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David L. Armstrong
Chairman

James W. Gardner
Vice Chairman

Linda Breathitt
Commissioner

October 8, 2013

PARTIES OF RECORD

RE: Case No. 2012-00428
CONSIDERATION OF THE IMPLEMENTATION OF SMART GRID AND SMART METER TECHNOLOGIES

Enclosed please find a memorandum that has been filed in the record of the above referenced case for the Informal Conference to be held on October 10, 2013. Any comments regarding this memorandum's content should be submitted to the Commission within five days of the receipt of this letter. Questions regarding this memorandum should be directed to Aaron Greenwell at 502-782-2563.

Sincerely,

Jeff Derouen
Executive Director

Attachments

INTRA-AGENCY MEMORANDUM

KENTUCKY PUBLIC SERVICE COMMISSION

TO: Main Case File - Case No. 2012-00428
CONSIDERATION OF THE IMPLEMENTATION OF SMART GRID AND SMART METER TECHNOLOGIES

FROM: Aaron Greenwell, Team Leader

DATE: October 8, 2013

SUBJECT: Cooperative Research Network PowerPoint Presentation for Informal Conference, October 10, 2013

Pursuant to Staff Notice of September 26, 2013, an informal conference ("IC") will be held on Thursday, October 10, 2013 at the Commission's offices at 211 Sower Boulevard, Frankfort, Kentucky. Presentations will be provided by representatives of the Electric Power Research Institute ("EPRI") and the Cooperative Research Network ("CRN").

In order to allow those participating in the IC by phone to more closely follow the proceedings, copies of the presentations will be placed in the case file. A copy of the CRN presentation is attached to this memo. A copy of the EPRI presentation will be filed once received.

Attachment: CRN PowerPoint

CRN®

Cooperative Research Network

Smarter Grid

Andrew Cotter and Doug Lambert, NRECA

October 10, 2013

National Rural Electric Cooperative Association®

A Touchstone Energy® Cooperative

Agenda

- The Grid today
- The Grid of the future
- How we will transition there
- Challenges
- Overview of NRECA Smart Grid Demo
- How we are overcoming challenges

About CRN

- The Cooperative Research Network™ (CRN), the technology research arm of the National Rural Electric Cooperative Association (NRECA)
  - Conducts collaborative research to accelerate technological innovation that can be applied by electric cooperatives worldwide.
  - The more than 900 co-ops nationwide comprise a real-world test bed for demonstrating the viability of emerging technologies.
  - CRN research is driven by the needs of cooperatives and their consumer members.

About NRECA T&DEC

- NRECA's Transmission & Distribution Engineering Committees
  - Investigates, develops and promotes engineering and operational solutions supporting electric coops
  - Represents cooperative utility interests in the development of engineering standards, rules and regulations.
  - Manages the MultiSpeak® Initiative for standardizing interoperability.
  - Develops education and training materials for technical workforce

Do we need a NEW GRID?

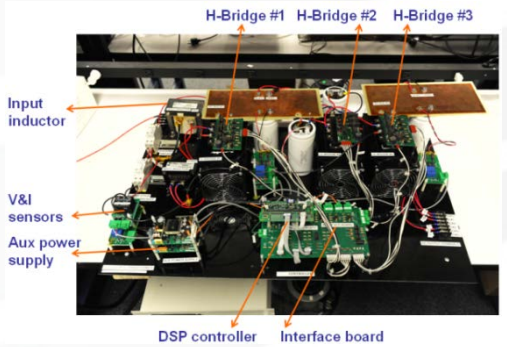
NO

- The grid is an amazing achievement and it works exceptionally well
- It is recognized as the greatest engineering achievement of the 20th century by the National Society of Professional Engineers (NSPE)
- **We are able to sustain reliable and cost effective delivery of electricity through basic maintenance and extension using conventional technology**

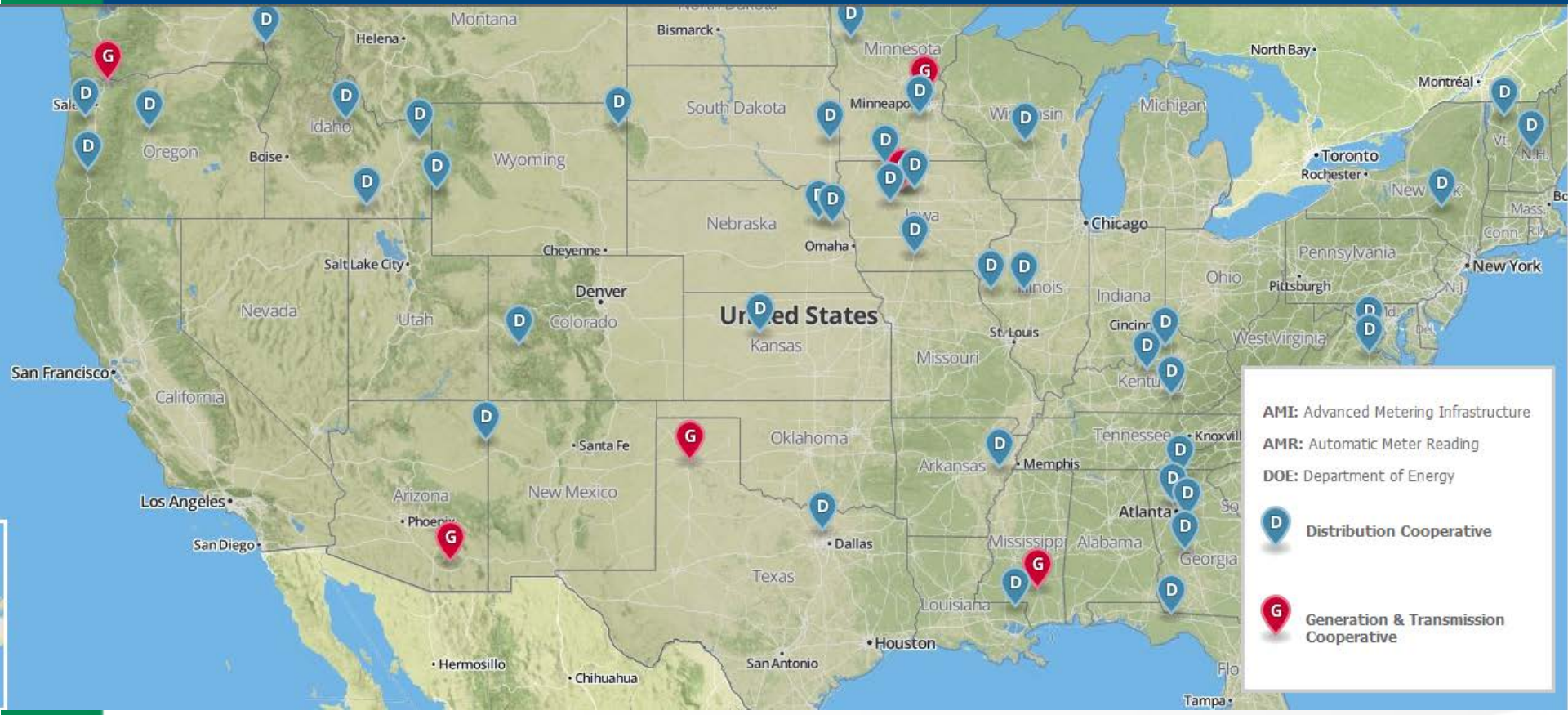


The grid “evolves” in small steps

- The grid looks the same, day-to-day, but over time is essentially reinvented, evolving, and upgrading continuously.
- This is true because:
  - The grid is immensely complex – vastly beyond “simple” things like the Apollo Space program.
  - Different portions of the grid are independently configured and controlled

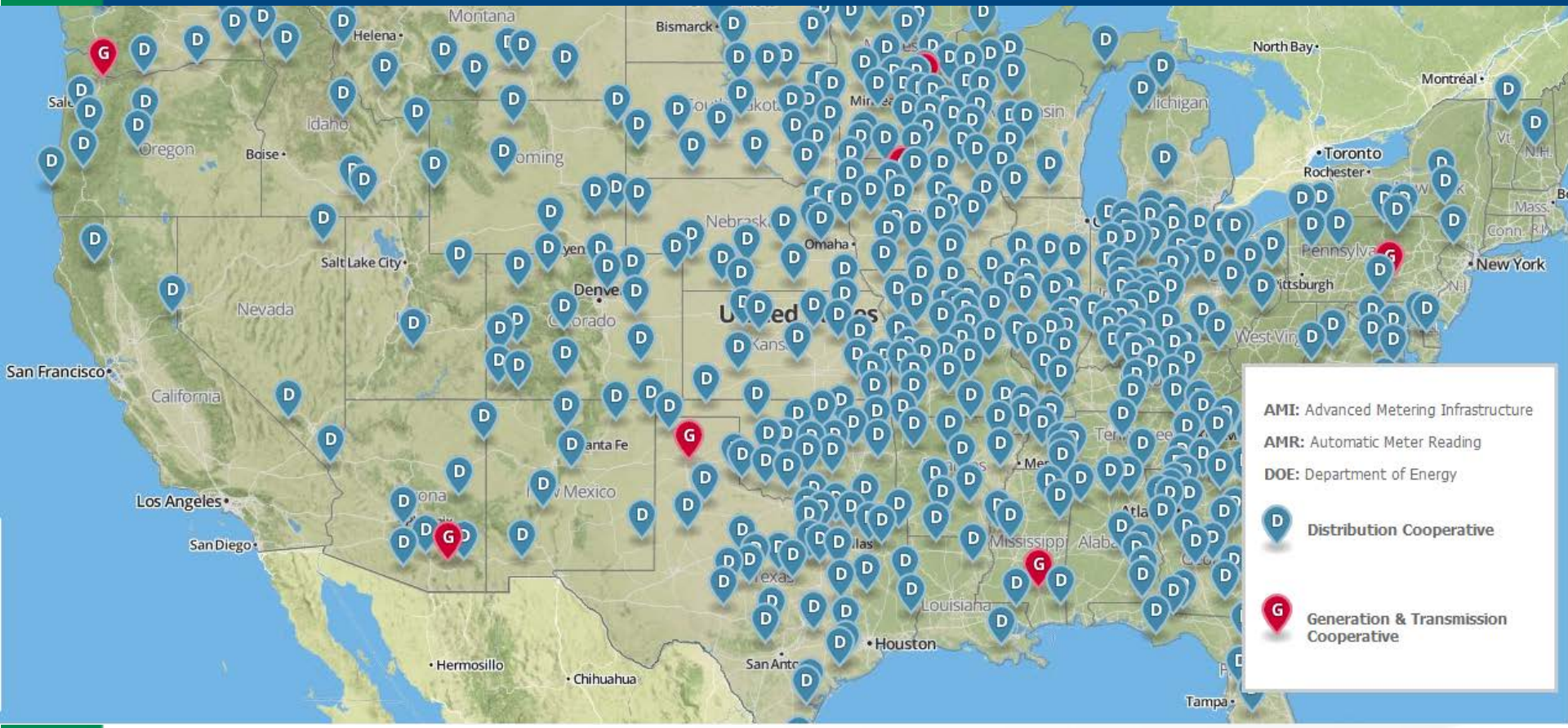


DOE Smart Grid Grant Recipients



- 23 Coops in 12 States implementing over 70 separate Smart Grid Activities
- Activities" include installing and validating Enabling Technologies, Demand Response and Distribution Automation
- Studies will produce data on implementation and operation of Smart Grid
- Project will enhance Cyber Security and Interoperability goals of electric coops

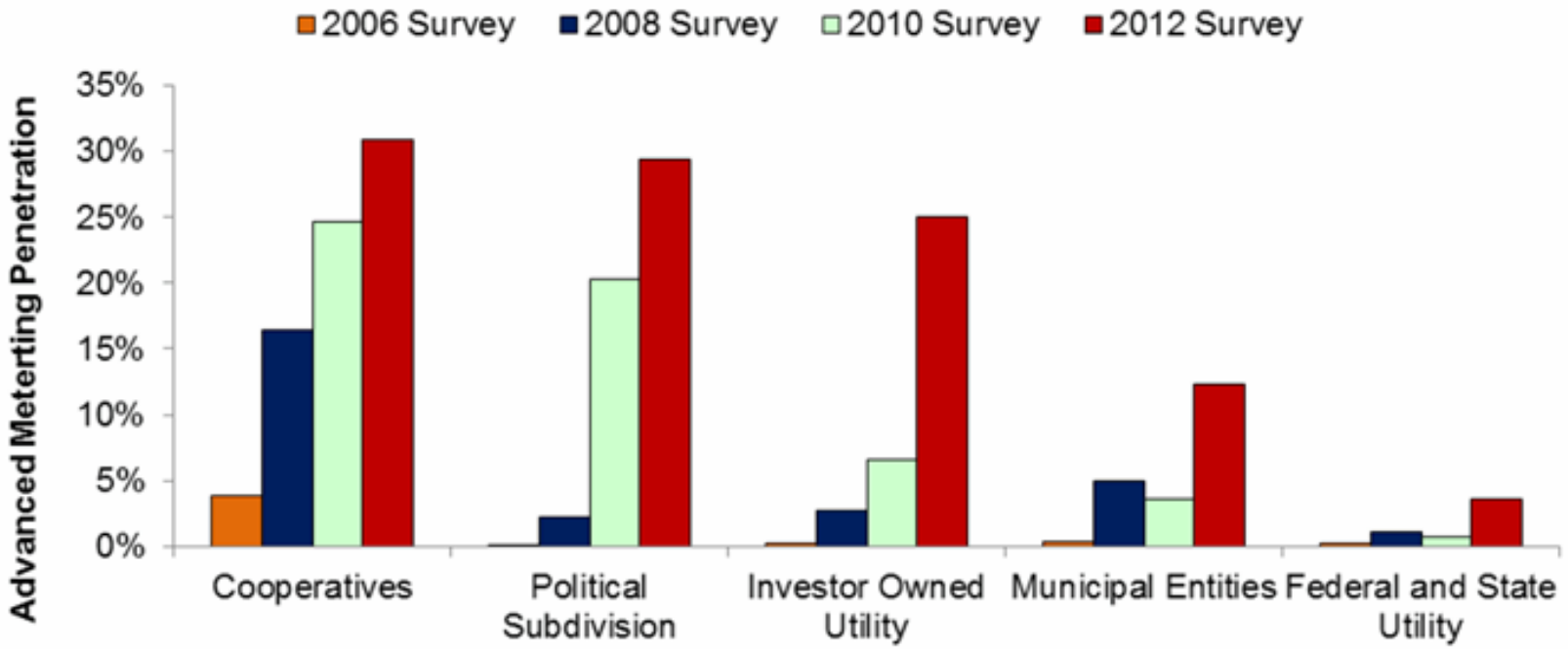
Electric Coop “Smart Grid” Deployments



Electric cooperatives are deploying advanced communication & automation technologies to improve service, increase reliability and help control electricity costs.

Advanced Metering Deployment History

Figure 2-3. Estimated advanced metering penetration by type of entity in 2006, 2008 and 2010, and 2012 FERC Surveys



Ownership	Cooperatives	Political Subdivision	Investor Owned Utility	Municipal Entities	Federal and State Utility
2006 Survey	3.8%	0.1%	0.2%	0.3%	0.2%
2008 Survey	16.4%	2.2%	2.7%	4.9%	1.1%
2010 Survey	24.7%	20.3%	6.6%	3.6%	0.7%
2012 Survey	30.9%	29.4%	25.0%	12.4%	3.6%

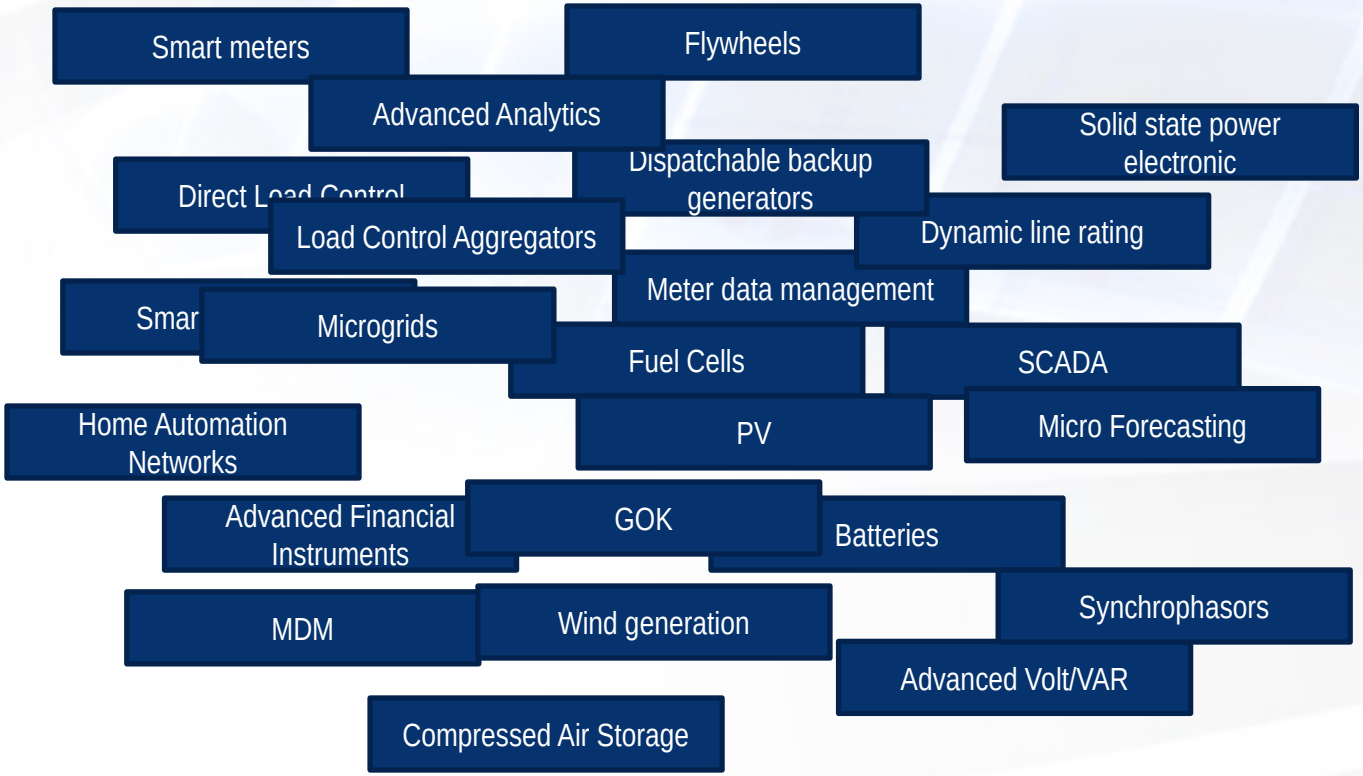
Source: FERC 2012 Survey on Demand Response and Advanced Metering
Link: http://www.ferc.gov/industries/electric/indus-act/demand-response/2012/survey.asp

What is a Smart(er) Grid?

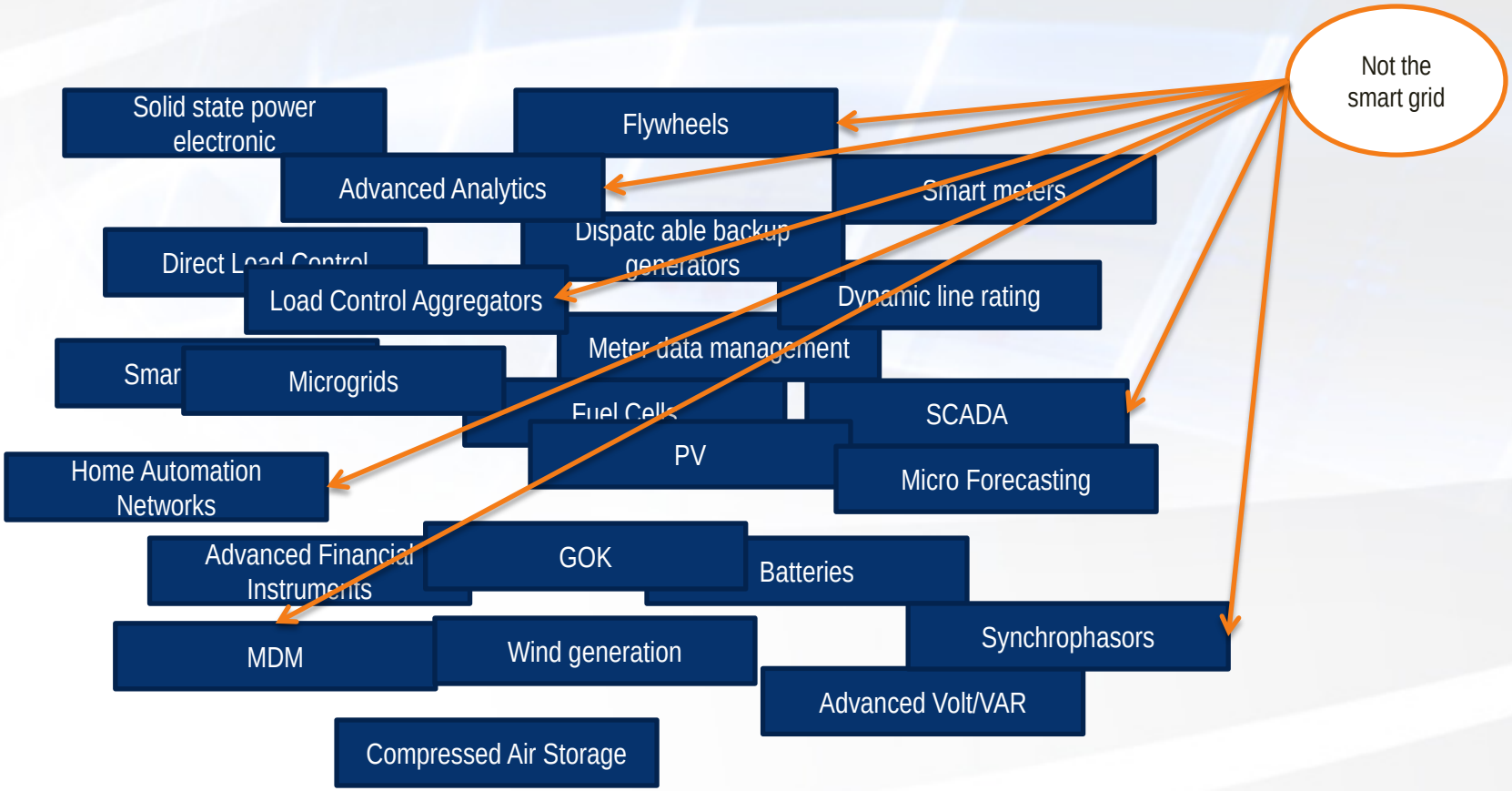
A Framework for Modernization

- Automated optimization and increased efficiency
- Self-healing and resilient against physical and cyber attack and natural disasters
- Enable renewables, energy storage, and PEVs
- Integration of "Smart Appliances"
- Provide more consumer information
- Deliver power quality for a new digital economy

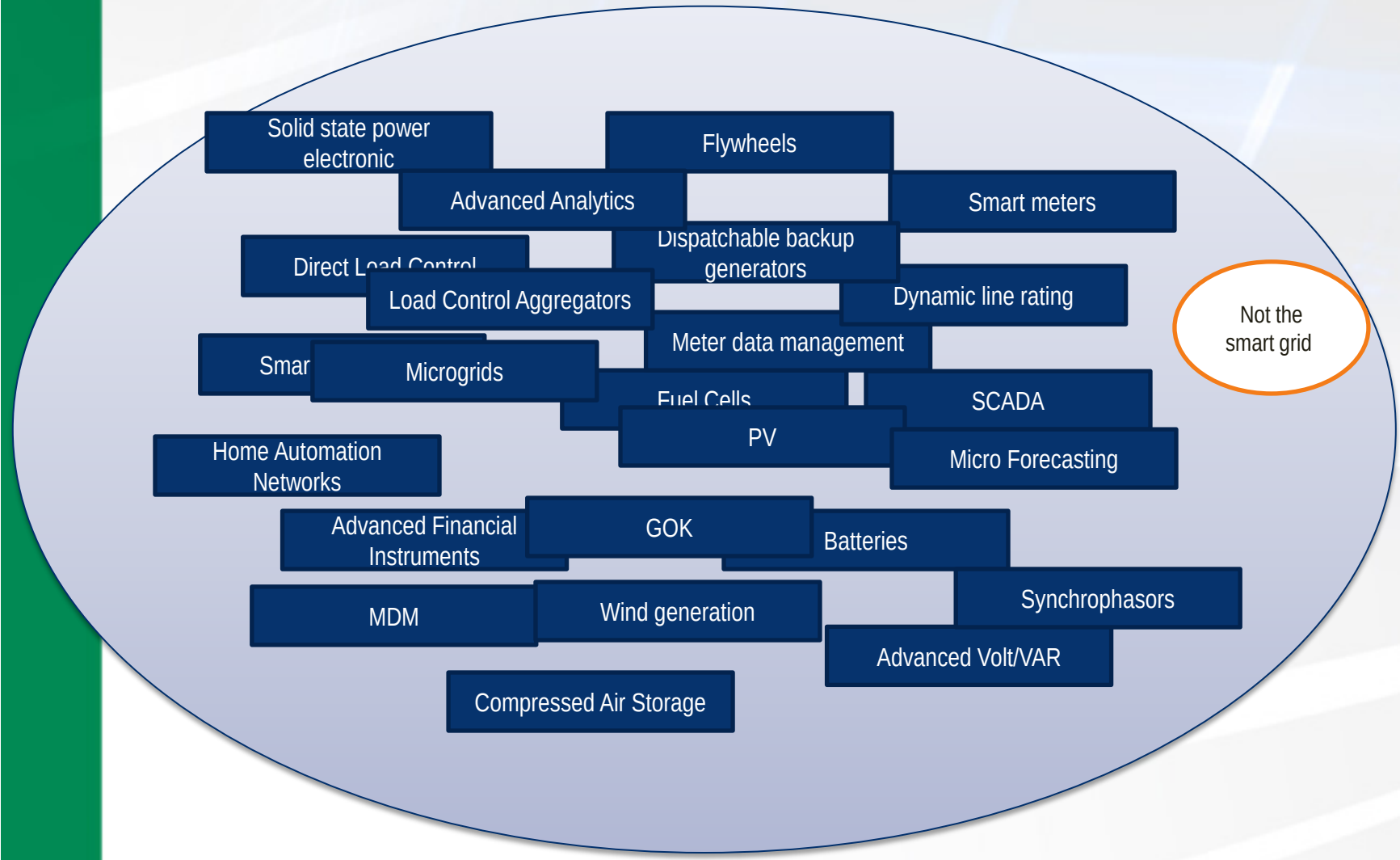
The smart grid encompasses many ideas and many technologies



The smart grid is not just one technology



The smart grid is not just a collection of technologies



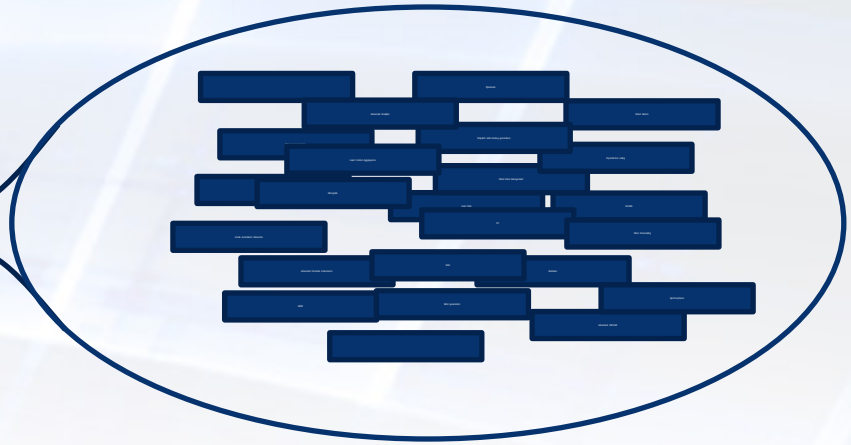
Smart application of new technologies

ADVANCED STATE ESTIMATION

ADVANCED FORECASTING

ADVANCED ANALYTICS

SMART CONTROL



Smart grid technology enables better knowledge of state and more immediate and more precise control

The smart grid IS the “smart” application of diverse and improving technologies to improve grid design, operation, and member services

How do we transition to a Smarter Grid?

One Step at a Time

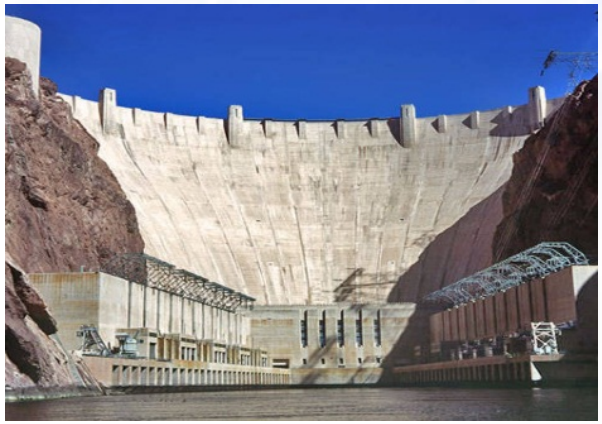
Every new tool or material allows and encourages an engineer to rethink every aspect of a problem – solid state technology is the new tool that is allowing engineers to imagine the smart grid.

Wood → Stone → Concrete → Iron → Steel → Fiber

Move Towards Optimization

Smart is an addition to big

- When the grid was first built, it was all about expansion – more power, delivered ubiquitously
- When you reached a limit, you built MORE

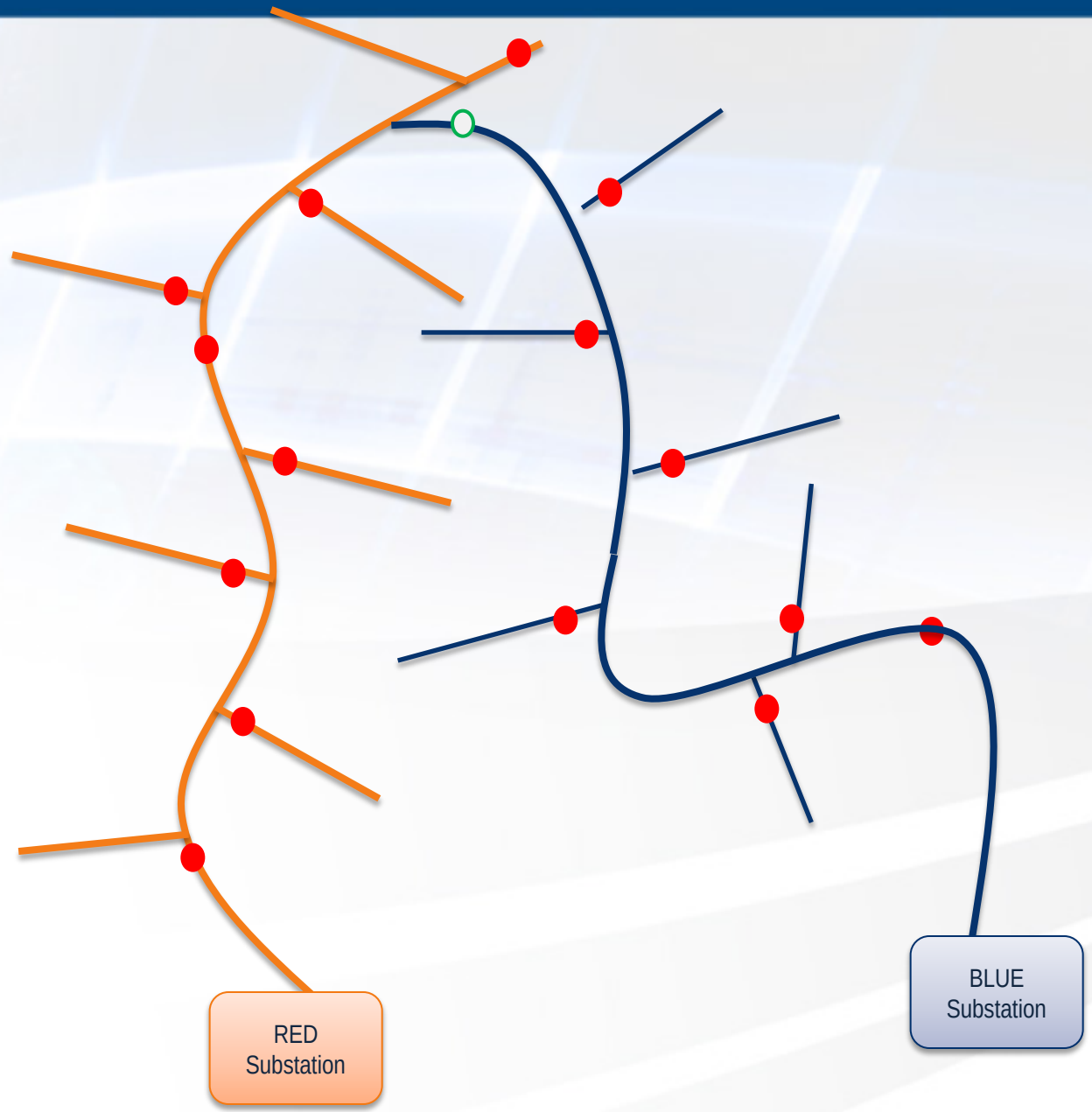


- **We still have a need to build out, but today we first look at getting more from what we have.**

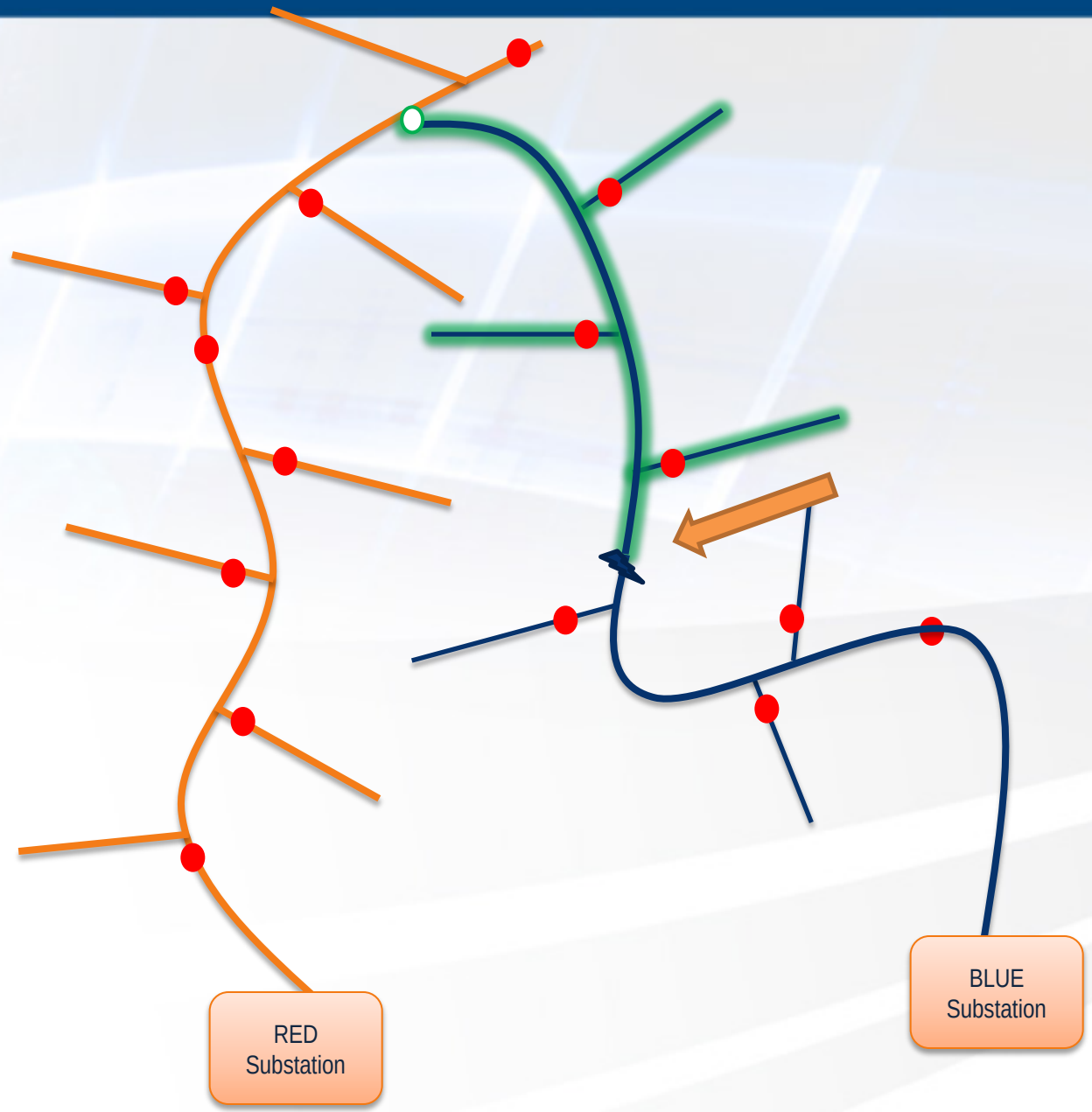
An Example: A Self Healing Grid

Implementing a smart feeder switch on paired feeders

Model 1: Two Feeders Operating Normally

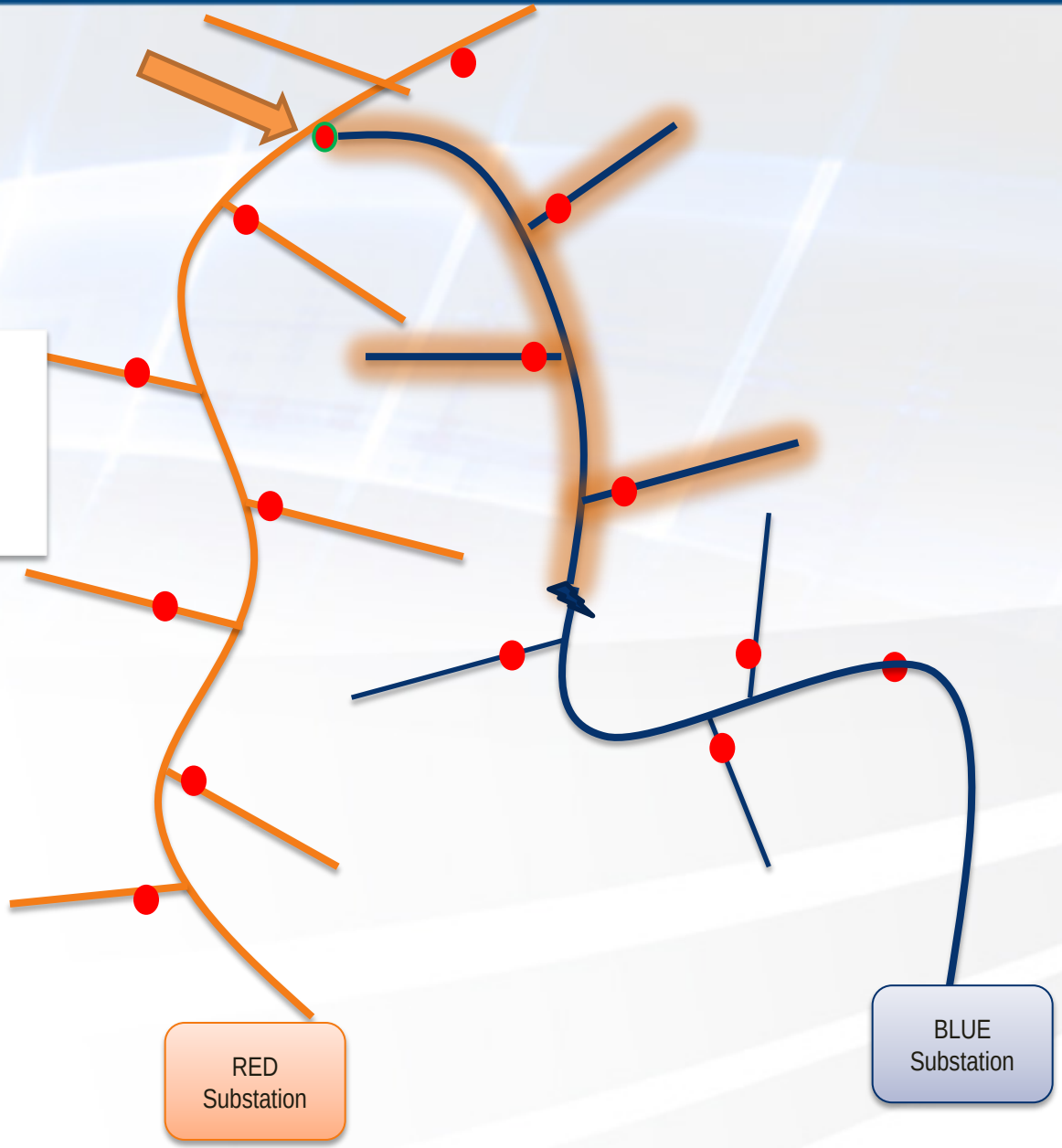


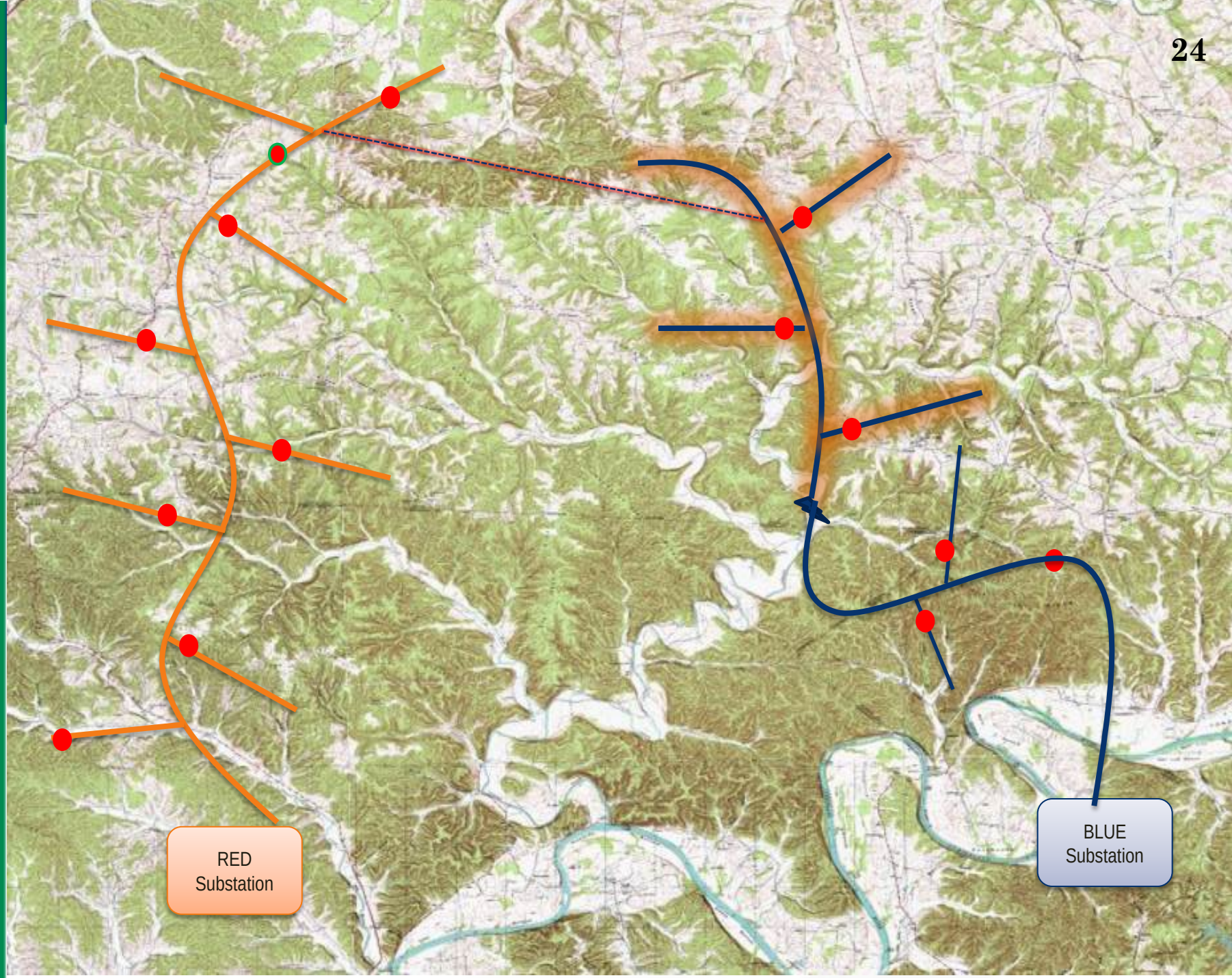
Model 2: A Fault Occurs



Model 3: A Smart Feeder Switch Opens: Provides Power to Blue Feeder

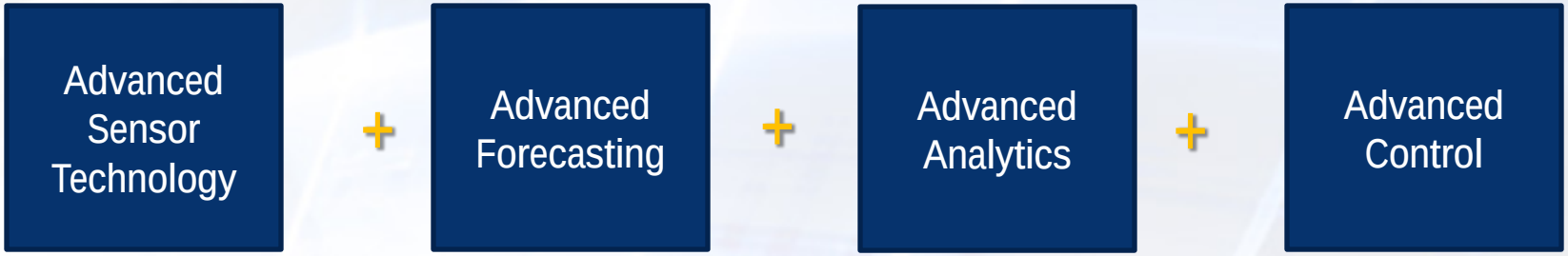
Model 3
The normally open switch ( ) connecting the red and blue feeder closes allowing the red feeder to power the blue, restoring power to both.




RED
Substation
BLUE
Substation

Resiliency does not come from just a smart switch

It takes a combination of:



Applies all “smart grid technologies”

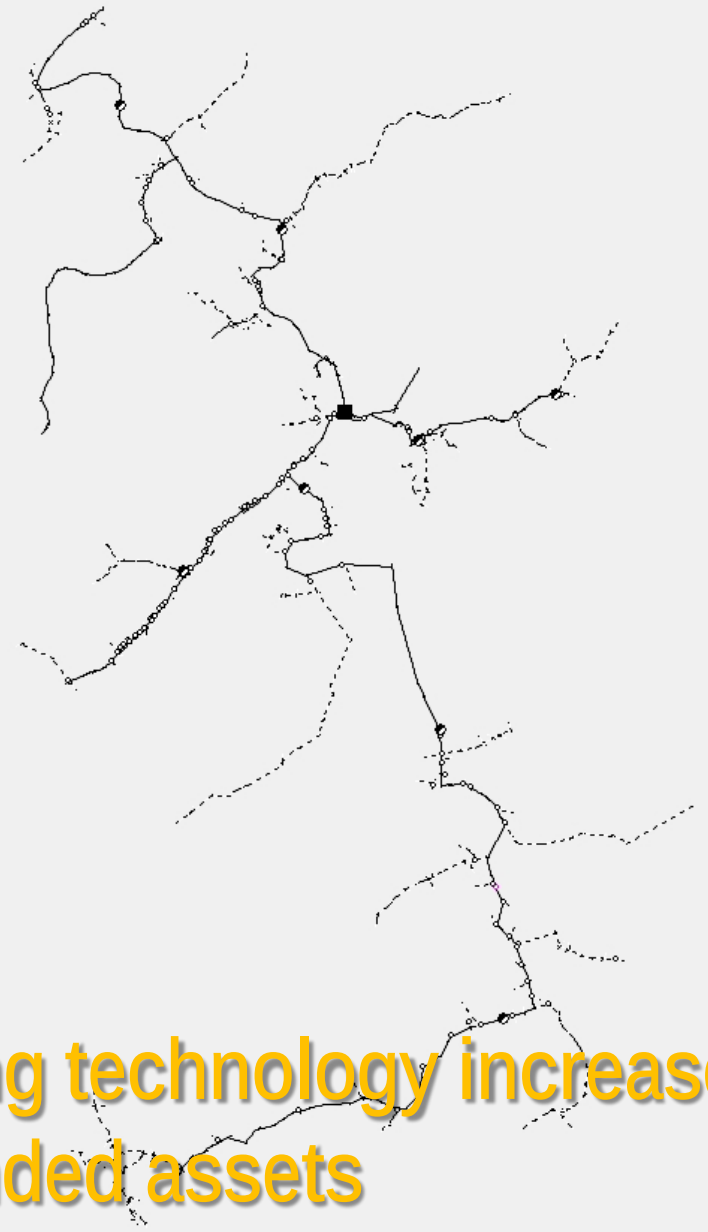
- Smart feeder switching
- Rolling disconnects
- Dispatchable backup generators
- Distributed energy
- Storage

Made possible by a communications backbone

What makes communications so challenging?

Communication Systems are Crucial

- Challenges
  - Mountains
  - Trees
  - Distance
  - Meter Density
- Technologies
  - Radio
  - Cellular
  - Fiber
  - Power Line Carriers
  - Microwave
  - Satellite



Investing in rapidly evolving technology increases the risks stranded assets

Speed Costs Money…

Kid, how fast do you want to go? – Banjo

Where are we today?

NRECA-DOE Smart Grid Demonstration Studies

1. Conservation Impact of Prepaid Metering
2. AMI-Based Load Research
3. Multi-Tenet Meter Data Management
4. Cost and Benefits of Conservation Volt Reduction
5. Cost and Benefits of Smart Feeder Switching
6. Demand Response & Critical Peak Pricing
7. Energy Storage
8. Advanced Communications Architecture
9. Strategy for Consumer Acceptance of Grid Modernization
10. Latency and Quantization impact on Demand Response

Examples from Demo Studies

Communications Architecture

- How do you build out a communications system that meets present and future applications?

AMI for Demand Management Studies

- How can a utility utilize hot water heaters and energy storage in a secure and coordinated demand management program?

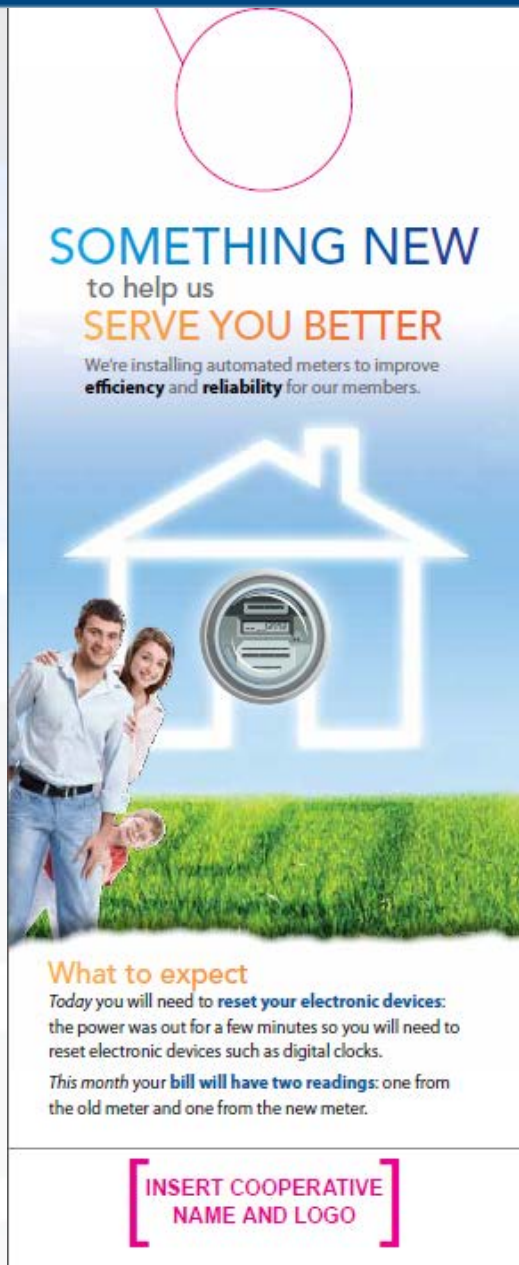
Challenges

- **Volume of Data and Computational Complexity**
  - Insights into next generation utility architectures, particularly managed services and cloud computing
- **Communications (Physical)**
  - Understanding the complex nature of the problem and formulating a follow-on study
- **Consumer Opposition**
  - Communications plan and template documents
- **Cyber Security**
  - Very popular guidance on cyber security assessment and planning
  - Input to the ESC2M2
  - MultiSpeak® cyber security assessment and extensions
- **Interoperability**
  - Expansion of MultiSpeak® interoperability standards, and better documentation of those standards though a body of use cases
- **Cost and Benefit of Smart Grid Technology**
  - Open Modeling Framework

Handling Consumer Opposition

Developed the SG Communicators Toolkit

- Sample communications plan and timeline
- A Guide to Communicating About Smart Meters
- Message Triangle for a Smart Meter Roll-out
- Sample press release
- Sample news letter article



Handling Consumer Opposition

SOMETHING NEW
to help us
SERVE YOU BETTER

We're installing automated meters to improve **efficiency** and **reliability** for our members.

We want to serve you better. With these new meters, we will be able to:

- **respond faster** to outages: the two-way meters tell us when and where there is an outage.
- provide **more accurate information about outages** and restoration times.
- **increase efficiency** – our employees will spend less time on the road reading meters and hunting down outages.

By upgrading our equipment and installing new meters with two-way communication we can improve reliability, keep costs down and serve you better. You can look forward to new services in the future.

Questions? You can find more information on our website [www.xxxxxxxx] or call [xxx-xxx-xxxx].

[Your co-op name]: Looking Out For You

[INSERT COOPERATIVE NAME AND LOGO]

Focused Messaging on Smart Meter health and privacy

Lessons Learned:

- Concerns are technology independent
- **There are no substitutions for personal communications**

Cyber Security Guide

1. **A Guide to Developing a Cyber Security and Risk Mitigation Plan** to enhance security at the co-ops participating in the demonstration as they acquire and deploy grid components and technologies.
2. **Cyber Security Risk Mitigation Checklist** of activities/security controls necessary to implement a cyber security plan, with rationales.
3. **Cyber Security Plan Template** for coops to create their own cyber security plan.
4. **Security Questions for Smart Grid Vendors** designed to facilitate a frank and open dialogue on cyber security with those who make and sell components.
5. **Interoperability and Cyber Security Plan**

Smart Grid Requires Interoperability

- MultiSpeak® - the utility information model that facilitates interoperability of diverse business systems and automation applications used by electric utilities.

Open Modeling Framework (OMF)

The Open Modeling Framework (OMF) in one sentence: A cost-benefit tool for smart grid improvements.

- Build around a powerful graphical interface
- Include a rich database of weather data, smart grid components, reports, and example analyses
- Combine and compare multiple models
- Integrate the best powerflow math available
- Open and extendable by anyone
- Host in the cloud to enable sharing and access powerful computational resources

Lessons Learned

- Biggest Challenge
  - Building communications infrastructure
  - Addressing cyber security across a diverse community
- What we did not expect
  - Grid automation is more complicated than expected
- Advice for future utilities
  - Smart Grid is not a discrete project, it is a sustained effort to build out grid and communications infrastructure

In Summary

We have a capable grid today

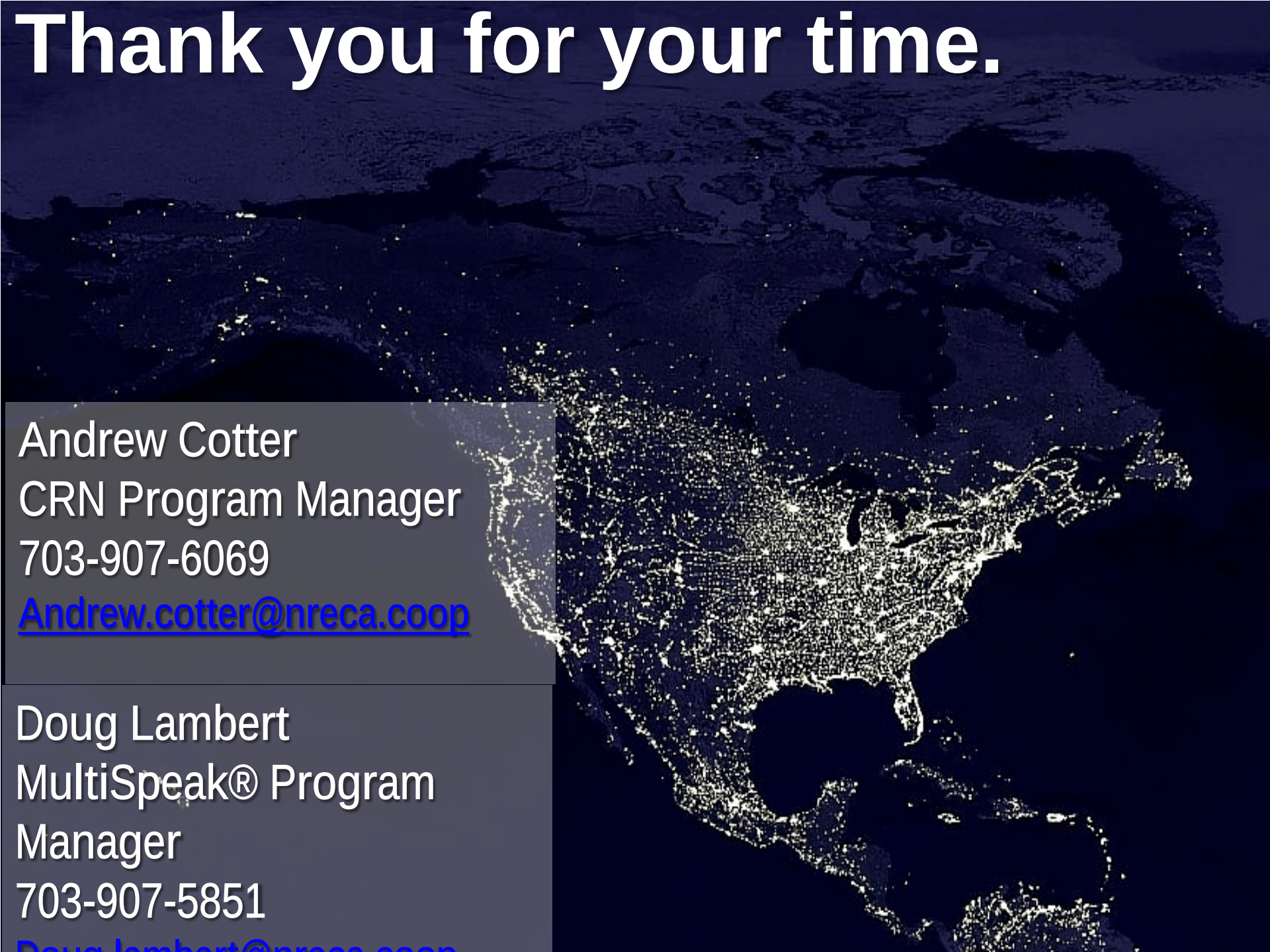
It has and will continue to improve, but it's an evolution

Cost-benefit analysis is key

…and very difficult to do



Thank you for your time.



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