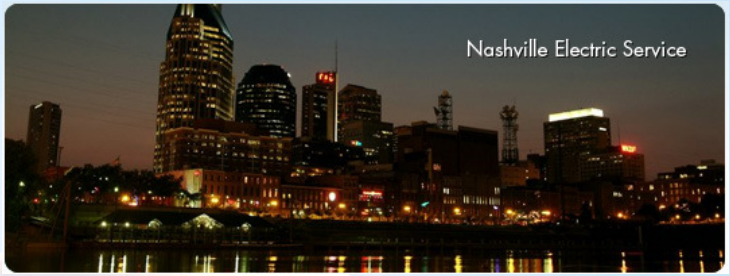
The Smart Grid for Today's Electric Utility and Tomorrow's Needs

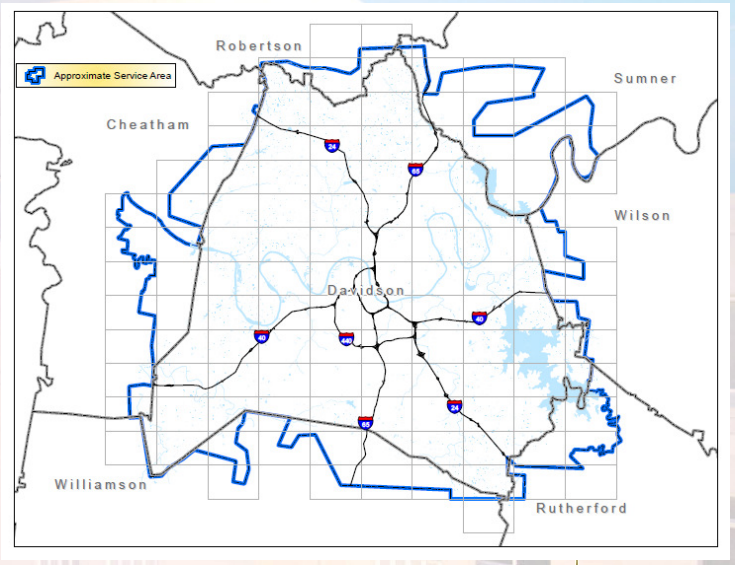
November 2, 2010

- **Presentation Agenda:**
  - **Introduction to Smart Grid components**
  - **Smart Grid industry status update**
  - **The Smart Grid at NES**
  - **Smart Grid project benefits**

NES is the 12th largest public power utility in the US



- Established in 1939
- 357,000 customers
- ~700 square miles of Davidson County and portions of 6 others
- 2,700 MW peak demand
- 52 substations and ~300 feeders
- Purchase power from TVA



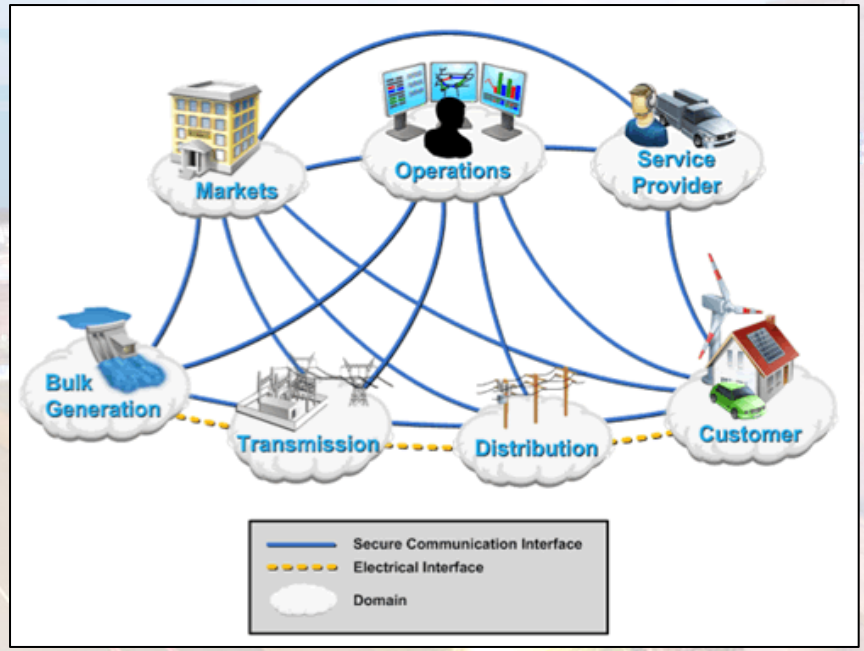
The Tennessee Valley is transitioning to time differentiated rates which has created significant interest in demand response

- Introduction to Smart Grid components and considerations for the distribution system

DOE characterizes the Smart Grid as having 7 major components.

The basic concept of Smart Grid is to add monitoring, analysis, control and communication capabilities to the national electric grid in order to improve reliability, maximize throughput, increase energy efficiency, provide consumer participation and allow diverse generation and storage options.

– NEMA



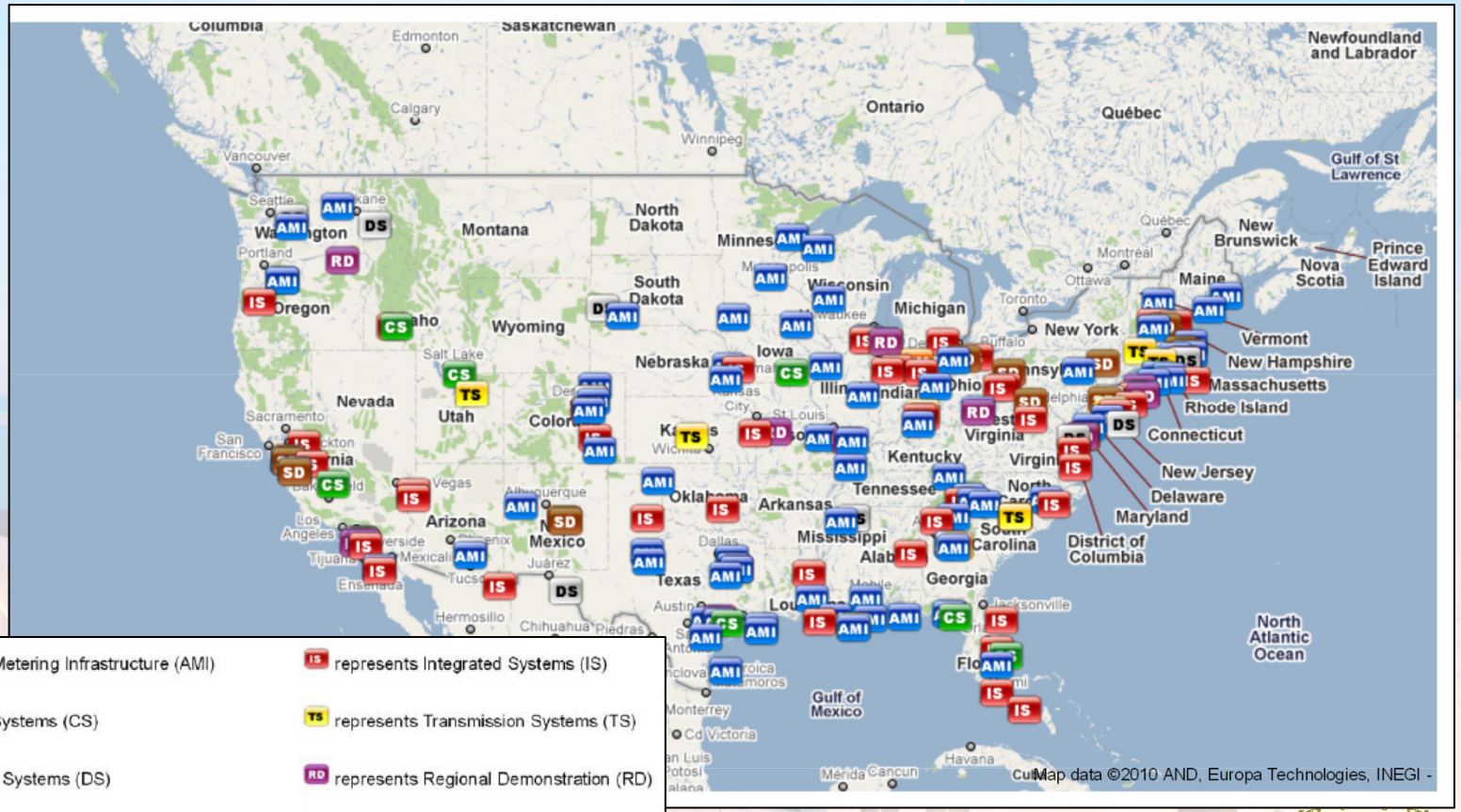
The Smart Grid is a platform for continuous value enhancement from generation to the customer's uses.

DOE defines the SG for its SGIG Program as including:

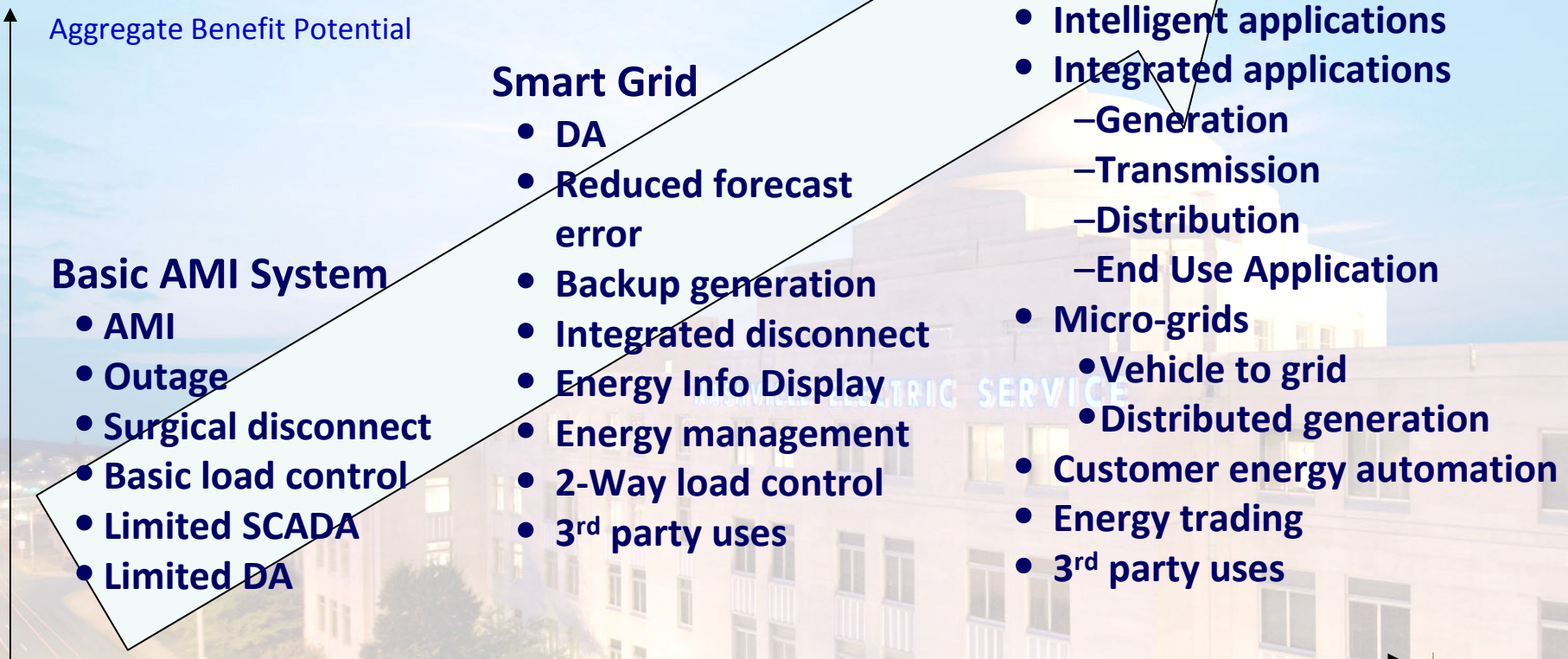
- AMI: interval meter reading, power outage, provisioning, customer links (HAN) etc.
- Demand Response: optimizing load using prices and or controls
- Distribution Automation: optimizing distribution system operation

- SG industry status update

Smart Grid is real and happening with $4 billion of projects underway in the US alone and more outside the US



Smart Grid implementation requires planning to enable future proofed investments.



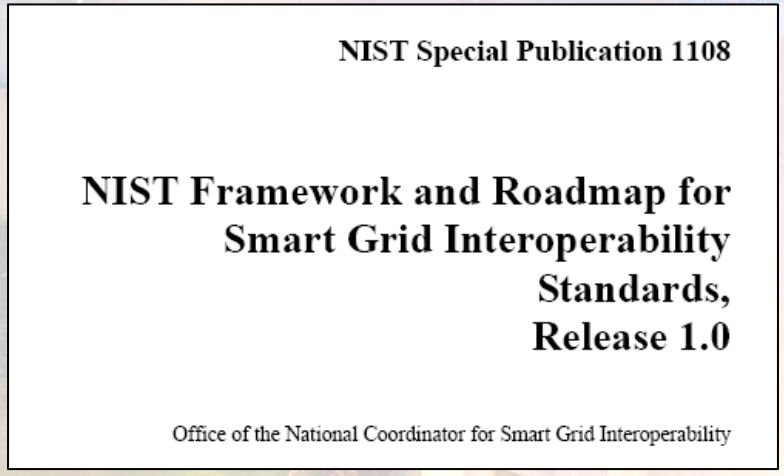
Basic AMI System
- AMI
- Outage
- Surgical disconnect
- Basic load control
- Limited SCADA
- Limited DA

Smart Grid
- DA
- Reduced forecast error
- Backup generation
- Integrated disconnect
- Energy Info Display
- Energy management
- 2-Way load control
- 3rd party uses

Advanced Smart Grid
- Intelligent applications
- Integrated applications
  - –Generation
  - –Transmission
  - –Distribution
  - –End Use Application
- Micro-grids
  - Vehicle to grid
  - Distributed generation
- Customer energy automation
- Energy trading
- 3rd party uses

DOE-NIST and the major industry suppliers are driving the adoption of standards (NIST SP 1108).

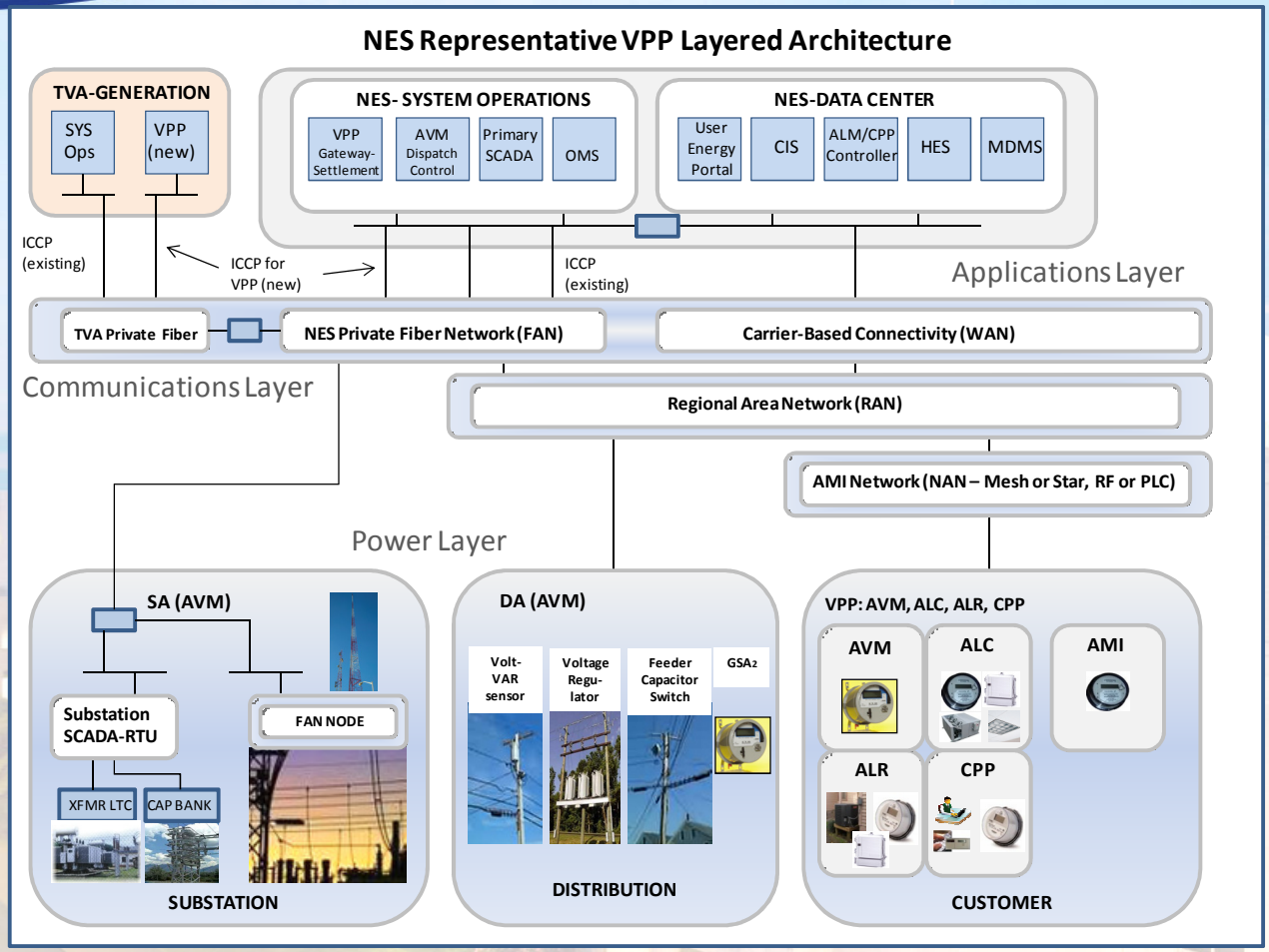
- **Proposed benefit: Interoperability and future proofing**
- **Major new examples:**
  - Communication - 802.15.4g, e; 6LowPAN, RoLL
  - NIST Cyber Security: AES 128, etc.
  - IT: CIM, DLMS
- Increased planning, due diligence, testing and implementation needs


NIST Special Publication 1108

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0

Office of the National Coordinator for Smart Grid Interoperability

NES's Smart Grid components reflect a broad view of applications and enabling technologies.



NES's Smart Grid will support AMI, DA and DR applications in order to address NES needs.

Distribution Automation | **AMI** | **DR**

Smart Substation
- Sensors
- Controllers
- Voltage Reg.
- Cameras

DG
- Solar
- Wind
- Etc.

Sectionalizer & Recloser

Line Sensors

Capacitor Bank Controller

Faulted Circuit Indicator

Smart Transformer

AMI Meter

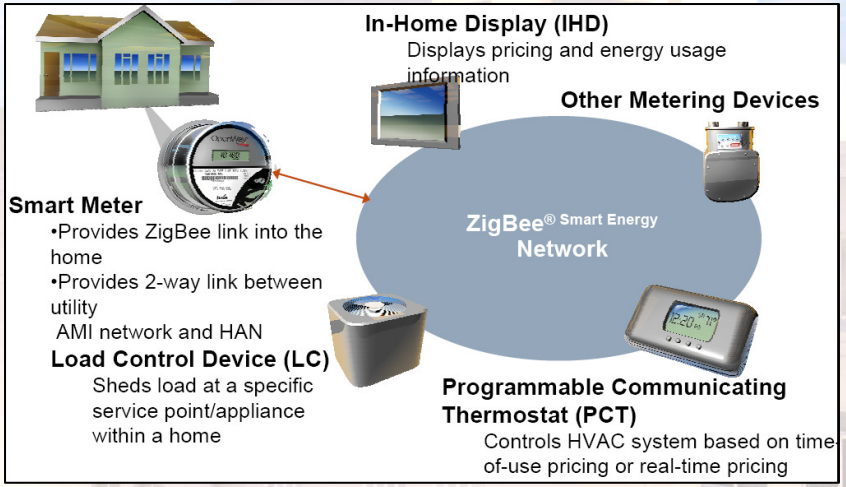
Direct Load Control

DR
- IHD
- PCT
- DLC
- REMS
- DG
- PHEV

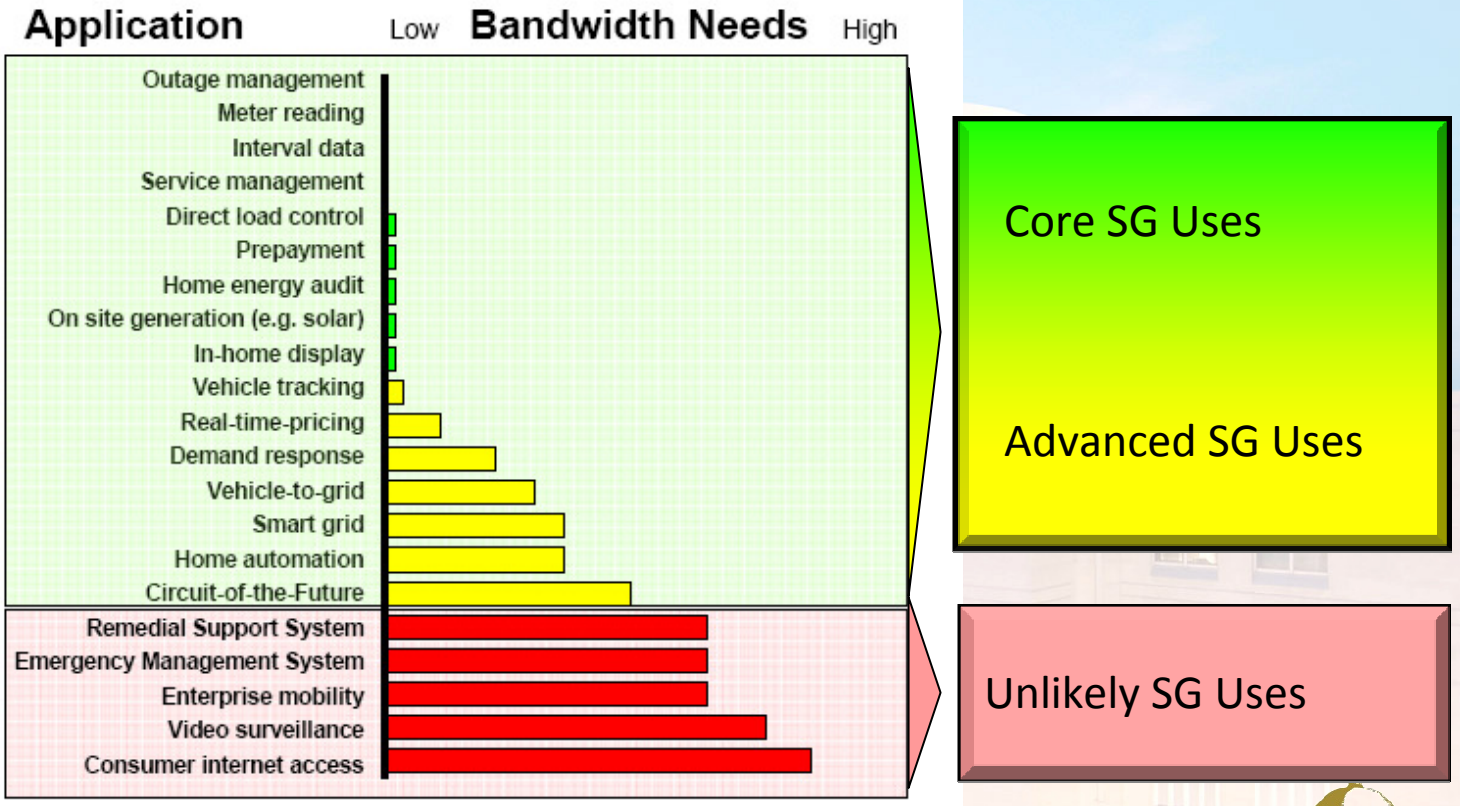
NES Virtual Power Plant Focus

The HAN was intended to help customers understand their energy use.

- Provide energy use data in to consumer devices
- Original vision: dedicated devices like PCT, IHD etc.
- Emerging vision: existing device like TV, cell phone, PC, laptop etc.
- Issues to be addressed
  - Cost
  - Technology risk
  - Customer adoption
  - "Standards"



A clear SG vision is crucial to implementing a "future proofed" system meeting long term needs.



Source: MW Consulting

Technical criteria selection creates the foundation for the Smart Grid solution that maximizes value.

Network Needs
- Data rate
- Latency
- Security
- Functionality
- Scalability

Industry Standards
- Interoperability
- Open

Endpoint Need
- Future Proofing
- Incremental Uses

Criteria to Consider

How are today's Smart Meters different than your dad's meter?

- **Functionality:**
  - 1,440 readings per month
  - 4 channels
  - Power outage reporting
  - Voltage reporting
  - Tamper
- **Reprogrammability**
- **Reconfigurability**
- **200A connect switch**

- Smart Grid at NES

NES' Smart Grid Guiding Principles will drive the implementation of a solution to meet long term needs

- Align with NES corporate vision and strategy.
- Use the NES fiber system for backhaul communications where feasible.
- Implement a system that can readily incorporate new requirements.
- Minimize disruption to operations when implementing AMI.
- Avoid commitments to limited lifetime and proprietary technology.
- Purchase off-the-shelf components, including software, where practical.
- Follow industry standards wherever possible.

NES' Smart Grid Vision Statement

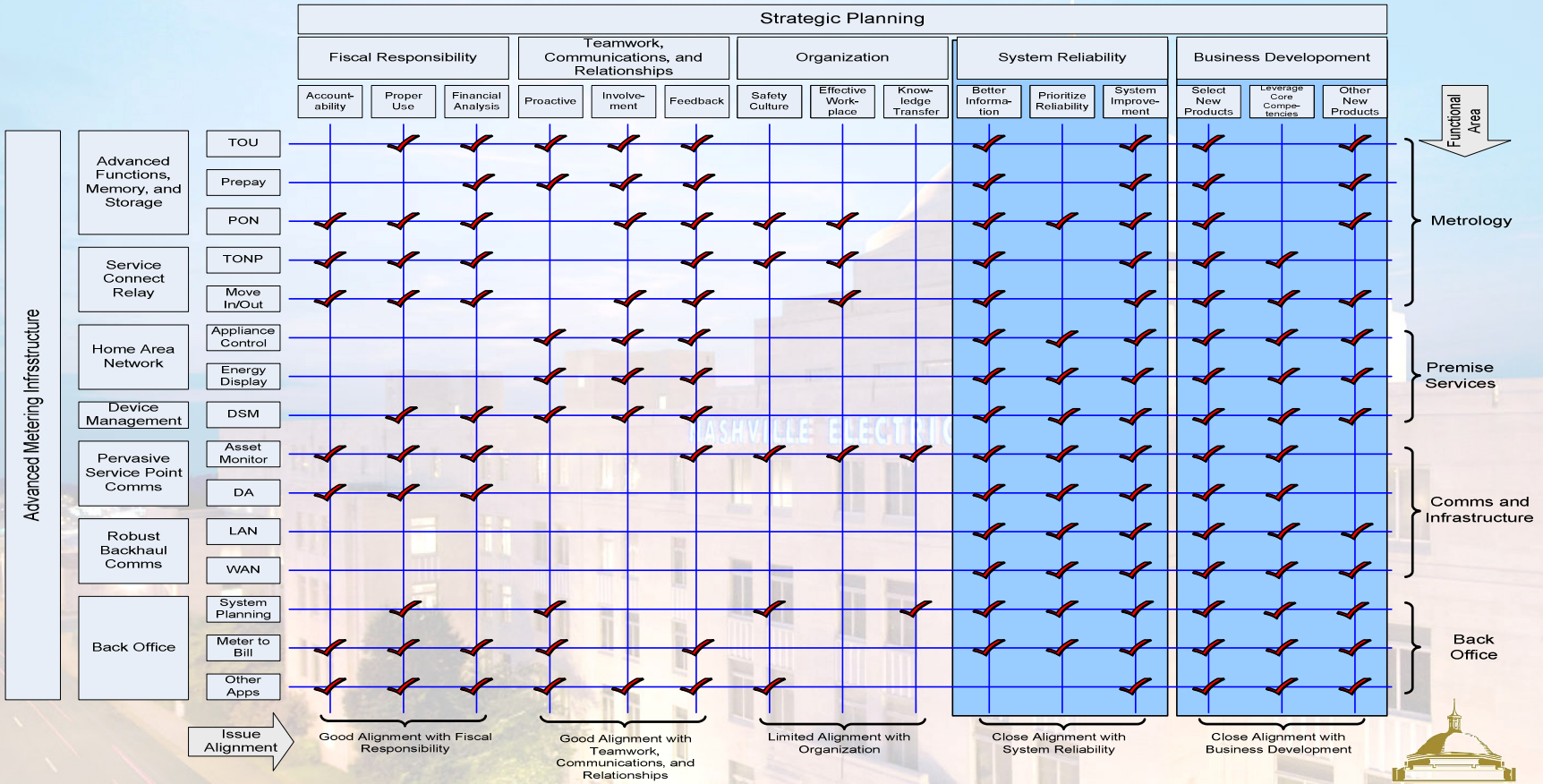
Smart Grid will significantly enhance NES' ability to accomplish its mission of providing safe, reliable and economical electric power for the comfort, convenience and security of its customers by:

- Empowering customers to make intelligent energy choices
- Enabling NES to offer new initiatives
- Supporting key societal conservation efforts and TVA demand response initiatives
- Facilitating effective management of key operating costs

Our project team has experienced internal and external resources to maximize project success factors.

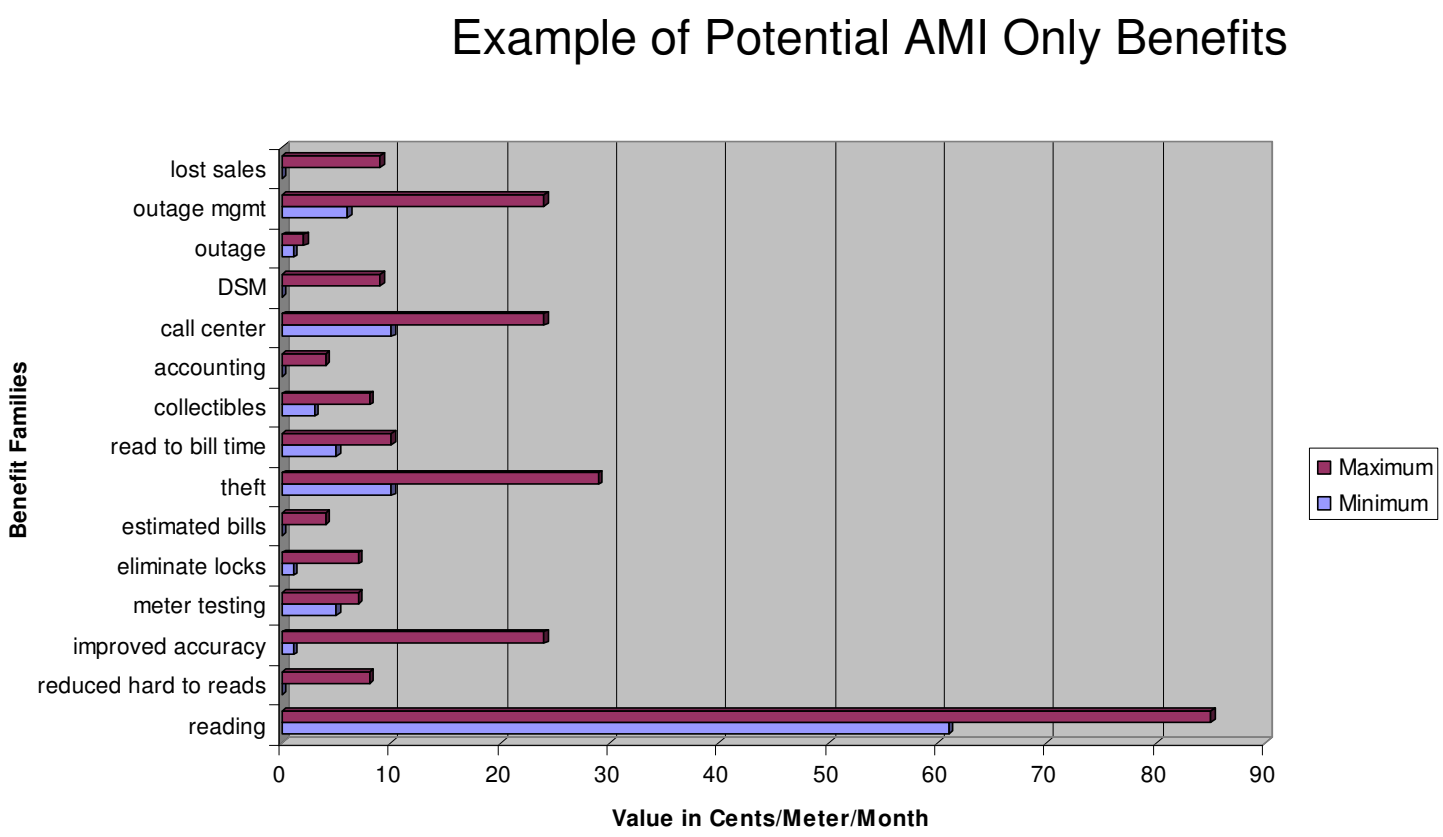
- **Smart Grid Core Team**
  - Tony Richman - Program Manager
  - Vic Hatridge - MDMS Project Team Lead
  - Ty Jones - Meter & Installation Team Lead
  - Sylvia Smith – Business and Financial Management Team Lead
  - Landon Roeder - AMI Network Team Lead
  - Bruce Mackie – Advanced Voltage Management Team Lead
  - Jim Purcell- Advanced Load Managmenent Team Lead
- **MW Consulting**
  - Strategy, communications, IT, security, implementation planning

NES' Smart Grid plan is based on a detailed strategic plan activity.



- Smart Grid benefits

NES has an AMI business case that is being enhanced to include DA and DR.



NES is also going to explore tomorrow's Smart Grid areas such as PHEV for benefits and impacts.

- Governor's Zero Emission Vehicle Partnership
- Partnering with TVA and EPRI on PHEV impact study
- Member of the eTec DOE-FOA-28 Partnership
- Participating in site determination of public charging infrastructure, EVSE data analysis, and R&D work which could include various battery technologies and piloting new rates

Questions?