Committee on Energy Resources and the Environment
Committee on Energy Resources and the Environment and Task Force on Innovation

Smart Grid Innovation Around the Country

NARUC Summer Policy Summit
Key Technology Trends Impacting Electric Utilities

**Evolving Customer Expectations**

- Distributed Energy Resources
  - Generates need to automate, enhance, and optimize the grid.

**Moore’s Law**

- AMI and Grid Modernization
  - Enables automation and provides data about what’s happening.

**Foundation for Utility Innovation and Enhanced Customer Value**

**Data Science**

- Analytics
  - Find new value and optimization opportunities from the data.

**MCALFE’S Law**

- Enhanced Networks (Grid and Telecom)
  - Being interconnected (electrically and logically) has more value than being silo’d.
The Smart Grid: Catalyst for Innovation and Customer Value

Emerging technologies may create new customer solutions that benefit everyone through a smarter grid.

**Products and Services**
Provide and enable customers with their desired smart, dispatch-ready products and services.

- Green Energy Products
- Smart Devices w/ Demand Response (DR)
- Energy Efficiency (EE)
- Backup Generator
- Other Utility Services
- Battery Storage
- Electric Vehicles (EV)
- Solar (PV)

**Interoperability & Standardization**
Reduces costs and enables better integration, flexibility, and security.

**Internet of Things**
Both customer and utility-owned assets work together to provide data, value, and control.

**Blockchains**
May further facilitate DERs and enable new business models.

Emerging technologies may create new customer solutions that benefit everyone through a smarter grid.
The Value of Distributed Intelligence and Grid–Edge Interoperability Frameworks

Stuart Laval
Viable Distributed Intelligence (DI) Frameworks

DOE PNNL's Grid Architecture 2.0: Laminar Coordination Framework (LCF)

SEPA's Open Field Message Bus (OpenFMB): Internet of Things (IoT) Interoperability Framework

PNNL-25480 (Courtesy of JD Taft)
Available at  http://gridarchitecture.pnnl.gov/

NAESB RMQ.26 Version 3.1
Please contact naesb@naesb.org
OpenFMB & DI: Maximizing Value of Interoperability Maturity

Interoperability Maturity Level

Legend
Business Technology

Open Field Message Bus (OpenFMB)

Value

Evolving Autonomy

Partial Syntactic Semantic Pragmatic Dynamic

Internet Protocol (IP)

IoT Pub/sub Protocols

Listening Translation

Hearing Connectivity

DOE PNNL’s Laminar Coordination Framework

Software-Defined Networking

IEC CIM 61850

Thinking

Situational Awareness

Copyright © 2017 Duke Energy All rights reserved.
Traditional Approach

Conventional deployed assets support a single use case and outcome

Use Cases
- DER Circuit Segment Management
- DER Forecasting
- Volt-Var Management
- Remote Device Configuration

Strategies
- Capacity Management
- DER Management
- Voltage Management
- Utility Operations
Proposed Approach

Distributed Intelligence (DI) deployed assets support multiple use cases and outcomes leading to stacked benefits

Use Cases

1  2  3
4  5  6
7  8  9
10 11 12
13 14 15
16 17 18
19 20 21
22

Strategies

Capacity Management
DER Management
Voltage Management
Utility Operations

Copyright © 2017 Duke Energy  All rights reserved.
Thank You!

For more information contact:

Stuart Laval, Duke Energy
Stuart.Laval@duke-energy.com
Putting Data to Work via Disaggregation
Shishir Saraiya
Head of Data Science
NARUC - July 2017
Energy Disaggregation

- Machine Learning Algorithms
- Leverages AMI data
- Adopted by 25+ utilities
Appliance Fingerprints

Refrigerator
Water Heater
Dryer
Stove
Oven
Electric Heating
Dishwasher
Washing Machine
Our Energy Future:

*Integrated Energy Network*

Anda Ray

SVP, External Relations and Technical Resources

NARUC Energy Resource and Environment (ERE) 2017
San Diego, CA
July 18, 2017
Generation and Storage

Cleaner, More Resilient and Flexible
Energy Resources

All Energy Resources Become More Interdependent

Gas/Oil  Heating  Electricity  Water
Connectivity

Enabled By Advances in Information and Communication Technologies
Customer Driven

5 C’s –

Convenience, Comfort, Choice, Control, Cost-effective
Efficient Electrification

Reduced Emissions, Reduced Cost, Controllable and Convenient
Integrated Electric Grid

Enables Maximum Value From Distributed Resources, Community and Bulk Generation, Efficient Electrification, and Consumer Flexibility
Technology Innovations, Policy, Regulation, Business Models and Market Designs Continue to Evolve to Enable Efficient Transformation
The Integrated Energy Network:
Connecting Customers to Reliable, Safe, Affordable and Cleaner Energy

- Improves Reliability
- Promotes Cleaner Energy and Efficient Electrification
- Provides Economic Efficiencies
- Expands Customer Choice and Enhances Value
Together…Shaping the Future of Electricity
Committee on Energy Resources and the Environment