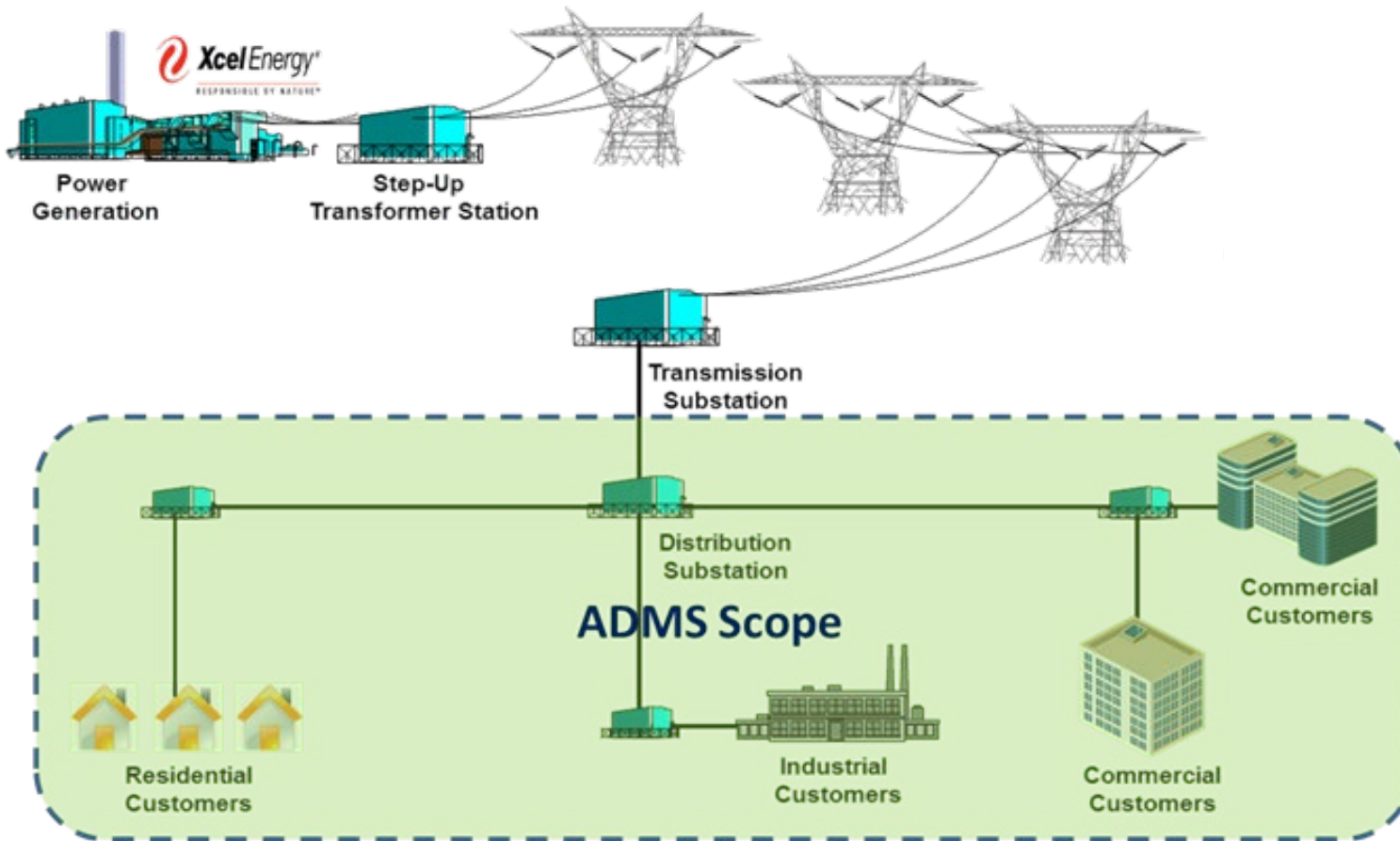
Transformation: Advanced Grid

*Strengthen the grid so that our customers view
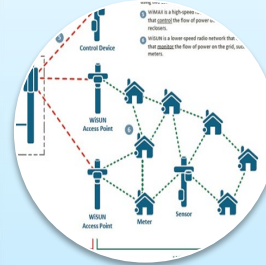Xcel Energy as their long-term energy solutions provider*

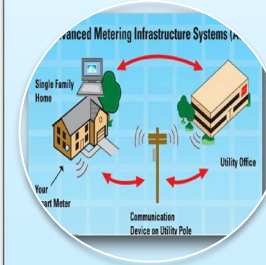
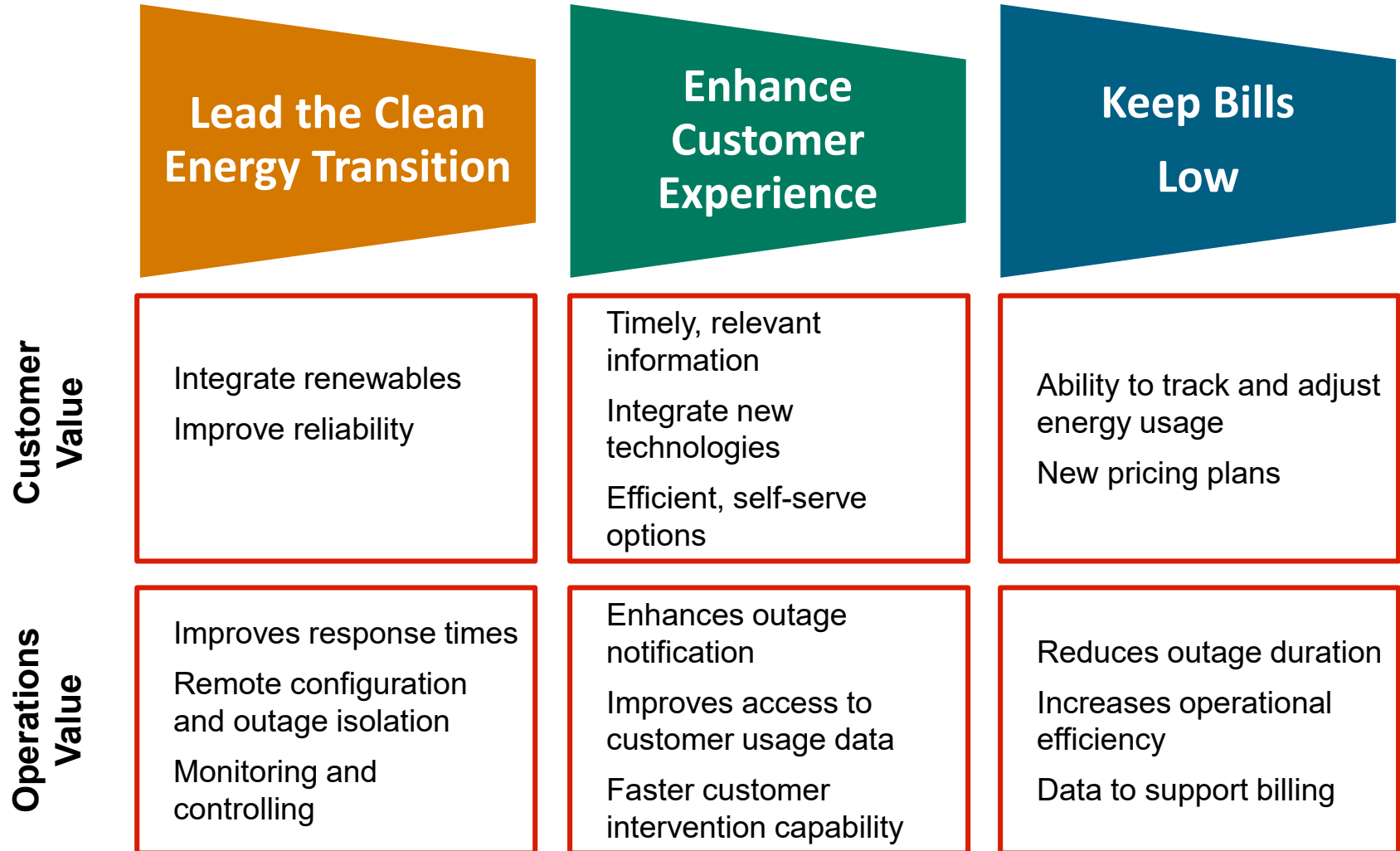| Advanced Distribution Management System (ADMS) | Fault Location, Isolation, and Service Restoration (FLISR) | Integrated Volt-VAr Optimization (IVVO) | Field Area Network (FAN) | Advanced Meter Infrastructure (AMI) | Emerging Technologies |

← Technology Suite – Enabling Customer Experience, Choice, Control & Enhancing Grid Operability →

Security and Data Solutions

Process Integrations, Change Management, Talent Strategy, Communications, Governance

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Appendix

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Xcel Energy's Advanced Grid Provides Value…

Lead the Clean Energy Transition	Enhance Customer Experience	Keep Bills Low
Customer Value		
Integrate renewables Improve reliability	Timely, relevant information Integrate new technologies Efficient, self-serve options	Ability to track and adjust energy usage New pricing plans
Operations Value		
Improves response times Remote configuration and outage isolation Monitoring and controlling	Enhances outage notification Improves access to customer usage data Faster customer intervention capability	Reduces outage duration Increases operational efficiency Data to support billing

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Advanced Distribution Management System