

Advanced Distribution Management Systems

How to choose the right solution to improve your utility's safety, reliability, asset protection and quality of service

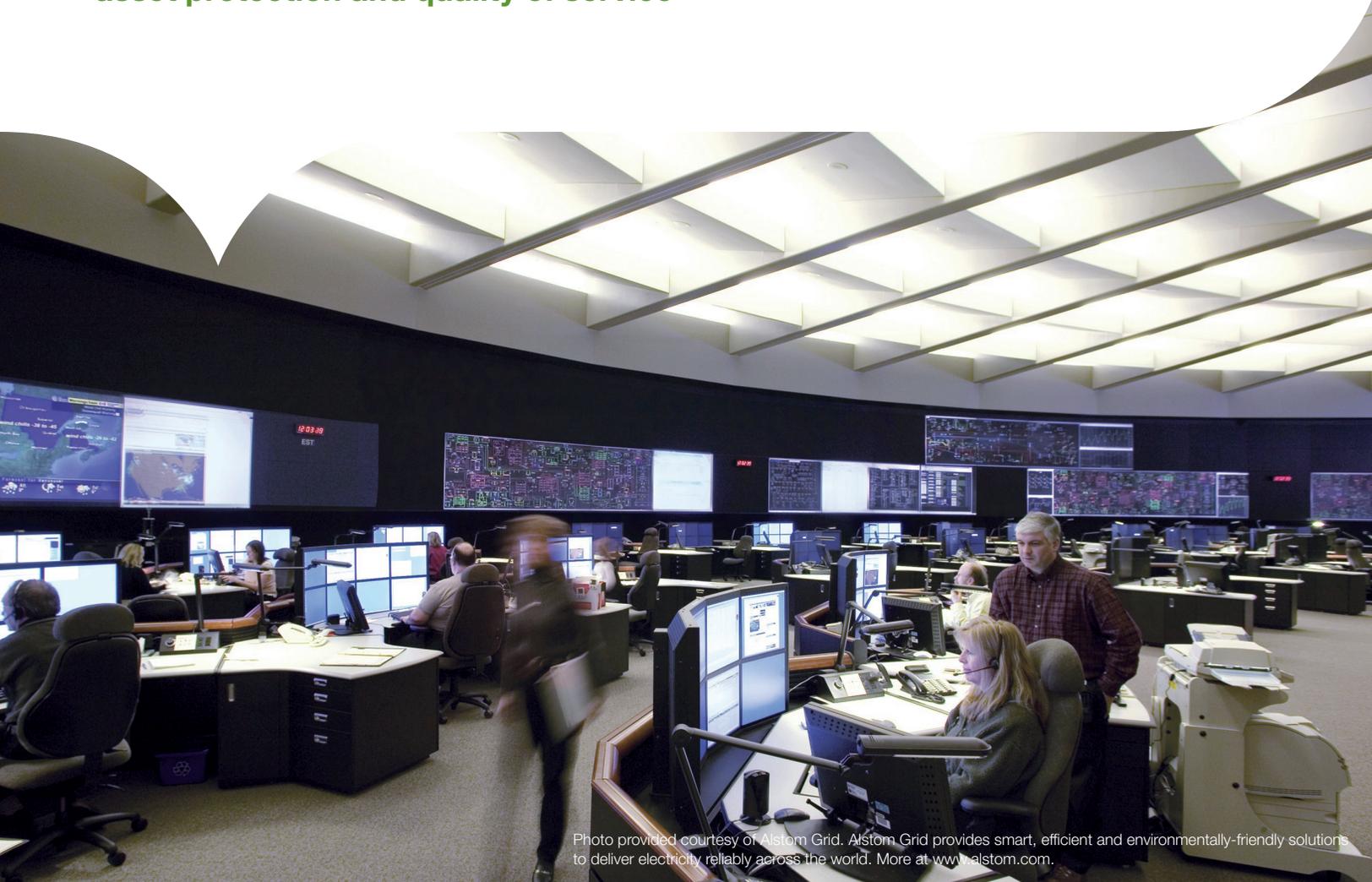
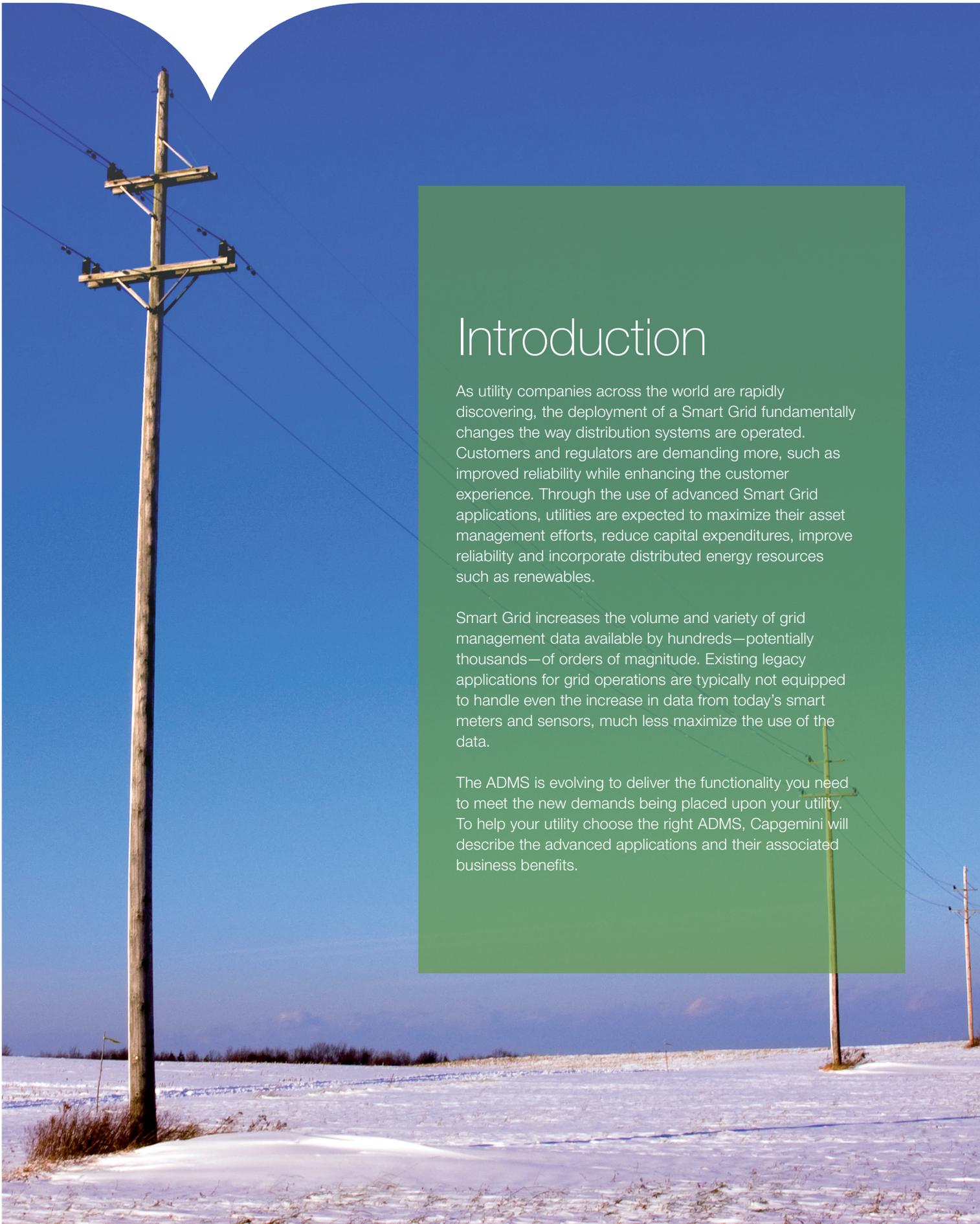


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Introduction

As utility companies across the world are rapidly discovering, the deployment of a Smart Grid fundamentally changes the way distribution systems are operated. Customers and regulators are demanding more, such as improved reliability while enhancing the customer experience. Through the use of advanced Smart Grid applications, utilities are expected to maximize their asset management efforts, reduce capital expenditures, improve reliability and incorporate distributed energy resources such as renewables.

Smart Grid increases the volume and variety of grid management data available by hundreds—potentially thousands—of orders of magnitude. Existing legacy applications for grid operations are typically not equipped to handle even the increase in data from today's smart meters and sensors, much less maximize the use of the data.

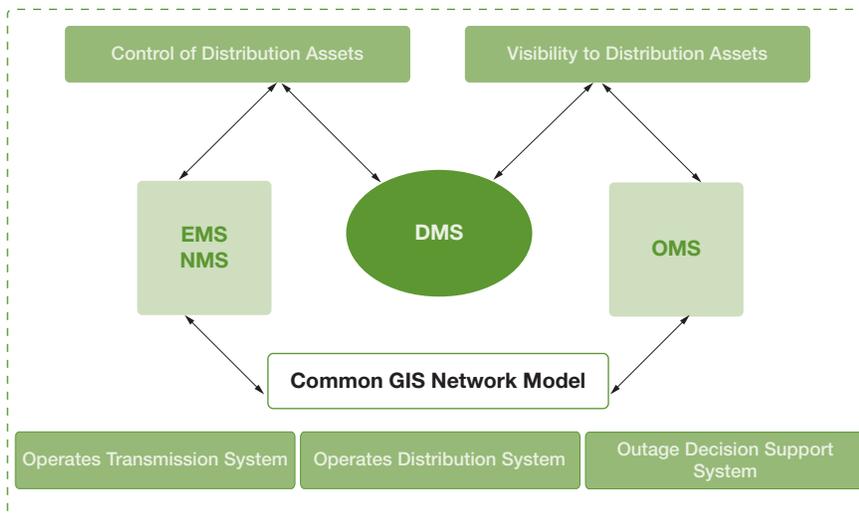
The ADMS is evolving to deliver the functionality you need to meet the new demands being placed upon your utility. To help your utility choose the right ADMS, Capgemini will describe the advanced applications and their associated business benefits.

The Advanced Distribution Management System

The ADMS is a decision support system that helps control room and field operating personnel monitor and control the electric distribution system effectively while improving **safety, reliability, asset protection and quality of service.**

Depending on your utility, the ADMS may need to be linked with the existing Energy Management or Network Management System and OMS. Sharing of data between these systems maximizes the efficiency of operation within your control room or control centers.

Figure 1: What is a Distribution Management



Major ADMS Components

Control System

The ADMS typically includes a SCADA system, an OMS and advanced applications.

Data is King!

The ADMS needs information to realize the full potential of its function. Data is obtained from intelligent field devices and enterprise systems. In addition, AMI networks can provide the last gasp information to enhance outage management processing within ADMS as well as the capability to perform outbound meter pings to test for voltage potential at the meter base endpoint.

Mobility

Mobile systems can be used to directly view and operate the network on field tablets or mobile data terminals. Outage

Management Systems get enhanced capabilities through mobility by providing e-ticketing for crew dispatch and tracking, occurrence/cause/repair reporting and up to date customer outage information.

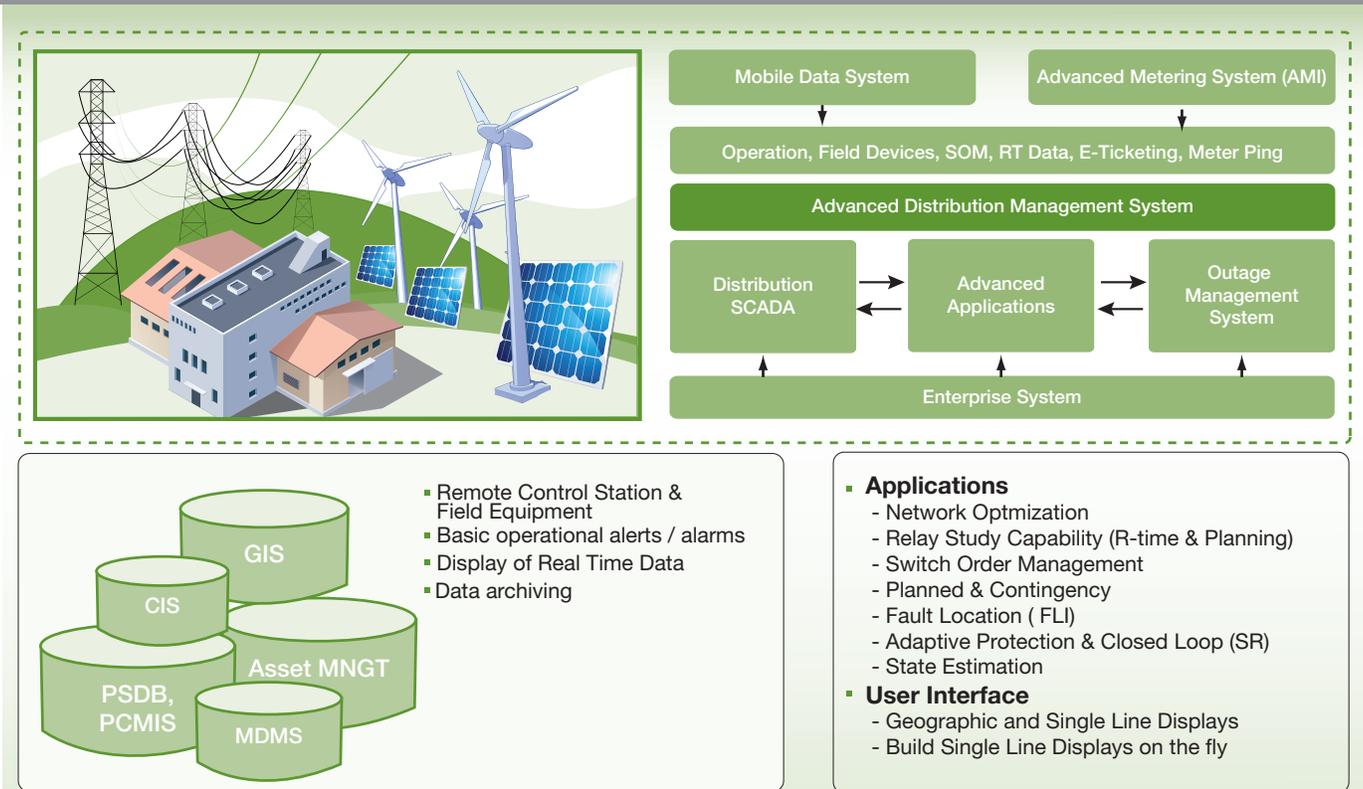
Advanced Applications

The following is a brief description of available advanced applications. What's important is to understand the applications, know the key business drivers and ensure the solution you are selecting has the functionality to successfully meet your utility's objectives.

Relay Protection Analysis, Adaptive Protection, Closed Loop

These applications are very closely linked. First, the relay protection analysis application performs analytical studies on

Figure 2: Major Components



the network. When supplemented by adaptive protection your system can determine the correct relay setting to support new configurations. Once the new configuration is known with a closed loop application, the system will automatically reconfigure without the need for operator intervention.

By providing the tools to the individuals who manage the system, in real-time you receive

- Improvement in your reliability indices – SAIDI, CAIDI
- Improvement in your operation effectiveness – a significant reduction in the number of studies required by supporting technical staff

State Estimation

State Estimation calculates results based on available telemetry points and customer load profile information. The more telemetry points on the system the greater the accuracy of the state estimation.

The application should be considered the enabler of other applications. Several other applications use state estimated values such as load flow analysis, relay protection analysis and volt var optimization just to name a few.

Switch Order Management

The Switch Order Management application provides the user with the option to create switching orders either manually or automatically. The application allows the user to customize the switching order to reflect current in-house templates. The business benefit is that all relevant factors are being analyzed on a single platform providing improved safety, reliability and operating effectiveness.

Fault Location Isolation Service Restoration (FLISR)

This application enhances the Fault Location process. Customer restoration is improved by having better information and the ability to direct field crews more accurately to the faulted location. Using information obtained from the relay IED and fault detectors location in the field will avoid lengthy line patrols and sectionalizing efforts.

Some DMS solutions also provide a means whereby data administrators can input historical failures for the feeder in the application. This historical information can be used as one of the mechanisms for determining faulted locations as well. The Isolation and Service Restoration piece of FLISR is the next step. Once the faulted section is known, remotely controlled devices can restore customer load either manually (via remote control) or automatically (without operator intervention).

The business benefits include: improved field resource utilization, reduced customer interruptions and less “windshield time” for field forces.

Network Reconfiguration

This application determines the optimum normal open points on the network to minimize line losses, provide optimum phase balancing while maintaining adequate voltage profiles.

When implemented, this application will develop a list of suggested improvements – new open and closed points on the network. Each step will reflect the net gain if implemented. The business benefit is the optimization of the system by minimizing line losses, optimum utilization of current assets while gaining work force efficiency benefits by utilizing the analytics of this DMS application.

Topology Analyzer

The Topology Analyzer application displays voltages, phasing, the state of the system (energized or de-energized) using different color schemes as determined by the utility. This application is applicable to the single line schematic displays and geographic displays. Some DMS solutions can create single line displays on the fly by the user selecting the feeders and/or sub stations they wish displayed in isolation of other superfluous equipment. From a user perspective this is very powerful as it provides simplicity and/or clarity for the task at hand.

The business benefit is somewhat obvious. Without a method to simplify the electrical connectivity, the visual diagrams would be extremely cluttered and not useful. A lot of work has been done by the vendor community to ensure optimum flexibility is provided for the user.

Volt VAR Optimization

The Volt VAR Optimization (VVO) application in its simplest form reduces the distribution system voltage, thereby reducing the overall demand. Today, there are a number of devices that can be utilized to manage the network at a lower voltage profile, including:

- Sub-station – under load tapchangers
- Capacitors – large and small
- Distribution stations – under load tapchangers
- Other DER devices

The VVO application has been designed to optimize the use of all of the mentioned devices to minimize the overall load on the system. Typically the VVO applications are rule-based to determine the order and use of these devices.

The business benefit is the reduction of power consumption. This will offset the need for capital upgrades such as additional generating facilities and network upgrades to meet increased load demands.

Intelligent Alarm Processing

Looking forward, with smarter grids there will be more sensors and more applications which equates to more alarms. Intelligent alarm processing was originally designed to put some smarts into the system by analyzing a group of alarms, and provide a more intelligent alarm analysis to aid the operator during an alarm overload situation. There have been significant improvements over time in this area. Alarms can be displayed based on prioritization.

With the trend towards a single control center consolidation, managing large systems, and increased operator area of responsibility, a highly configurable and functional alarm management processing is essential.

Consideration When Purchasing an ADMS

ADMS solution providers are typically driven by the business requirements provided by utilities and will develop their platforms accordingly.

There is no magic bullet when determining the best ADMS solution. Business requirements will vary from utility to utility but some of the baseline drivers for consideration are safety, customer satisfaction and reliability of service (industry norms include SAIFI, CAIDI, SAIDI indices – the big three).

Some of the new challenges facing utilities are the integration of Distribution Generation, PHEV Management and Demand Management (giving the customer options on how to manage

their power consumption and the utility a means to manage the load profile). Volt VAR Optimization is another big ticket functionality, especially if you are a utility that is vertically integrated to include generation.

When you consider selecting an ADMS it is important to clearly understand your business drivers today and in the future. ADMS along with other Smart Grid devices can provide a number of added-value propositions to your business.

The following table identifies some typical business drivers and ADMS applications. The check-mark reflects improvement areas for the utility.

Figure 3: Advanced DMS Applications / Key Utility Business Improvement Areas

	Worker Safety	Reliability Improvement	Customer Satisfaction	Energy Efficiency	Increased Capacity Utilization	O&M Improvement
State Estimation	✓	✓	✓	✓	✓	✓
Switch Order Management	✓	✓	✓			✓
FLISR	✓	✓	✓			✓
Network Reconfiguration		✓		✓	✓	
DER Management	✓	✓	✓	✓	✓	✓
Load Forecasting	✓	✓	✓		✓	✓
Volt VAR Optimization				✓	✓	
Intelligent Alarm Processing	✓	✓	✓		✓	✓
Relay Study Capability	✓	✓	✓		✓	✓
Adaptive Protection		✓	✓			✓
Closed Loop		✓	✓			✓

Conclusion

Today, the utility industry is rallying behind the Smart Grid as a way to make valuable infrastructure improvements, increase customer options, and improve efficiency. The Smart Grid requires utilities to seriously consider an Advanced Distribution Management System to accommodate and optimize the new technology that will be installed in the field. ADMS solutions are needed to analyze the massive amounts of new data generated by Smart Grid devices, perform automated tasks to support applications like Volt VAR and FLISR in a closed loop providing new levels of operating effectiveness and work load management improvement in the control room.

Finally, ADMS speeds cost recovery for Smart Grid investments, offsets the need to construct new central generation, and provides a flexible grid-management platform that can accommodate emerging demands from the utility customer, shareholder and regulator.

For more details contact:

Larry Rouse
larry.rousse@capgemini.com

Tom Crawford
thomas.crawford@capgemini.com



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