



Realizing the Smart Grid

- A Solutions Provider's Perspective

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What is the Smart Grid?

Smart Grid



Two Way Communications.....Sensors.....Distributed Computing

Markets



Transmission



Substation



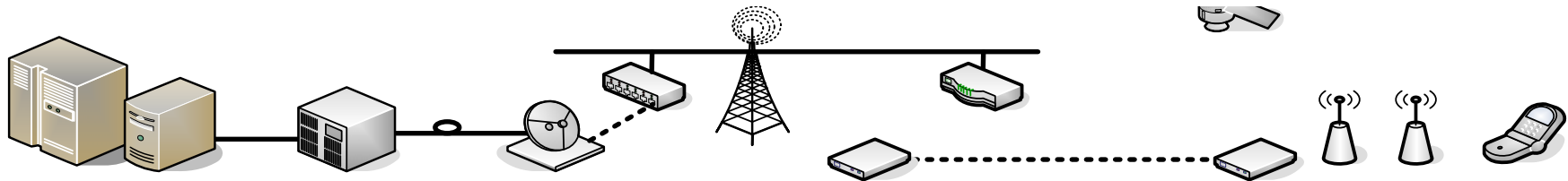
Distribution



Consumer



Information & Communication Enabled Power Infrastructure



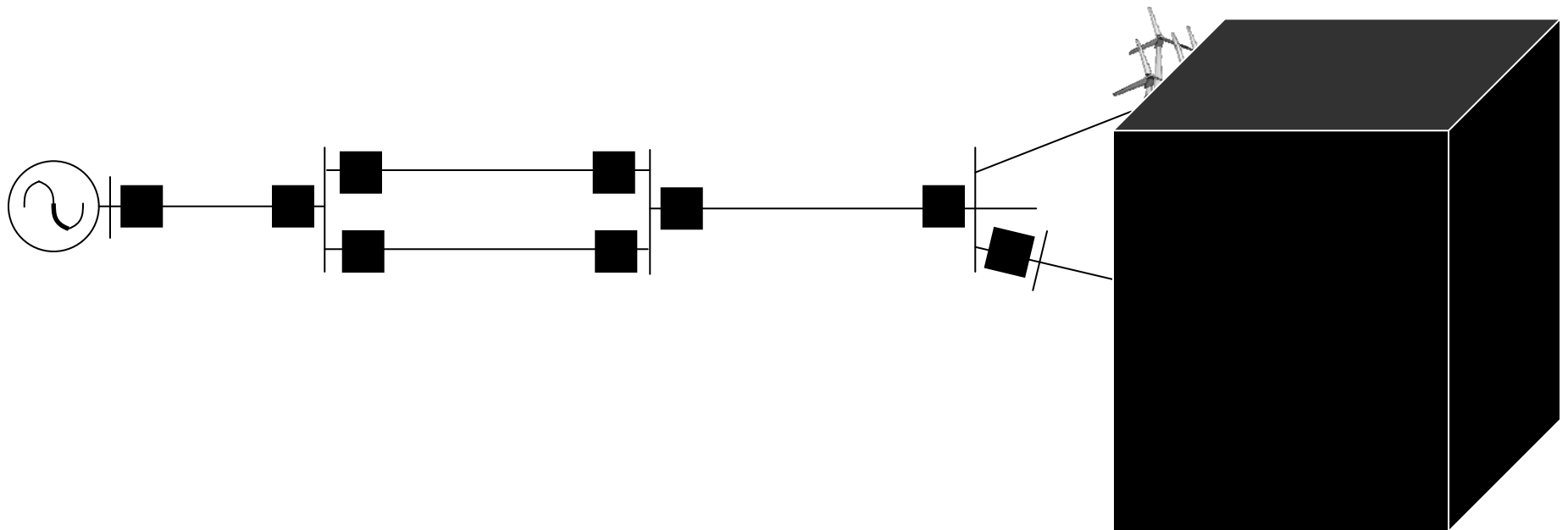
The use of advanced communication techniques to link all aspects of the electric grid together (from generator to consumer) with sensors and smart devices, in order to provide enhanced operational capabilities that:

- 1) Engage **CONSUMERS** with the ability to wisely use electricity, electric devices and new services (from smart thermostats to PHEV);*
- 2) Ensure **EFFICIENT** use of the electric grid (optimizing current assets while integrating emerging technologies such as renewables and storage devices); and*
- 3) Enhance **RELIABILITY** (protecting the grid from cyber and natural attacks, increasing power quality and self-healing capabilities).*

View of the Smart Grid

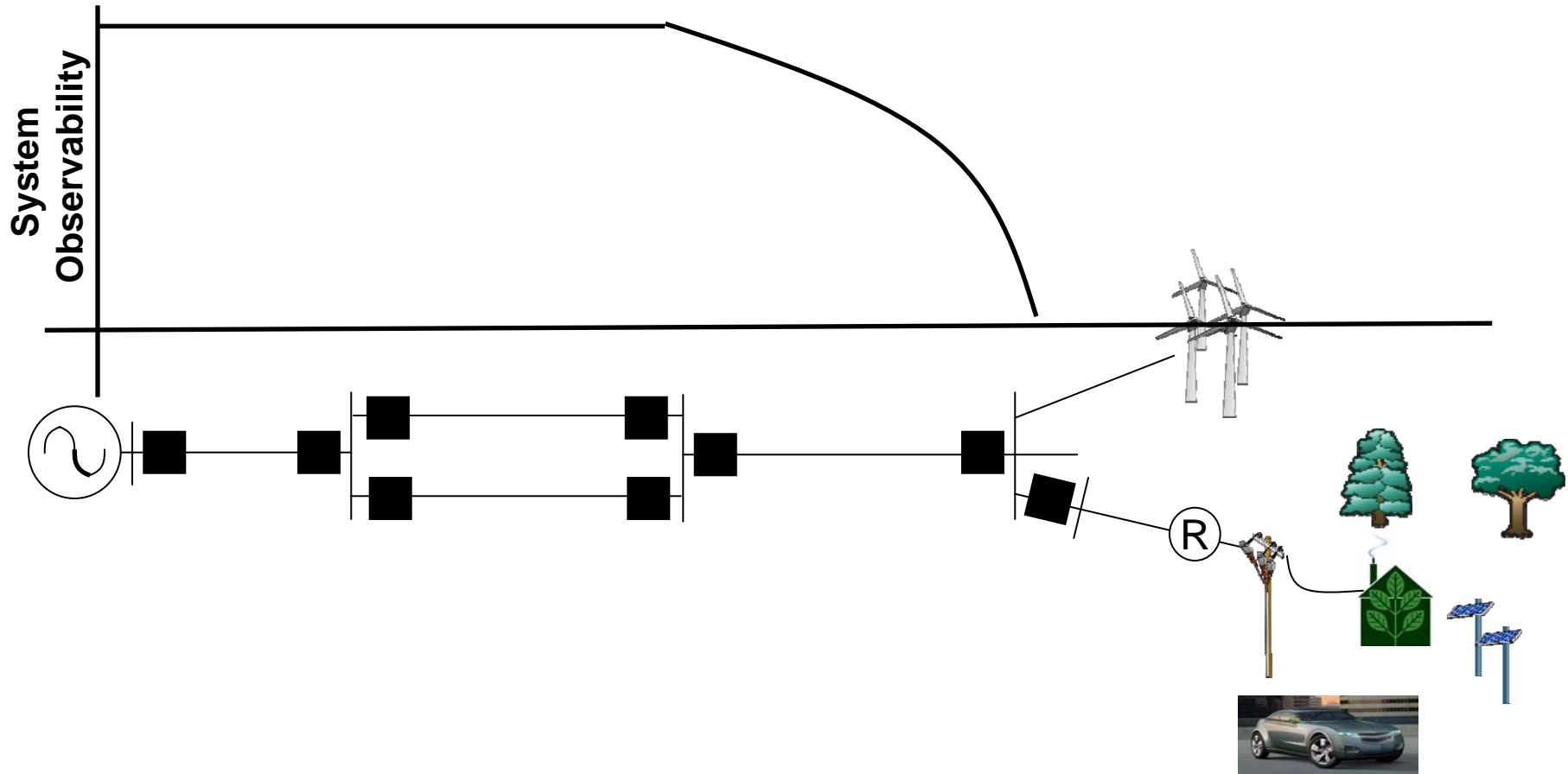
- Smart Grid
 - Includes aspects of transmission, distribution, generation, and in-home devices
 - Includes many technologies such as SCADA, AMI, Demand Response, Distributed Generation, Smart Sensors, Distributed Intelligence
 - AMI is a key part of the Smart Grid but not the only part
 - Large effort on leveraging AMI for the Smart Grid
- Partnering and Interoperability will be a must for the smart grid.
 - Partnering with utilities, standards groups, and key technology partners to realize components of the smart grid

Today's Grid



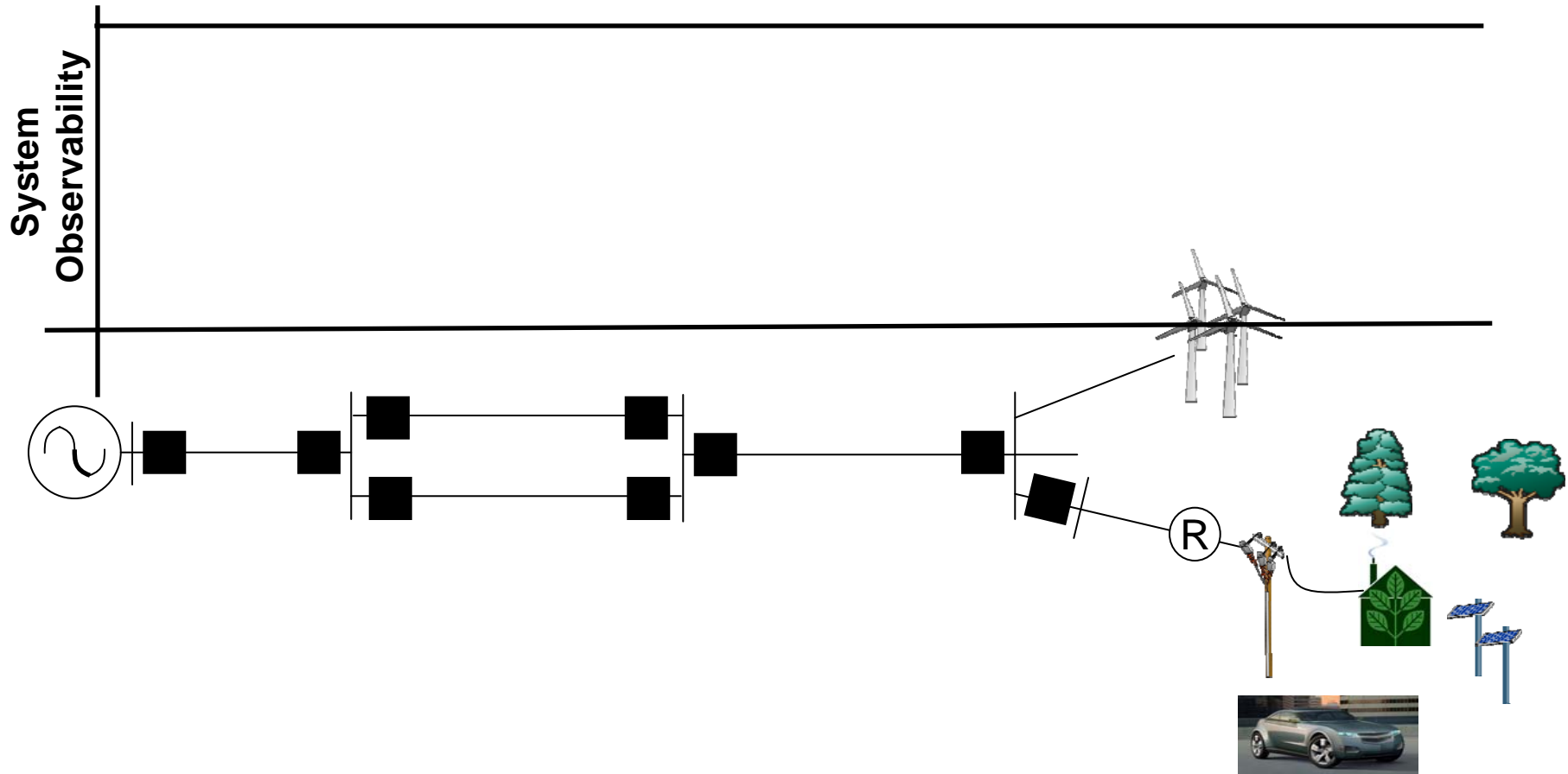
Generation and Transmission SCADA	Distribution SCADA	Feeder and Customer Premise
Battery backup for real-time control Second scan rates	Typically limited to substations Battery backup for real-time control Second scan rates	Limited information available

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Smart Grid – Opportunities Using AMI



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What is AMI?

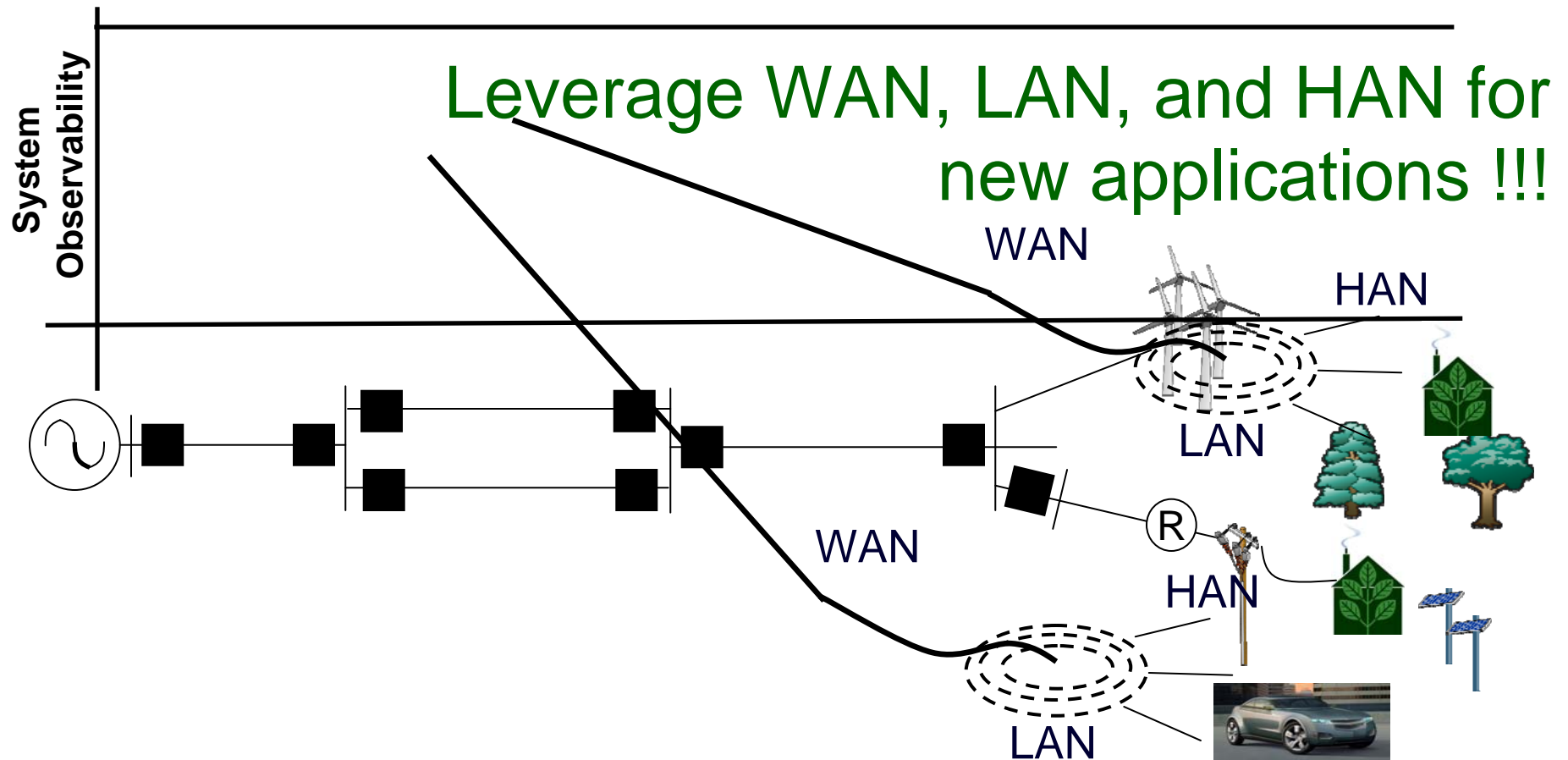


AMI – the Basics

- **Multi-Utility Requirements**
 - Electric (power always available)
 - Gas (battery powered communications)
 - Water (battery powered communications)
- **Multi-technology solution involving the WAN, LAN, and HAN solutions**
 - WAN involves public wireless, satellite, or utility infrastructure such as fiber, dedicated wireless, or other technology with varying bandwidths
 - LAN typically unlicensed 2.4 GHz or 902-928 MHz. Highest bandwidth is >100kHz.
 - HAN typically Zigbee 2.4 GHz or Homeplug line carrier technologies or interface to LAN
- **Smart Meters**
 - Driving force behind AMI
 - Meter total energy consumption, load profiling, etc in the meter so can be audited
 - Measurement Canada requires meter certification
 - Provides ability to flash upgrade smart meter functionality in the future
 - 2 way communications enables new functions at a residential level such as load profiling, service connect/disconnect, communications of usage/rates to the home

How does AMI drive the Smart Grid?

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Smart Grid Benefits Utilizing AMI



- **Outage/Restoration Detection & Fault Location**
 - Opportunity - Improve outage notification, restoration indication and fault location
- **Loss Detection**
 - Opportunity – Losses are difficult to detect on the distribution network
- **Volt/VAR monitoring and control**
 - Opportunity – Provide communications out to feeders
- **Load Flow / State Estimation**
 - Opportunity – Distribution load flows are typically based on substation data and distribute loads based on transformer rating
- **Power Quality Monitoring**
 - Opportunity – Provide power quality and voltage monitoring at key points in the distribution network
- **Switch Control**
 - Opportunity – Increase number of distribution network switches with communications on the distribution network

Smart Grid Deployments



- **Loss Detection**
 - Partner with technology providers and Canadian utilities to deploy a loss detection system
- **Volt/VAR monitoring and control**
 - Partner with US utility and have completed field trial for volt/var system
- **Load Reduction**
 - Partner with a US utility to deploy a load reduction system for peak situations
- **In-Home Displays**
 - Partner with technology providers for several deployments in the US and Canada
- **Others Underway**

Standards

Initial Candidate List Low Hanging Fruit Standards



- ANSI C12.19 / IEEE 1377 / MC1219
- IEEE C37.118
- IEC 61968/61970 (CIM)
- MultiSpeak
- IEEE 1547
- BACnet – ASHRAE/ANSI 135, ISO 16484-5
- IEC 61850
- IEC 60870-6 TASE.2
- DNP3
- IEC 62351
- NERC CIP 002-009
- NIST Security Standards – FIPS 140-1, NIST SP800-53, NIST SP800-82, etc.
- IEEE 802 family
- IETF Internet Standards – TCP/IP, VPNs, TLS, SNMP, etc.
- IEC PAS 62559
- UtilityAMI UtiliSec/AMI-SEC Specification
- UtilityAMI 2008 HAN Systems Requirements Specification
- HomePlug/ZigBee Alliance Smart Energy Profile

Standards

- **Standards will help improve the realization of the Smart Grid**
- **New area so some standards are difficult to understand**
 - **Few field deployments in place – need more**
 - **Interacts with many areas of the utility – Control/IT/Metering/Protection/Standards**
 - **Need flexibility for innovation**
- **Global standards are needed**
 - **Multinational issue**
- **Need to be robust**
 - **Electric Meters field life of 15-20 years**
 - **Water Meter Modules + battery field life of 15-20 years**
 - **Gas Meter Modules + battery field life of 15-20 years**

Summary

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- **Smart Grid is a fantastic opportunity to improve how the distribution grid performs and provide information to consumers**
- **AMI is part of Smart Grid and is a cost effective means to leverage multi-technology communication solutions on the distribution network and into the home**
- **There is a tremendous need for utilities and technology providers to continue Smart Grid deployments for new applications**
- **Standards are needed to help the industry move faster**

Thank You!

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