Future Grid at Great River Energy

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Agenda

- What is grid modernization and what’s happening
- Existential questions guiding our work
- Who is Great River Energy
- Overview of the Future Grid initiative
The grid of the future

The Integrated Grid
Utility industry trends

**CONVENTIONAL**
- Dispatchable Centralized Generation
- Passive Distribution System
- Rigid & Centralized System Control
- Human-in-the Loop Grid Management
- Passive & Predictable Loads
- Supply Oriented Business Model
- Private Communication Network / Physically Secure

**EMERGING**
- Variable & Distributed Generation
- Two-way Flows Situational Awareness
- Flexible & Cost-effective Distributed Controls
- Faster System Dynamics
- Transactive Loads
- Service-oriented Business Model
- Hybrid Communication Network Vulnerable to Physical Attack

**DRIVERS**
- Policies
- Technologies
- Aging infrastructure
- Customers
- Competition

**PRIVATE COMMUNICATION NETWORK / PHYSICALLY SECURE**
- Hybrid Communication Network Vulnerable to Physical Attack

**HYBRID COMMUNICATION NETWORK**
- Vulnerable to Physical Attack
Role of the consumer

- More in control of their consumption and production of energy
- More price sensitive
  - Especially when there are options to the commodity
- But consumers are diverse
  - Segmentation work?
"Utility of the Future" Projects

- PNNL/Gridwise
  - Gridwise Architecture 2020
- CalCEF
  - Clean Energy and Utility of the Future
- CA PUC
  - AB 327
- e21 Great Plains Institute,
  - CEE, Xcel Energy,
  - MN Power et al.
- Michigan State University
- Energy Future Coalition:
  - Utility 2.0 Pilot
- State of New Jersey
  - Grid Resiliency Task Force
- New York – REV Proceeding
- C2es:
  - Power 2030
- Resnick Institute
  - Grid2020
- Arizona State University
  - Utility of the Future
- RMI eLab
- Binz/Lehr
  - Utility 2020
- NREL/Colorado State University
- Florida State University
  - SUNGRIN
- HI – Power Supply Improvement Plan

State of Massachusetts:
- Grid Modernization Working Group
AEE/MIT-IPC:
- Utility 2.0
Ceres:
- 21st Century Electric Utility

GREAT RIVER ENERGY™
California

- SB 17 – 2009
- AB 327 and PUC order on distribution planning
- Distribution resource plans
- Integrated DER proceeding
- Energy storage
- 50% RPS and double energy efficiency by 2030
- And...
New York REV

- Aftermath of Superstorm Sandy
- Governor Cuomo strategy: Reforming the Energy Vision
- Public/private partnership
REV goals

- Make energy affordable for all New Yorkers
- Support the growing clean energy innovation
- Cut greenhouse gas emissions 80% by 2050
- Empower New Yorkers to make more informed energy choices
- Improve New York’s existing energy infrastructure
- Create new jobs and business opportunities
- Protect New York’s natural resources
- Build a more resilient energy system
Minnesota’s e21 Initiative: Developing a 21st Century Electric System

And a regulatory framework that better aligns how utilities earn revenue with customer demands and public policy goals.
## e21’s distinguishing features

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<th>MN e21</th>
<th>NY REV</th>
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<td>Stakeholders via Voluntary Collaboration</td>
<td>Driven By</td>
<td>Regulators via Commission Order</td>
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<td>Fully Regulated</td>
<td>Regulatory Model</td>
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<td>Average Rates</td>
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<td>High Rates</td>
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<td>“Winter is Coming”</td>
<td>Urgency of Action</td>
<td>Urgent Response to Sandy and deferred maintenance</td>
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<td>Preparation</td>
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<td>Primarily Utilities</td>
<td>Means to Achieve Policy Outcomes</td>
<td>Primarily Markets</td>
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Phase I: Toward a Customer-Centric Framework

BEFORE
• “Build More, Sell More”
• Few customer choices

AFTER
• At least a portion of earnings tied to performance
• More customer options
e21 Phase II:
From “Blueprint” to “Building the House”

e21 established three subgroups:

1. Grid Modernization

2. Integrated System Planning

3. Performance-Based Utility Compensation
Looking ahead to Phase III

- Shift from generating ideas to **focus on implementation**
  - Work product will be 1-3 “Innovation Projects” each year
  - Pilots, Projects, Programs that put e21 concepts into practice

- **Increase engagement of regulators** to shorten the distance between good idea and implementation.

- **Increase participation of national experts** to help identify gaps and emerging best practices.

- **Continue multi-interest stakeholder engagement**, and increase consumer advocate participation.
Docket 15-556: Investigation into Grid Modernization

- MPUC staff report
- ICF International report, *Integrated Distribution Planning*
- Action step Q12017
A staged approach is depicted in the diagram, showing the progression from Grid Modernization (Walk) to DER Integration (Jog) to Distributed Markets (Run) over time. The stages include:

- **Grid Modernization (Walk)**
  - Advanced Technology Investments
  - Aging Infrastructure Refresh

- **DER Integration (Jog)**
  - DER Integration & Optimization
  - Dist. Platform Development

- **Distributed Markets (Run)**
  - Multi-party Transactions & Market Operations

The diagram illustrates the evolution of DER (Distributed Energy Resources) adoption and integration over time, highlighting key milestones and phases in the journey towards a more advanced and efficient distribution system.
Minnesota energy policy

Current state

- MN RPS – 25% by 2025 (30% by 2020 for Xcel)
- IOU solar mandate – 1.5%
- Conservation Improvement Program (CIP)
  - IOUs – 1.5% (2% for Xcel)
  - Co-op’s and municipals - .5%

Talk for 2017 session

- MN RPS – 50% by 2030
- CIP – 2.5%
Why do we complain about good weather?

- Legitimate conflicting objectives of generation asset ownership and purchasing to serve load, conflate our strategies, business models
- Generation (and transmission) assets are a hedge in the wholesale market
- Energy services strategy should align with the interests of the consumer

Is a focus on the commodity the right focus?
A shrinking monopoly?

- Convergence of digital technologies provides competitors access to our customers
- Environmental concerns are driving customer behavior
- Technology allows for creation and discovery of new value for consumers
- Reframe the value proposition
What business should we be in?

- Aspire to “trusted energy services supplier and advisor”
- Aspire to “own the home”
- Aspire to providing a “technological ecosystem”
- Serve “tomorrow’s consumer” while partnering with NRG, Google, Best Buy, Amazon, Arcadia, etc
Cooperatives are well positioned!

- Distribution cooperatives owned by consumers
- G&T is owned by distribution cooperatives
- Self-regulated
- Challenge is reconciling the business needs of a wide diversity of cooperatives

Cooperatives can control their destiny
Overview of Great River Energy

- 28 member cooperatives
- 4th largest G&T in nation
- 2015 total revenue – $1.35B
- 2015 load
  - 55.4% residential
  - 1.5% seasonal
  - 43.1% C & I
Future grid objectives

- Get alignment around a shared vision of the future
- Explore the potential for shared technology platforms
Technology roadmap

- Transformational technologies
- Core operations technologies
- Foundational technologies
Already in place

- 700 MHz and fiber network
- Automated vehicle location (AVL)
- Demand response
- Distribution automation
- Distribution system management
- GIS
- Trunked mobile radio
Shared technology platform status

- GIS - ERSI: 27
- DMS - OSI: 16
- Mobile Radio - TMR: 15
- Communications - 700 Mhz: 15
- Backhaul - fiber: 13
- GIS - NISC: 12
- MDMS - NISC: 11
- Customer Portal - NISC: 18
- OMS - NISC: 5

Legend: Evaluating (blue) | Install/Use (red)
Technology platform...

- Opens the door to the possibilities
  - Telecommunication network
  - Automated metering infrastructure (AMI)
  - Demand response management system (DRMS)
  - Meter data management system (MDMS)

- Energy management and distribution management systems
Future grid committee so far...

- Four pillars underway
- Engaged in strategic benchmarking
- Built membership and participation
- Formalized structure and leadership
- Sponsored future grid strategy forum
- Hosted technical workshops
  - Demand response
  - Meter data management
  - AMI
  - Data analytics
Pilot projects underway

- Distribution equipment health assessment (LREC/GRE)
- Grid Ballast DOE demonstration (Connexus/NRECA/GRE/DOE)
- Data analytics (GRE/MVEC/LREC)
- Conservation voltage reduction (CVR) pilot (Connexus/GRE)
- Smart thermostat pilot (Connexus/GRE/EnergyHub)
- Grid-interactive water heater pilot (LREC/GRE)
- More in development

ICE tool

The Interruption Cost Estimator (ICE) is a tool designed for electric reliability planners at utilities, government organizations or other entities that are interested in estimating interruption costs and/or the benefits associated with reliability improvements. It was funded by the Lawrence Berkeley National Laboratory and the Department of Energy and developed by Nexant.
Applied research

- Strategic use of EPRI membership
  - Sponsoring member participation
- Actively seeking partnerships, funding
  - DOE Grid Modernization Laboratory Consortium
  - University of Minnesota
  - Vendors, third-parties
- Developing pilot project structure
  - Business case, deliverables, communication
2017 and beyond

- Education
- Partnerships
- Progress on four pillars
- Separate EMS/DMS
- Rate design committee
- Member support
  - Broadband
  - Distribution planning
In closing

- Making big changes in small steps requires
  - Commitment by GRE
  - Commitment by members

- GRE & members can, and will, write the future together
Sources

- California’s Smart Grid
- Great Plains Institute – e21 initiative
- More Than Smart
- New York Reforming the Energy Vision (REV)
- Smart Grid Consumer Collaborative (SGCC)