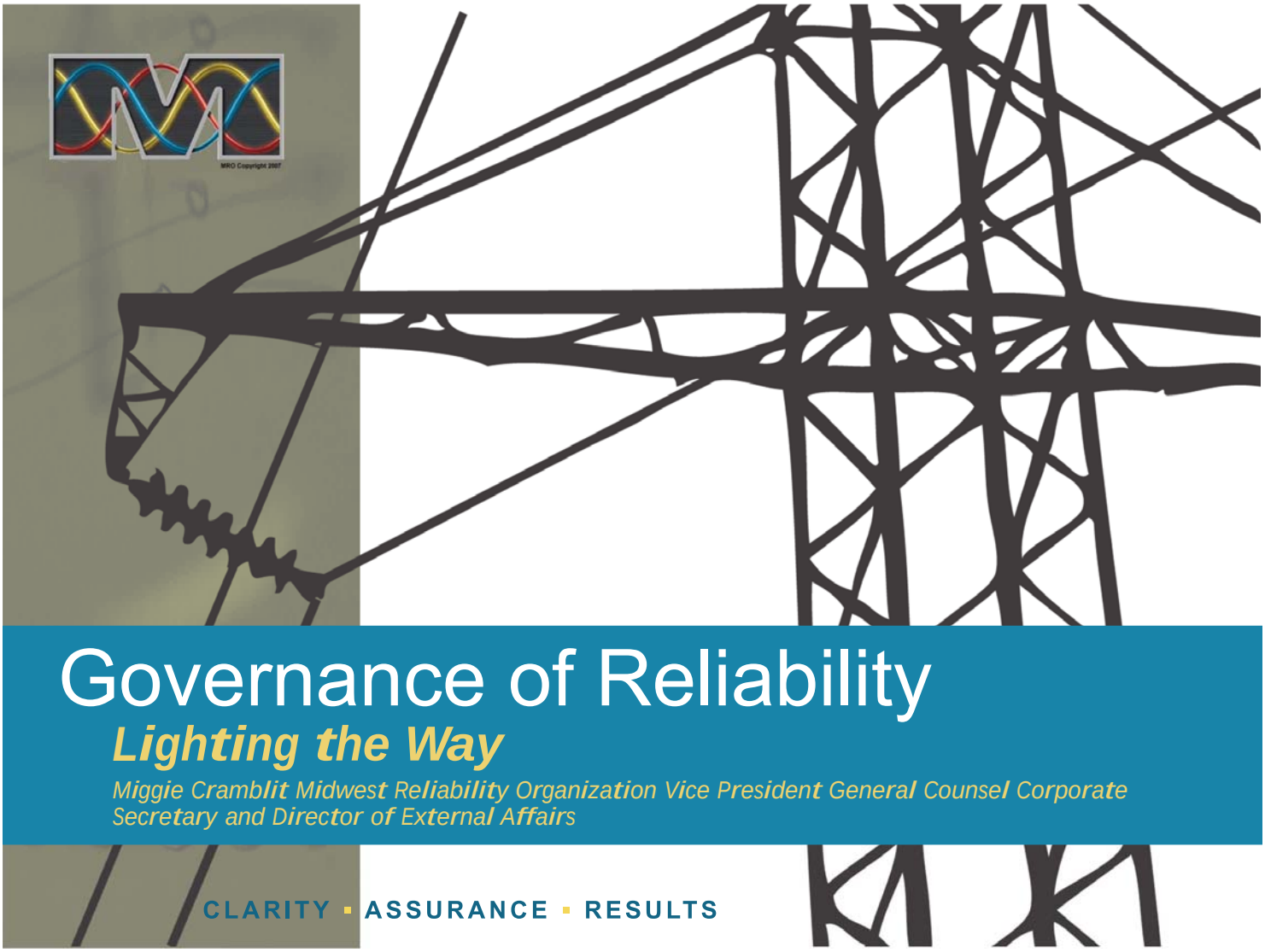


Governance of Reliability

Lighting the Way

Miggie Cramblit Midwest Reliability Organization Vice President General Counsel Corporate Secretary and Director of External Affairs

CLARITY ▪ ASSURANCE ▪ RESULTS

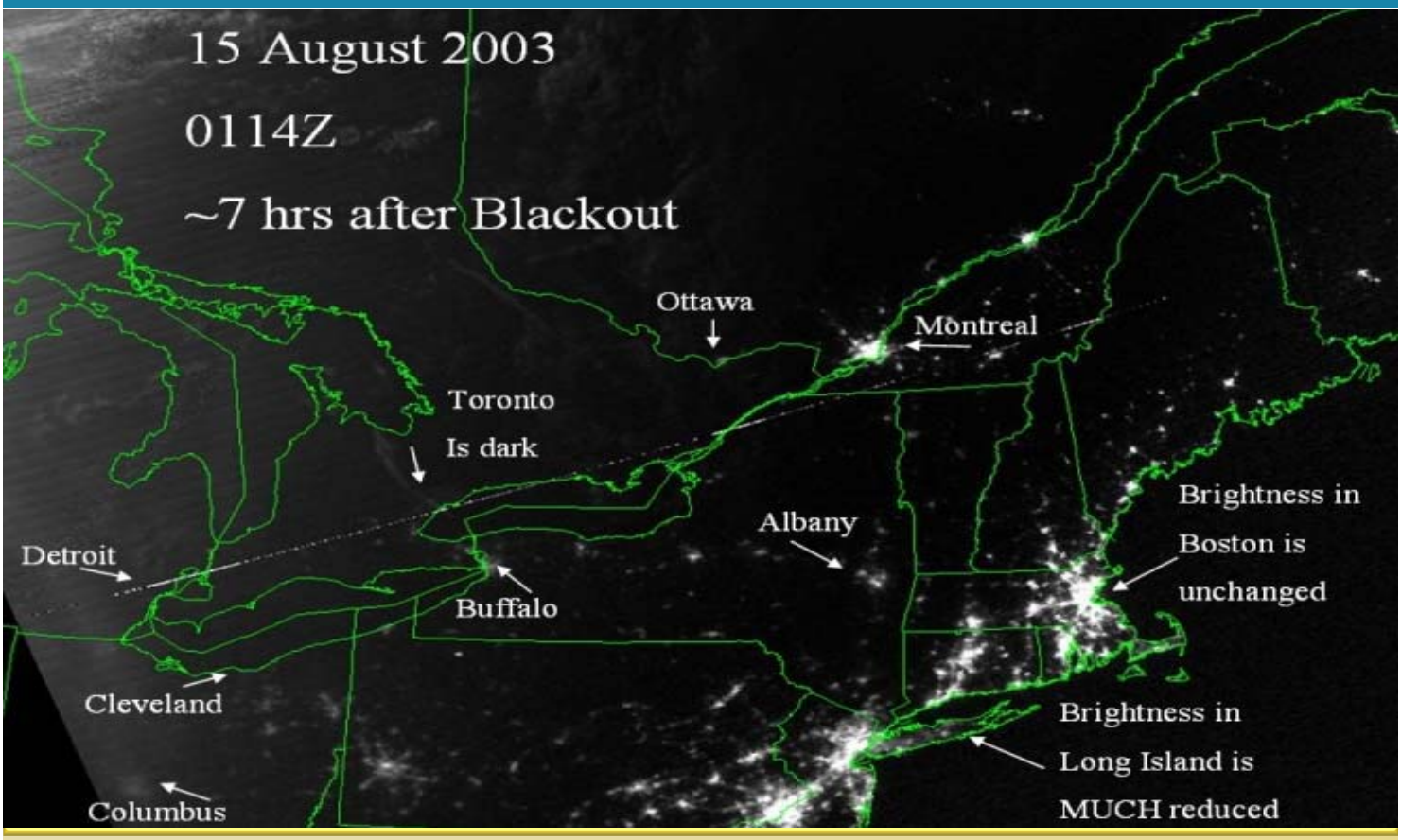
Discerning the Past Creating the Future

"What is past is prologue."

William Shakespeare

CLARITY ▪ ASSURANCE ▪ RESULTS

August 14, 2003 Blackout



“this blackout could have been prevented”

U.S.-Canada Power System Outage Task Force

Canada

March 31, 2004

Dear Mr. President and Prime Minister:

We are pleased to submit the Final Report of the U.S.-Canada Power System Outage Task Force. As directed by you, the Task Force has completed a thorough investigation of the causes of the August 14, 2003 blackout and has recommended actions to minimize the likelihood and scope of similar events in the future.

The report makes clear that this blackout could have been prevented and that immediate actions must be taken in both the United States and Canada to ensure that our electric system is more reliable. First and foremost, compliance with reliability rules must be made mandatory with substantial penalties for non-compliance.

We expect continued collaboration between our two countries to implement this report's recommendations. Failure to implement the recommendations would threaten the reliability of the electricity supply that is critical to the economic, energy and national security of our countries.

The work of the Task Force has been an outstanding example of close and effective cooperation between the U.S. and Canadian governments. Such work will continue as we strive to implement the Final Report's recommendations. We resolve to work in cooperation with Congress, Parliament, states, provinces and stakeholders to ensure that North America's electric grid is robust and reliable.

We would like to specifically thank the members of the Task Force and its Working Groups for their efforts and support as we investigated the blackout and moved toward completion of the Final Report. All involved have made valuable contributions. We submit this report with optimism that its recommendations will result in better electric service for the people of both our nations.

Sincerely,

U.S. Secretary of Energy

Minister of Natural Resources Canada

Mandatory Reliability Standards

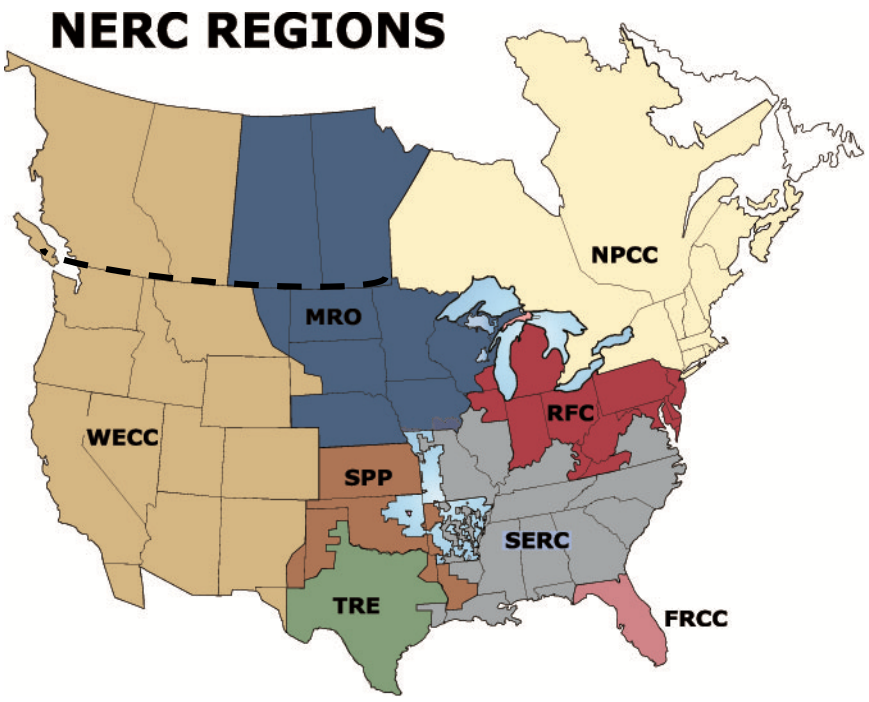
U.S.-Canada Power System Outage Task Force

“First and foremost, compliance with reliability rules must be made mandatory with substantial penalties for non-compliance.”

Response to Blackout

- North American Electric Reliability Corporation (NERC) designated as the Electric Reliability Organization subject to oversight by FERC and Canadian governmental authorities (2006)
- Mandatory reliability standards for owners, users and operators of the bulk power system (BPS); penalties of up to $1M/Day (2007)

NERC Delegates Authority to Eight Regional Entities



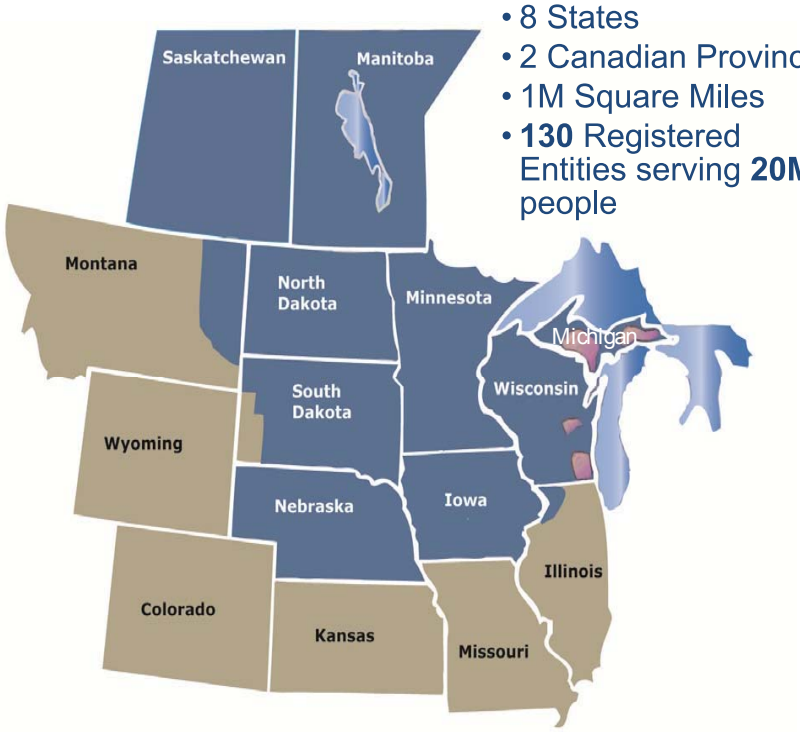
- Western Electricity Coordinating Council (**WECC**)
- Midwest Reliability Organization (**MRO**)
- Southwest Power Pool (**SPP**)
- Texas Regional Entity (**TRE**)
- Northeast Power Coordinating Council (**NPCC**)
- Reliability*First* Corporation (**RFC**)
- Southeast Reliability Corporation (**SERC**)
- Florida Reliability Coordinating Council (**FRCC**)

Midwest Reliability Organization

- **Midwest Reliability Organization (MRO) is one of eight Regional Entities with a delegation agreement to enforce mandatory reliability standards and one of three cross border regions.**
- **MRO has a Memorandum of Understanding with SaskPower recognizing MRO's role with regard to the bulk power system in MRO's Region.**

The MRO Region

- 3 Reliability Coordinators and 6 Planning Authorities
- 450 Registered Functions
- Total net energy for load is 275M MW hours (MWh)
- Long distances from generation to load creates unique stability and technical issues in the MRO region
- Mix of organized and bi-lateral markets
- Large public power – many shared facilities
- History of cooperation on reliability matters



MRO Region

- 8 States
- 2 Canadian Provinces
- 1M Square Miles
- **130** Registered Entities serving **20M** people

What does MRO do? START WITH THE "WHY"

ZERO uncontrolled cascading events within the design criteria of an interconnected system

A Reliable and Secure Bulk Power System

MRO VISION


Maintain and improve the quality of life through a highly reliable regional bulk power system.

MRO PURPOSE

Strive to assure each bulk power system owner and operator within our region is a highly effective reliable organization.

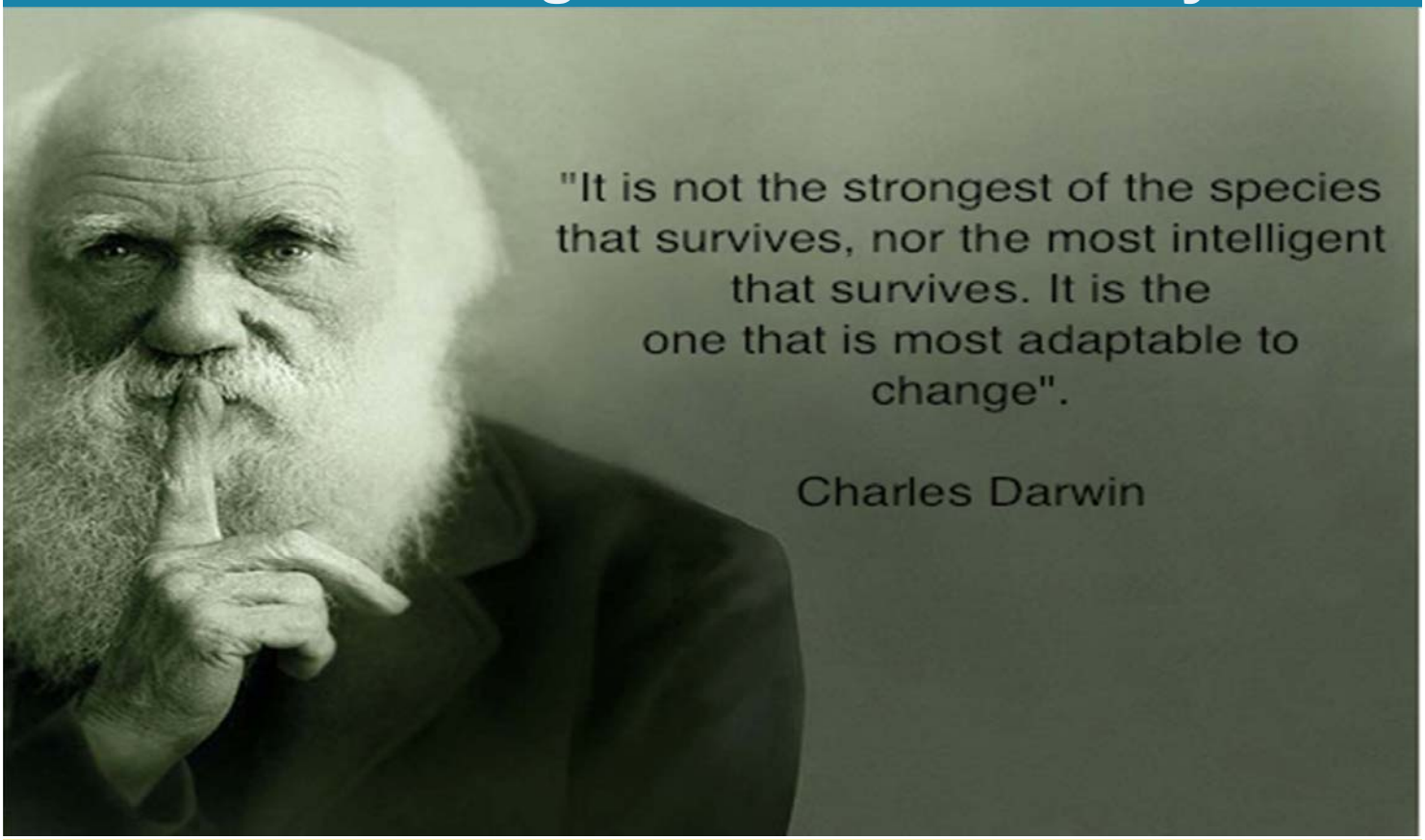
HEROs

Keeping the Small Stuff Small

Five characteristics of highly reliable organizations:

1. **Preoccupation with failure**
   - Attention on close calls and near misses ("being lucky vs. being good"); focus more on failures rather than successes
2. **Reluctance to simplify interpretations**
   - Solid "root cause" analysis practices
3. **Sensitivity to operations**
   - Situational awareness and carefully designed change management processes
4. **Commitment to resilience**
   - Resources are continually devoted to corrective action plans and training
5. **Deference to expertise**
   - Listen to your experts on the front lines (ex. authorities follows expertise)

Creating the Future Highly Reliable Regional Bulk Power System



Reliability Assurance Initiative
Underlying Premise

- **It is not practical, effective or sustainable to continue to monitor and administer all compliance-related matters to the same degree, regardless of risk….**

Reliability Assurance Initiative
Taking Risk Into Account

- **Scoping our work based on the particular risk an Entity posed to the Bulk Power System**
- **Differentiating our response to violations of Reliability Standards**
  - **Possible Violations** – Failure to demonstrate compliance with Reliability Standards for a significant matter
  - **Compliance Exceptions** – Failure to demonstrate compliance with Reliability Standards for a matter that is not significant and the matter has been or will be addressed in a reasonable timeframe

Reliability Assurance Initiative

Summary of MRO's Approach

MRO is providing **Clarity** by:

- Re-engineering its compliance and enforcement approach grounded in strong stakeholder engagement and professional practices around risks

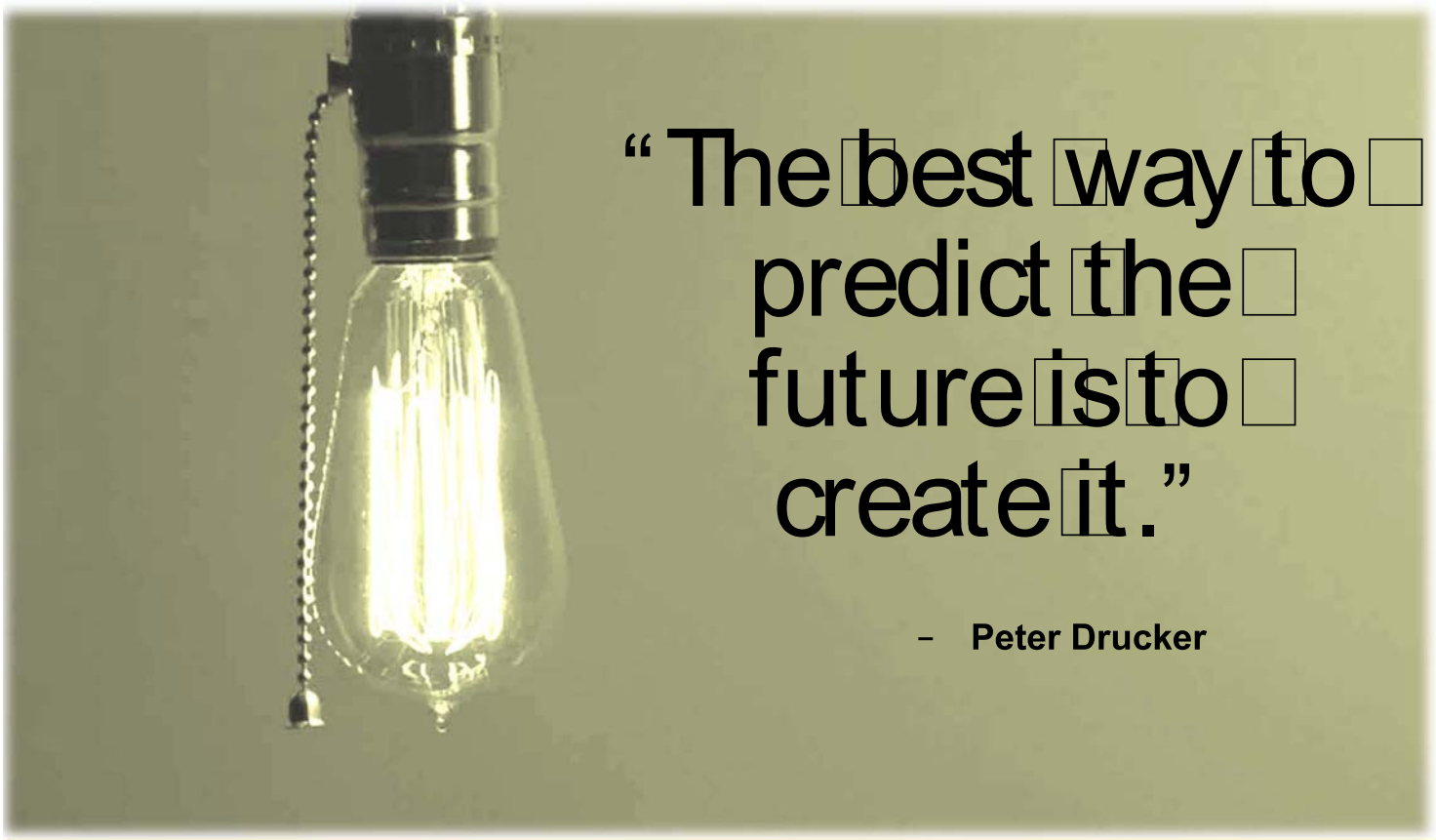
Improving **Assurance** by:

- Considering Registered Entities' risk and their management practices around risk in the scope and conduct of our work
- Recognizing Registered Entities who design and implement strong corrective action programs because they can be objectively relied upon for higher performance
- Reserving enforcement proceedings for significant matters by creating a new, transparent path outside of enforcement for matters that do not pose significant risk
- Using the existing CMEP tool set more effectively and efficiently to focus on risk and reduce administrative compliance costs for all Registered Entities (big and small)

Driving **Results** with:

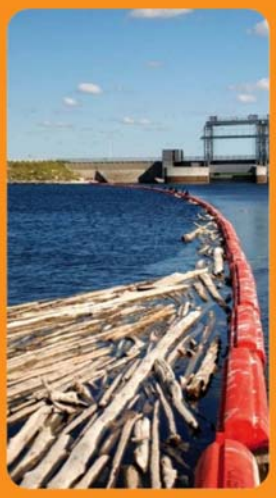
- Less risk. Fewer, less severe events
- Solid cultures. Self-identified matters increase beyond 70% of all matters
- Less administrivia. Number of regulatory filing reduced by 50% in 2015
- Great taste/ Less filling. Registered Entities experience a double digit decrease in administrative compliance costs and see more value in the CMEP

Just Do It.


"The best way to predict the future is to create it."
– Peter Drucker

Questions?

SaskPower Reliability Leadership



December 11, 2013

Rachelle Verret Morphy, VP Law, Land, and Regulatory Affairs

SaskPower
Powering the future

SaskPower's story

Formed through *The Power Commission Act* in 1929, SaskPower is a provincial Crown corporation.

Vision

A world-leading power company through innovation, performance and service

Mission

Reliable, affordable, sustainable power

Values

- Safety
- Dedication
- Respect

SaskPower
Powering the future

Our focus

People

1) Customer experience
2) Workplace excellence
3) Stakeholder relations

Financial

1) Process efficiency and cost management

Stewardship

1) Supply mix diversification
2) Infrastructure management, renewal & growth
3) Environmental stewardship
4) Technology enablement

SaskPower
Powering the future

Corporate profile

People

- Over 490,000 customers
- Over 2,800 permanent full-time employees

Financial

- Over $6 billion in generation and transmission assets

Stewardship

- 4,094 MW of total generation capacity
  - 3,513 MW – SaskPower
  - 581 MW – Independent Power Producers
- 3,448 MW is record system peak load – set December 5, 2013

SaskPower
Powering the future

SaskPower system map

As of December 31, 2012

AVAILABLE GENERATION (net capacity)

HYDROELECTRIC

1. Athabasca Hydroelectric System - 23 MW
   - Wellington (5 MW)
   - Waterloo (8 MW)
   - Charlot River (10 MW)
2. Island Falls Hydroelectric Station - 101 MW
4. Nipawin Hydroelectric Station - 255 MW
5. E.B. Campbell Hydroelectric Station - 288 MW
13. Coteau Creek Hydroelectric Station - 186 MW

NATURAL GAS

3. Meadow Lake Power Station - 44 MW
7. Yellowhead Power Station - 138 MW
9. Ermine Power Station - 92 MW
10. Landis Power Station - 79 MW
12. Queen Elizabeth Power Station - 430 MW
15. Success Power Station - 30 MW

WIND

16. Cypress Wind Power Facility - 11 MW
18. Centennial Wind Power Facility - 150 MW

COAL

20. Poplar River Power Station - 582 MW
21. Boundary Dam Power Station - 828 MW
23. Shand Power Station - 276 MW

INDEPENDENT POWER PRODUCERS

6. Meridian Cogeneration Station - 210 MW
8. NRGreen Kerrobert Heat Recovery Facility - 5 MW
11. Cory Cogeneration Station - 228 MW
14. NRGreen Loreburn Heat Recovery Facility - 5 MW
17. SunBridge Wind Power Facility - 11 MW
19. NRGreen Estlin Heat Recovery Facility - 5 MW
22. NRGreen Alameda Heat Recovery Facility - 5 MW
24. Red Lily Wind Power Facility - 26 MW
25. Spy Hill Generating Station - 86 MW
26. Prince Albert Pulp Inc. - 10 MW
27. North Battleford Energy Centre - 261 MW
(under construction as at December 31, 2012)

TRANSMISSION

- 230 kV
- 138 kV/115kV/110kV
- Switching station
- Interconnection

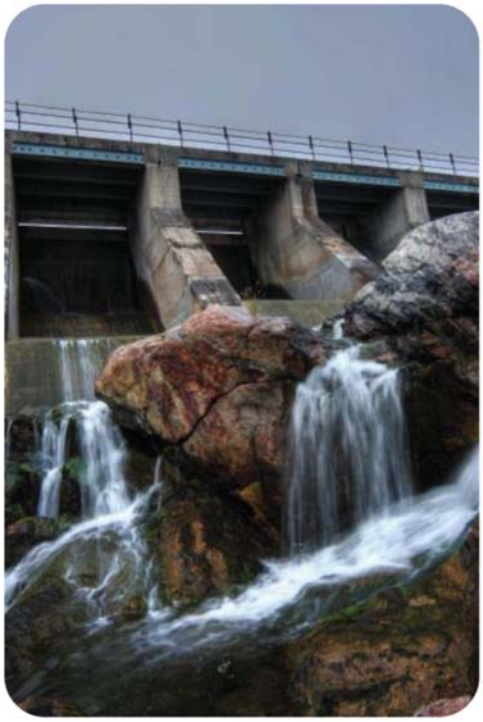
SaskPower
Powering the future

Generating electricity

SaskPower operates:

- Three coal-fired power stations
- Seven hydroelectric stations
- Six natural gas stations
- Two wind facilities

We also purchase wind, cogeneration, natural gas and heat recovery power from Independent Power Producers.



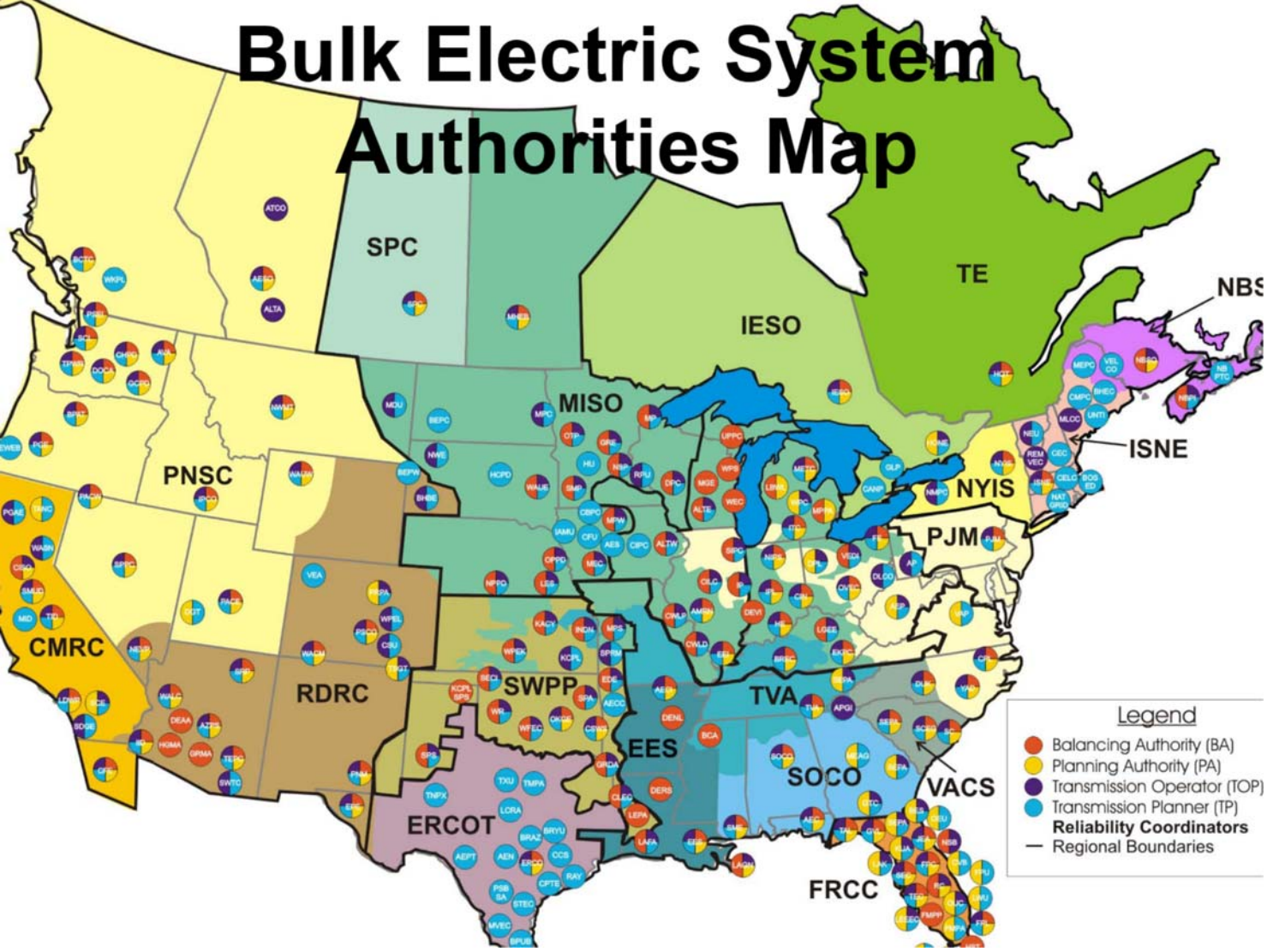
SaskPower
Powering the future

SaskPower's network

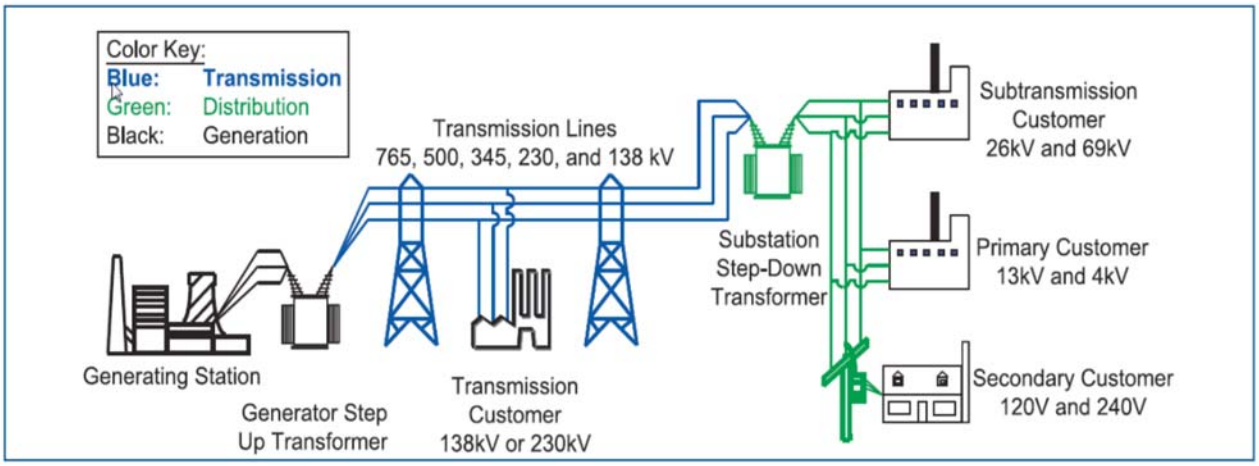
- Large geographic area with widely-dispersed population
- About three customers served per circuit kilometer
- Nearly 152,000 km of power lines
- 51 high voltage switching stations
- 185 distribution substations
- Interconnections at Manitoba, Alberta and North Dakota borders

SaskPower
Powering the future

Bulk Electric System Authorities Map



A Reliability Managed System Integrates the Entire Power System



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The 2003 Blackout

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Powering the future

The Blackout

- Over 50 million customers affected
- $10 Billion impact on economy
- Resulted U.S. 2005 Energy Policy Act giving the Federal Energy Regulatory Commission authority to oversee mandatory enforceable standards for the entire United States
- Resulted in the creation of the North American Reliability Corporation (NERC), an international standard setting body
- The bilateral working group on energy (US and Canada) established principles for implementing a reliability managed system
- SaskPower established a project to embrace industry recognized reliability standards

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Powering the future

SaskPower's Leadership Challenge

- To move from "good engineering practice" to industry recognized power system standards
- To choose a standard setting body, and to establish "membership" in the reliability community
- To establish or assign a reliability coordinator
- To create the formal relationship between NERC, MRO and SaskPower
- To be audited as a control area, as a reliability coordinator, and as to the entire corporation meeting reliability standards
- To establish a managed system and a proxy for a regulatory authority

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Authority to Establish Standards

- Authority to establish standards for third parties exists under *The Power Corporation Act* (Saskatchewan)

  8.2 (2) To ensure the reliability and security of the corporation's lines, apparatus, equipment or other facilities and supply of electrical energy, the corporation may:

  - (a) establish design, operation or reliability standards for facilities owned or operated by a person that are interconnected with;
    - (i) the transmission and distribution lines, apparatus, equipment or other facilities of the corporation;
    - (ii) the generation apparatus, equipment or other facilities of the corporation; or
    - (iii) any other apparatus, equipment or other facilities of the corporation; and
  - (b) require compliance with the standards established pursuant to clause (a).

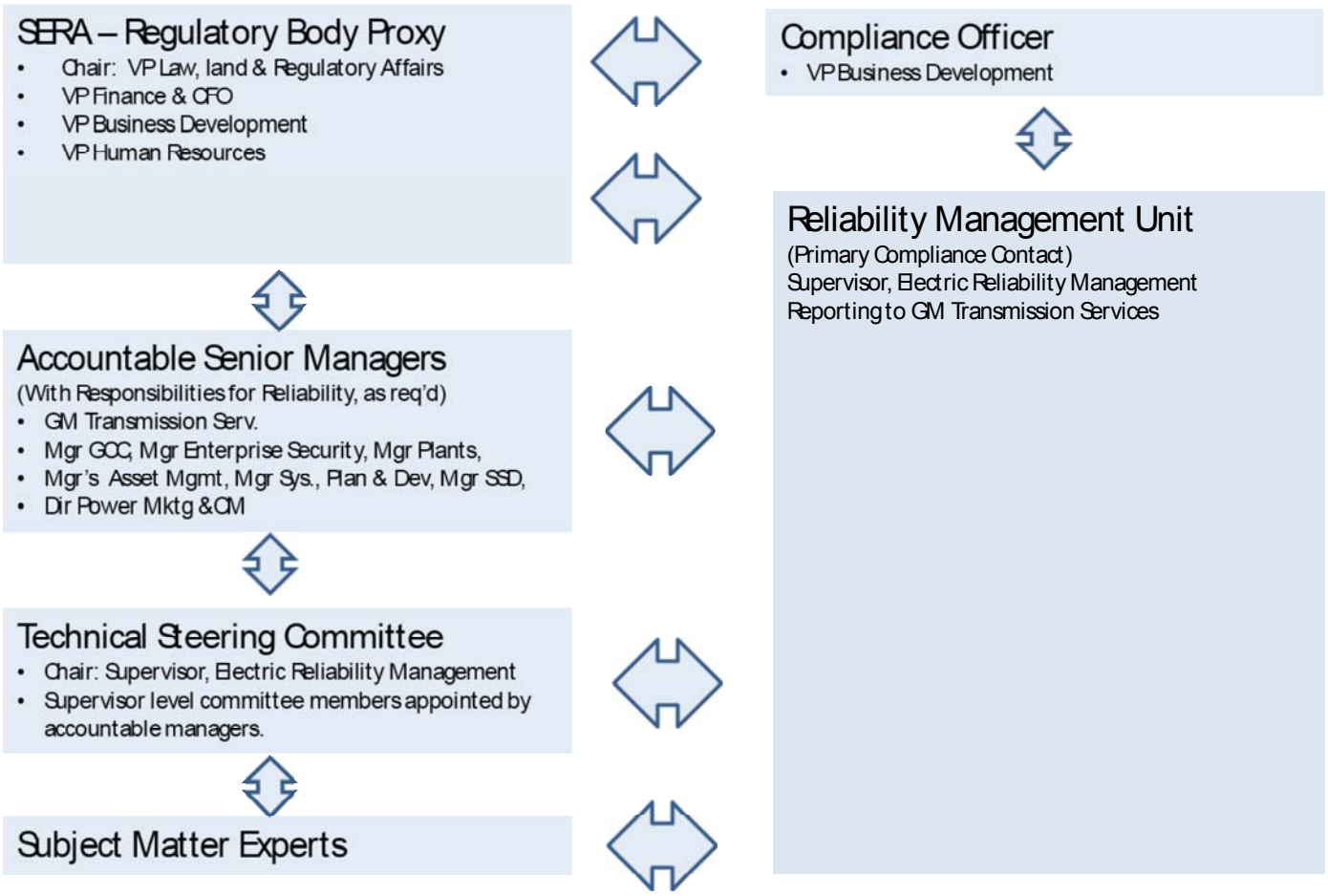
SaskPower
Powering the future

Saskatchewan Electric Reliability Authority

- In March 2010, SaskPower established the Saskatchewan Electric Reliability Authority (SERA) with a mandate:
  - to implement bulk electric system reliability standards in Saskatchewan;
  - to monitor and enforce compliance; and
  - to report to the SaskPower Board of Directors on reliability management.
- SERA is not a standalone entity, but rather a function within SaskPower.

SaskPower
Powering the future

SaskPower Reliability Compliance Structure



NERC Compliance History

- Identified as a major business issue in 2001 when wholesale open access was implemented.
- Detailed engineering assessment of adequacy completed following August 14th 2003 blackout.
- Formal Board decision to adopt NERC standards, join a regional reliability council, and designate a reliability coordinator spring of 2004.
- Accepted to MRO June 2004.
- Control Area audit October 2004, resulting in certification.
- Independent Reliability Coordinator Readiness Audit, November 2004.
- Pre-NERC Readiness Audit for Reliability Coordinator-2006 .
- SaskPower declaration of Reliability Coordinator for Saskatchewan 2006.
- NERC R/C Formal Approval December 2007.
- Compliance and Process Mapping Approved by MRO NERC BOD, pending SaskPower approval 2008.
- Full NERC Compliance Audit completed in 2008.
- SERA mandate approved in 2010, with full managed system in place by 2013.

SaskPower
Powering the future

Questions?

Powering the future of Saskatchewan

SaskPower
Powering the future

National Electrical Manufacturers Association (NEMA)

North American Smart Grid Update

Steve Griffith, NEMA Smart Grid Industry Director

Generation West Conference

December 11th, 2013

Agenda

- Introduction to NEMA
- Origins of Smart Grid in the U.S
- Activities
  - Federal Agencies
  - SGIP –Smart Grid Interoperability Panel
  - NEMA

NEMA Mission Statement

As the voice for the electrical equipment and medical imaging manufacturers, NEMA is a pacesetting champion for safety, innovation, interoperability, environment, and market enhancement through advocacy, business information, and standards for products, systems, and technologies.

NEMA Business Operations

Industrial Automation Division

1CM	Carbon/Manufactured Graphite
1EW	Arc Welding
1IS	Industrial Automation Control
1MG	Motor and Generator
1PE	Power Electronics

Lighting Systems Division

2BL	Ballast
2EM	Emergency Lighting
2LC	Lighting Controls
2LE	Luminaire
2LL	Lamp
2SL	Solid State Lighting

Electronics Division

3DB	Dry Battery
3DC	Residential & Commercial Controls
3DCRH	Electric Resistance Heating
3SB	Signaling Protection & Communication
3SB-2	Health Care Communications
3TS	Transportation Mgt. Systems

Industrial Imaging Division

4IIC	Industrial Imaging and Communications

Building Systems Division

5CT	Cable Tray
5EN	Enclosures
5EVSE	Electric Vehicle Supply Equipment
5FB	Conduit Fittings
5FB-2	Cable Ties
5FU	Fuse
5HC	Health Care Facility Equipment
5LVDE	Low Voltage Distribution Equipment
5OS	Outlet and Switch Box
5PP	Ground Fault Personnel Protection
5PR	Pin & Sleeve Plug
5RN	Steel Conduit
5TC	Polymer Raceway Products
5VS	Low Voltage Surge Protective Devices
5WD	Wiring Device

NEMA Business Operations

Insulating Materials Division

6IM	Insulating Materials
6MW	Magnet Wire

Wire and Cable Division

7HW	High Performance Wire and Cable
7MO	Modular Wire
7WC-1	Building Wire
7WC-2	Power & Control Cable
7WC-4	Flexible Cords

Power Equipment Division

8CC	Electrical Connector
8CP	Capacitor
8EI-1	Electricity Metering Group
8EI-3	Meter Mounting/Test Equipment
8HV	High Voltage Insulator
8LA	High Voltage Surge Arrester
8SG	Switchgear
8TD	Transmission & Distribution Automation
8TP-1	Dry Type/Specialty Transformers
8TP-2	Transformer

Medical Imaging and Technology Alliance

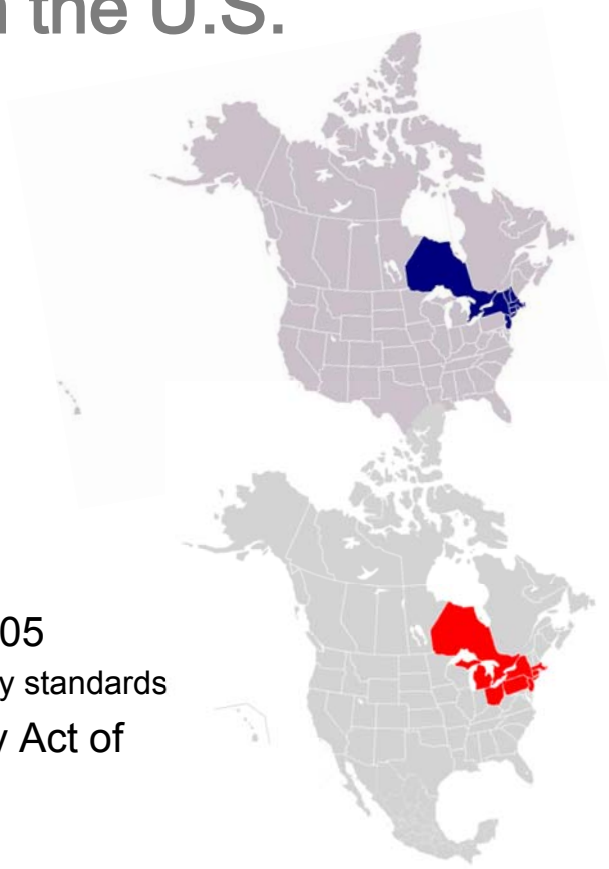
9MII	Medical Imaging Informatics
9MS	Magnetic Resonance
9MO	Molecular Imaging
9RT	Radiation Therapy
9UD	Ultrasound Imaging
9XR	X-Ray Imaging Products

Strategic Initiatives

Tax Reform Working Group
Code Adoption
Energy Storage Council
High Performance Buildings Council
Industrial Energy Efficiency Coalition
Smart Grid Council
Cybersecurity Council

Origins of Smart Grid in the U.S.

- The Blackout of 1965
  - 25 million people affected
  - 80,000 square miles
- The Blackout of 2003
  - 55 million people affected
  - 110,000 square miles
  - The Blackout of 2003
- Congressional Action
  - Environmental Protection Act of 2005
    - FERC charged with mandating reliability standards
  - Energy Independence and Security Act of 2007 (EISA)



Energy Independence & Security Act (EISA)

SEC.1301. “It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid:”

1. Increase Use of Digital Controls
2. Dynamic Optimization
3. Integrate Distributed Resources
4. Demand Response
5. Smart Metering
6. Smart Appliances
7. Storage and Peak Shaving
8. Customer Control
9. Communications Standards
10. Reduce Market Barriers

10 National Objectives for Smart Grid

Energy Independence & Security Act (EISA)

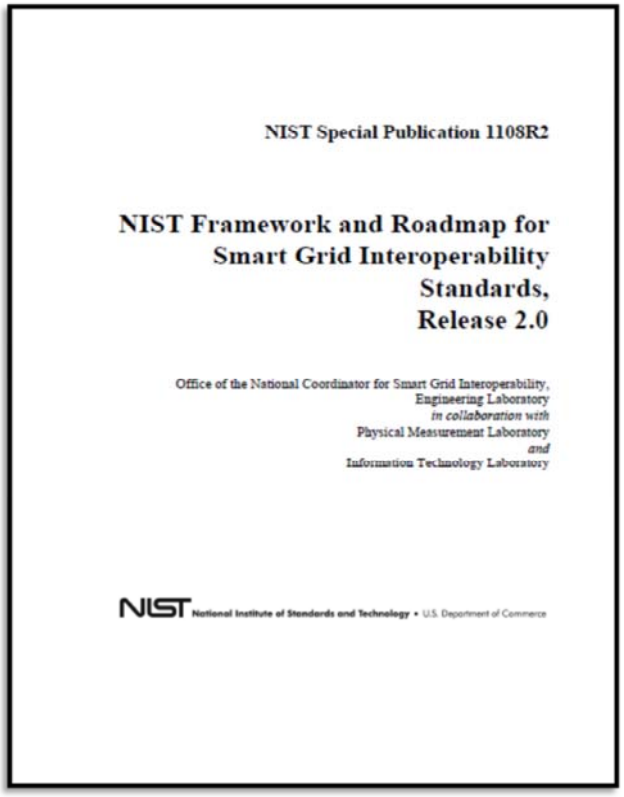
- The Federal Energy Regulatory Commission (FERC)
  - Smart Grid Policy, Final Rule (18 CFR Chapter 1)
  - Four key grid functionalities:
    - Wide Area Situational Awareness
    - Demand Response
    - Electric Storage
    - Electric Transportation
- The National Institute of Standards and Technology (NIST)
  - Framework and Roadmap (Special Publication 1108)
  - FERC List plus:
    - Advanced Metering Infrastructure
    - Distribution Grid Management
    - Cybersecurity
    - Network Communications

8 Application Areas for Smart Grid

NIST

NIST Special Publication 1108R2

- Release 2.0 March 2012
- 8 Application Areas
- 37 Standards identified for implementation
- 61 Standards designated for further review
- 19 Priority areas identified for new standards activity
  - Three additional areas have since been identified



NIST Special Publication 1108R2

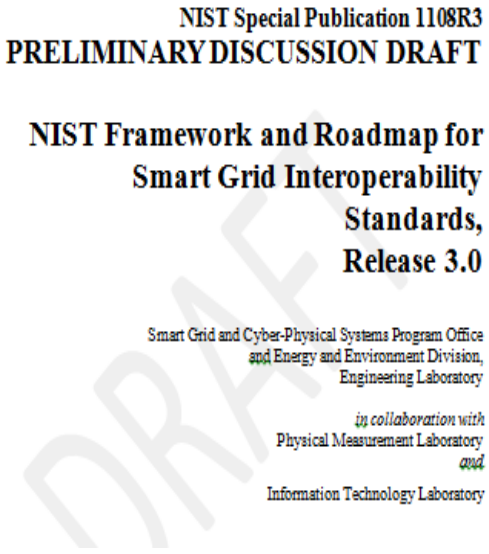
NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 2.0

Office of the National Coordinator for Smart Grid Interoperability,
Engineering Laboratory
in collaboration with
Physical Measurement Laboratory
and
Information Technology Laboratory

NIST National Institute of Standards and Technology • U.S. Department of Commerce

NIST Special Publication 1108R3

- Release 3.0 Publish date mid 2014
- 67 Standards identified for implementation
- Describes 23 Priority areas identified for new standards activity
- SGIP transition- several SGIP committees are key to framework evolution/improvement



NIST Special Publication 1108R3
PRELIMINARY DISCUSSION DRAFT

NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 3.0

Smart Grid and Cyber-Physical Systems Program Office
and Energy and Environment Division,
Engineering Laboratory

in collaboration with
Physical Measurement Laboratory
and
Information Technology Laboratory

DRAFT

SGIP SMART GRID INTEROPERABILITY PANEL

SGIP 2.0 Introduction

What is the SGIP 2.0?

- Established to support NIST
- Framework for coordinating all smart grid stakeholders
  - Accelerate standards harmonization
  - Advance Interoperability
  - Facilitate technical work
  - Navigate processes and relationships
  - Communication on standards information and interoperability benefits

SGIP 2.0 Member Groups

Membership

Domain Expert Working Groups (DEWGs)

- Building to Grid
- Industry to Grid
- Home to Grid
- Vehicle to Grid
- Business & Policy
- Distributed Renewables, Generation & Storage

Priority Action Plans (PAPs)

- Wireless Comm - 02
- Energy Storage Interconnect - 07
- Distribution Grid Mgmt - 08
- Standard DR & DER Signals - 09
- Map IEEE 1815 to IEC 61850 - 12
- Power Line Comm - 15
- Wind Plant Comm - 16
- Facility Smart Grid Info Std - 17
- Wholesale Demand Response - 19
- Green Button ESPI Evolution - 20
- Weather Info - 21
- EV Fueling Submetering - 22

Standing Member Committees

- Architecture
- Cybersecurity
- Implementation Methods
- Testing & Certification

- Conceptual Models & Roadmaps
- Requirements
- Use Cases
- Whitepapers
- Standards Evaluations
- Catalog of Standards

SGIP 2.0 Catalog of Standards

- ANSI
  - C12 Suite (Elec. Meters)
- ASHRAE
  - 135-210 (BACnet)
- IEC
  - 60870 Suite (Telecontrol)
  - 61850 Suite (Network Comms.)
  - 62351 (Power Management)
- IEEE
  - 1547 (Interconnection)
  - 1815 (DNP3)
  - 1901 (Power Line Comms)
- IETF
  - RFC 6272 (IP)
- ITU-T
  - G.9960 and G.9972 (Wireline Transceivers)
- NAESB
  - REQ 21/22 (Energy Services Info)
- NEMA
  - SG-AMI1 (Meter Upgradability)
- NIST
  - IR 7628 (Cybersecurity)
  - IR 7761 (Wireless)
  - IR 7862 (PLC coexistence)
- OASIS
  - EMIX/Energy Interop
  - WS Calendar (Time Sync)
- SAE
  - J1772 (EV connector)
  - J2836 (PEV interactions)
- SGIP
  - 2011-0008_1 (Energy Comms)

NEMA Activities

- Education and engagement on the value of the Smart Grid
- Advancing Interoperability
- Cybersecurity is evolving and a critical issue
- Energy Storage
- NEMA Brazil Smart Grid Program
- NEMA China Smart Grid Program

Education and Engagement

- Value of the Smart Grid-Four themes: Efficiency, Reliability, Resiliency, and Security
- Target audience
  - Federal
  - State Public Utility Commissions and Regulators (NARUC)- Increased focus

DOE Voices of Experience Model

- The success of Smart Grid lies in the customers hands
- Both utilities and state regulators are looking for a way to measure the success of customer education programs
- Working group consisting of well over 120 stakeholders (including over 50 utilities)
- Model will be a resource for utilities to use when rolling out Smart Grid programs in the future

- Available at the following URL:

http://www.smartgrid.gov/voices

Advancing Interoperability

- ANSI/NEMA SG-IC Smart Grid Interoperable and Conformant Testing and Certification Scheme Operator Guidelines
  - Addresses one of the challenges identified by NIST in implementing Smart Grid
  - Brings consistency and portability to the interoperability testing process among Smart Grid Products
  - Defines roles and responsibilities of the four main participants in the testing process
    - Interoperability Testing and Certification Authority (ITCA)
    - Accreditation Body (AB)
    - Testing Lab (TL)
    - Certifying Body (CB)
  - Available at the following URL

http://www.nema.org/Standards/Pages/Smart-Grid-Interoperable-and-Conformant-Testing-and-Certification-Scheme-Operator-Guidelines.aspx

Cybersecurity is evolving & critical

- New digital & communication technologies are adding new cyber access points
- Sharing knowledge is powerful
- While not all cybersecurity threats can be controlled-vulnerabilities can be mitigated
- Presidential Executive Order

Cybersecurity is evolving & critical

- NEMA's work with the Edison Electric Institute (EEI)-Shared Principles Document
  - A secure supply chain is essential to a secure grid
  - Cybersecurity aspects should be "built-in" and not "bolted-on" manufacturers products
  - Open lines of communication and information sharing
- NEMA's Cybersecurity Council
  - Guideline for managing supply chain integrity thru the four phases of the product life cycle
  - Policies for liability and indemnification protection

Energy Storage Applications/Use Cases

- Energy storage (ES) is absolutely key to realizing the full potential of renewables (wind/solar) due to their intermittent nature
- Integration with renewables is but one category of uses of ES
- There are between one and two dozen end uses for ES which are economically viable
- One or more uses over a day is/will be common

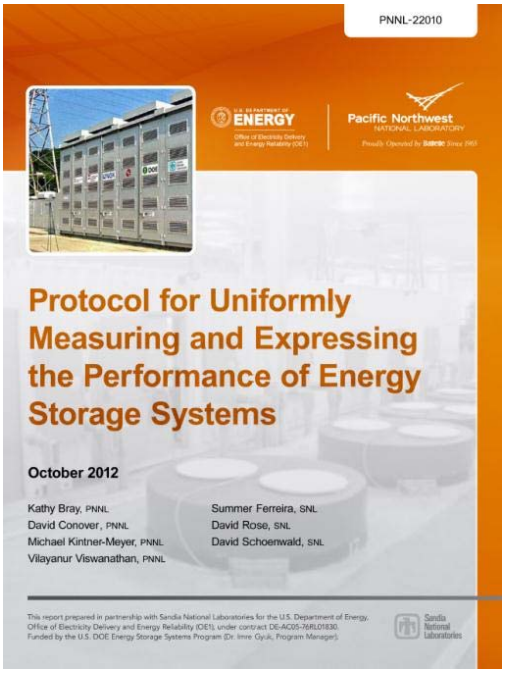
Energy Storage "End Use"		Scenarios			
		A. Renewables Support/ Dispatchability	B. Distributed Storage	C. Demand-side Management	D. Ancillary Services
1	Ancillary services: frequency regulation				X
2	Ancillary services: spin/ non-spin/ replacement reserves			x	X
3	Ancillary services: ramp			x	X
4	Black start				
5	Real time energy balancing				x
6	Energy price arbitrage		x		
7	Resource Adequacy		x		
8	Intermittent resource integration (ramp/voltage support)	X			
9	Intermittent resource integration (time shift, voltage sag, rapid demand support)	X			
10	Supply firming	X			
11	Peak shaving		x		
12	Transmission peak capacity support				
13	Transmission operation				
14	Transmission congestion relief				
15	Distribution peak capacity support (upgrade deferral)		X		
16	Distribution operation (voltage / VAR support)		X		
17	Outage mitigation: micro-grid		x	x	
18	TOU energy cost management			X	
19	Power quality			X	
20	Back-up power			X	

Figure 4: Energy Storage Deployment Scenarios

CPUC Final Staff Report: Energy Storage Framework: http://www.cpuc.ca.gov/PUC/energy/electric/storage.htm

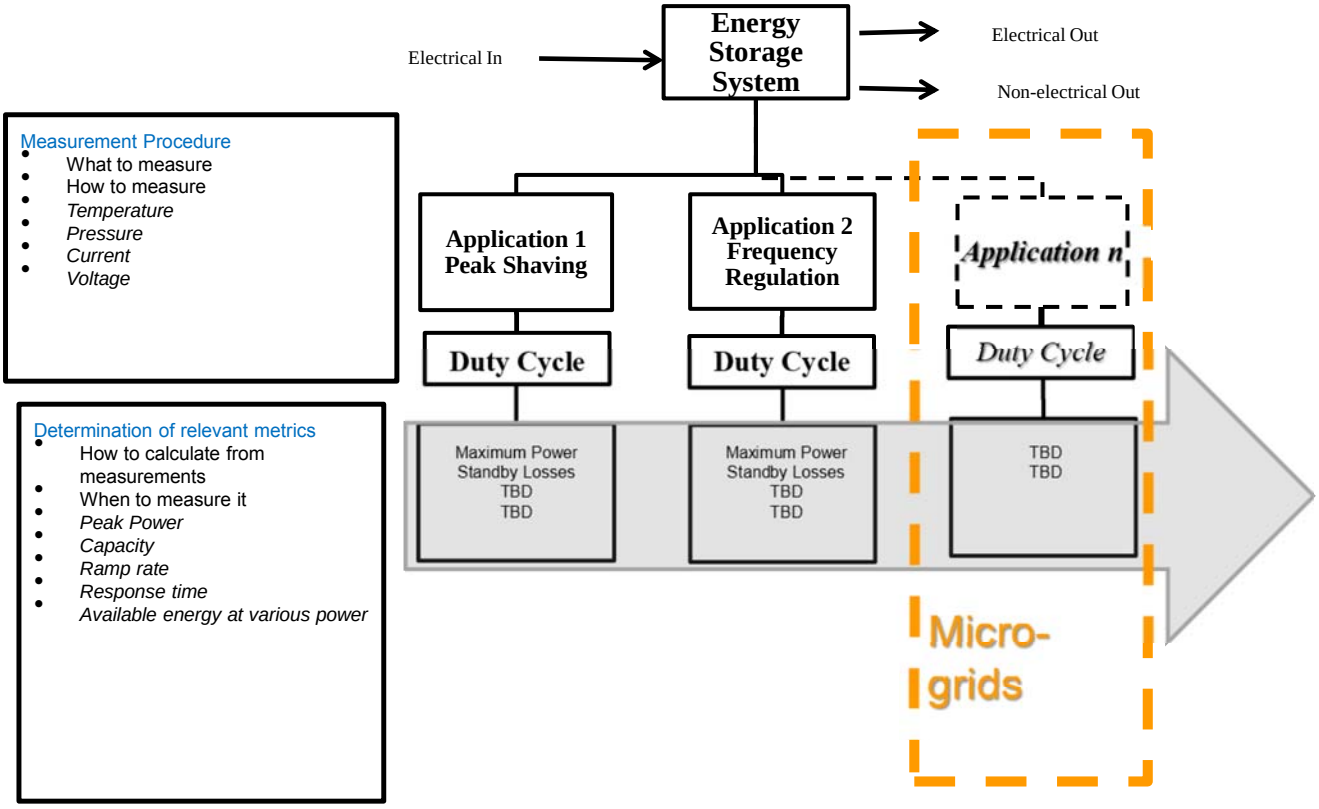
DOE/PNNL Performance Protocol

- Indifferent to storage medium "Technology Agnostic": driven by representative duty cycle
- Written by 100+ stakeholders: manufacturers, integrators, PUCs, ISOs, industry groups, academia, and utilities
- Allows for ongoing expansion to future use cases



http://www.pnl.gov/main/publications/external/technical_reports/PNNL-22010.pdf

Protocol Framework



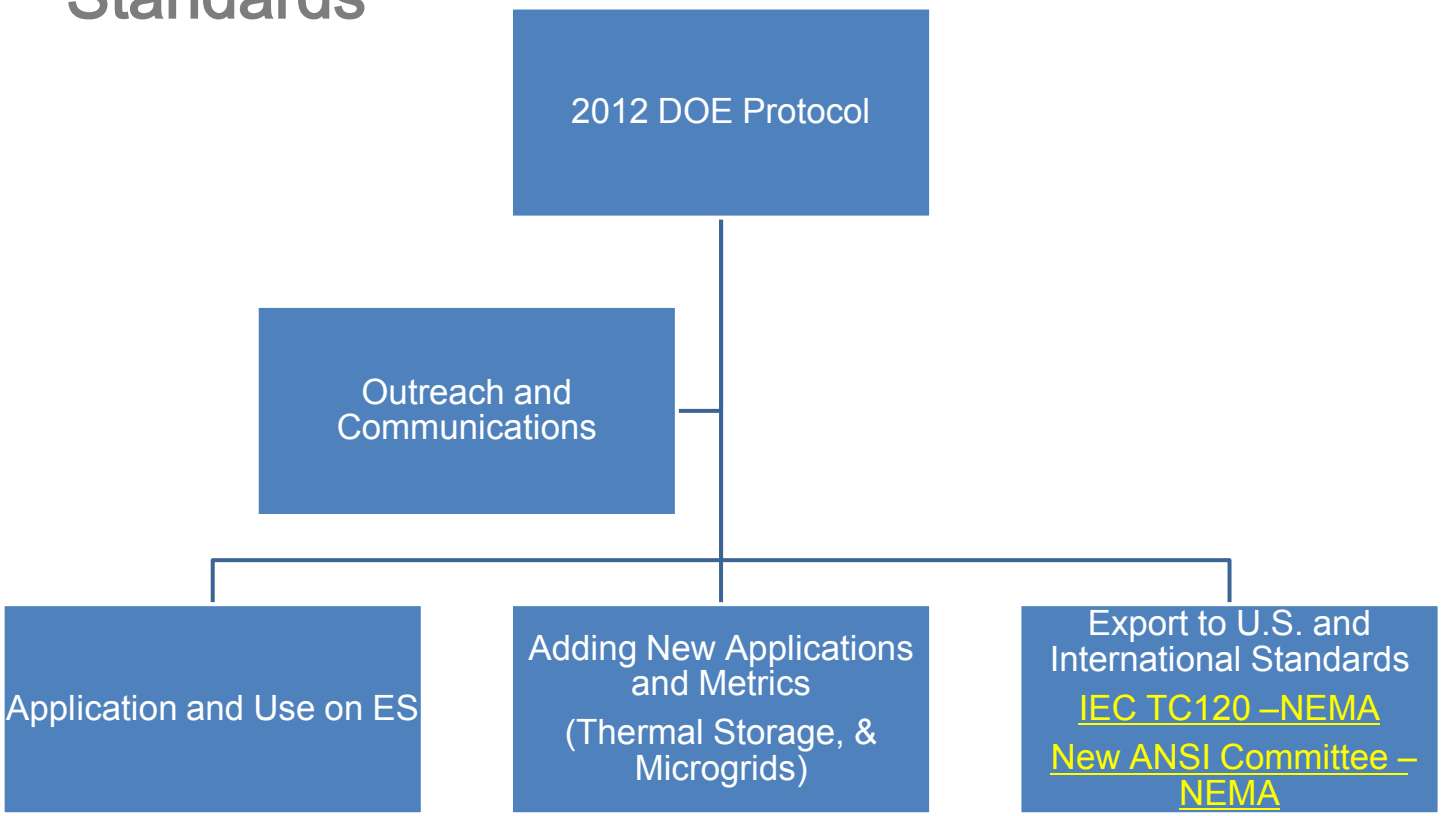
Measurement Procedure

- What to measure
- How to measure
- *Temperature*
- *Pressure*
- *Current*
- *Voltage*

Determination of relevant metrics

- How to calculate from measurements
- When to measure it
- *Peak Power*
- *Capacity*
- *Ramp rate*
- *Response time*
- *Available energy at various power*

Industry Work Program, Transition to Formal Standards



NEMA Brazil Smart Grid Program

- In collaboration with US Department of Commerce
- Program Period of performance: Oct. 2013 –Sept. 2016
- Objectives:
- Improve market access for NEMA member companies
  - Clear understanding of need for interoperable standards.
  - Understanding of how to do business in Brazil.
- Grow the market for Smart Grid Products
  - Compile buyer's guide of members' SG products.
  - Collaborate with electrical regulators (federal and state).
- Increase government commitment to grid modernization
  - Create and present ROI model to decision-makers.
  - Work with Brazilian stakeholders to identify policies needed to facilitate grid modernization
- Participate in ongoing U.S.–Brazil Strategic Energy Dialogue and U.S.–Brazil Commercial Dialogue.

NEMA China Smart Grid Program

- In collaboration with US Trade and Development Agency (USTDA)
- Program Period of performance: September 2013- September 2015
- Objective:
- Conduct (4) two-day workshops related to Smart Grid Technical Assistance (TA) in China
  - Develop topics
  - Recruit Participants
  - Evaluate Program Impacts
  - After Action Reports and any needed follow/up

Important Links

- www.nema.org/smartgrid
- www.nist.gov/smartgrid
- www.sgip.org

Questions?

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