Ever-growing grid challenges …

Increasing complexity of the grid due to integration of distributed energy resources and storage

Aging infrastructure

Growing regulatory and customer pressure to provide reliability

Climate change - extreme weather conditions
... and impact on distribution utilities

<table>
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<th>Primary Drivers for Smart Grids</th>
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<tr>
<td><strong>Reliability</strong></td>
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<tr>
<td>• Avoid outages</td>
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<td>• Reduce outage duration</td>
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<td>• Utilize consolidated user control across the entire grid</td>
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<td><strong>Cost Reduction</strong></td>
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<tr>
<td>• Minimize grid losses</td>
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<td>• Maximize grid utilization</td>
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<tr>
<td><strong>Automation &amp; Communication</strong></td>
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<tr>
<td>• Automate fault localization and supply restoration</td>
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<tr>
<td>• Gain maximum benefit from smart meter information</td>
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<td>• Closely interact with field IEDs</td>
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<td><strong>Renewable Integration</strong></td>
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<tr>
<td>• Securely balance intermittent generation, switchable loads, and storages</td>
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<tr>
<td>• Optimally curtail/restore generation acc. to grid loadability</td>
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Emerging Utility Needs
The Answer
ADMS = Automated Distribution Management System

Next-generation power distribution management.

The Integration of Distribution SCADA, Advanced Fault and Network Analysis and Outage Management operated on one technology platform with one Common User Interface.
Monitor, control and optimize the secure operation of the electrical distribution network.

Reduce network loading at peak times and increase asset utilization, network efficiency and reliability.

Proactively and safely guide operators when needed most, i.e. during storms and outage-related restoration activities.
One system that takes distribution management to the next level.

| Holistic       | One single operational technology platform and one Common User Interface for SCADA, Distribution Network Application (DNA) and Outage Management System (OMS). |
|               |
| Flexible       | Adapt your system to emerging and ever-changing regulatory requirements through modularity and step-by-step extensions. |
| Transparent    | Full network transparency, from High Voltage (HV) down to Low Voltage (LV), for faster decision-making. |
| Business-centric | Open to new Smart Grid business cases and to easy interoperability with any Enterprise IT. |
ADMS
Integration of Operational IT with Enterprise IT
Distribution Network Applications
Fault Location

- Handles **outage faults** (i.e. short-circuit faults) and **non-outage faults** (i.e. earth faults)
- Triggered on state change of fault indicators and feeder CB’s unexpected tripping
- **Fast localization of faulty section**
- Designed to **determine the smallest possible faulted section** based on available real-time information
- Essential to **restore supply fast and to as many customers as possible**
- Uses remote metered and manually updated information such as:
  - **Protective devices’ tripping** (CB’s, re-closers, etc.)
  - Status of **fault passing indicators**
  - Status of **earth fault relays**
  - Fault information from **Impedance fault relays**
Distribution Network Applications

Fault Location

Circuit Breaker Tripped

Faulted area calculated by ADMS

Fault Indicator active / passive
Distribution Network Applications
Fault Location with impedance search

Impedance search checks calculated reactance (via short circuit calculation) against reactance received from protection device

Detailed Fault location with impedance search in addition to the colored potentially faulted area
Once the faulty segment has been identified:

- ADMS finds out how to isolate the faulty segment
- ADMS finds out how to restore power to all related non-faulty segments

✓ Minimizes the outage time for the affected customers
✓ Establishes the series of required switching operations
✓ Used also for outage planning (equipment isolation for planned maintenance)
Faulted area determined by ADMS

Select any faulted equipment and start isolation/restoration
Distribution Network Applications
Fault Management Workflow

Isolation and restoration procedure is calculated for faulted area

Proposed steps are highlighted
Distribution Network Applications
Isolate equipment for planned outages

Select the equipment (e.g. line) that should be taken out for maintenance and execute program

Isolation/Service restoration steps are calculated and highlighted
ADMS Summary
Key Benefits

1. Monitor, control and optimize distribution network operation
2. Integrate increasing renewable generation
3. Optimize asset utilization with minimal network load and losses
4. Efficiently manage day-to-day maintenance and repair efforts
5. Shorten outage restoration times, especially under severe conditions

High reliability of supply and reduced operational costs
Thank you for your attention!