# Committee on Energy Resources and the Environment

NARUC Summer Policy Summit

# 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.

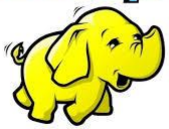
**MOORE'S LAW**

AMI and Grid Modernization

Enables automation and provides data about what's happening.

## Foundation for Utility Innovation and Enhanced Customer Value

hadoop



**DATA SCIENCE**

Analytics

Find new value and optimization opportunities from the data.

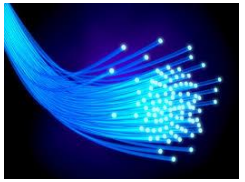
**METCALFE'S LAW**

Enhanced Networks
(Grid and Telecom)

Being interconnected (electrically and logically) has more value than being silo'd.

Wi-Fi

4G LTE



# The Smart Grid: Catalyst for Innovation and Customer Value

## 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)

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

## 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.

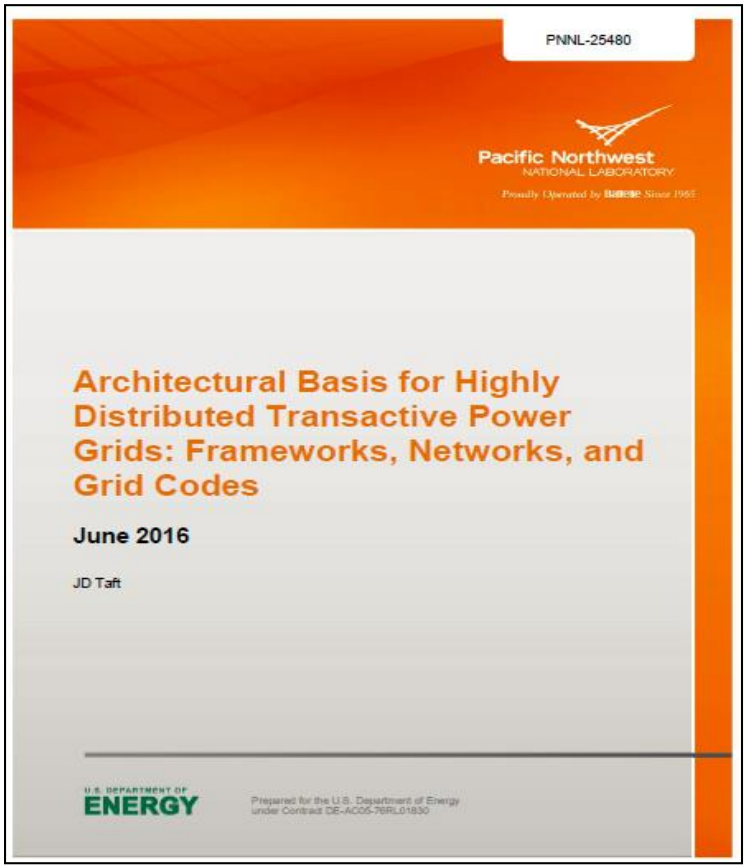
# Duke Energy Emerging Technology Office

# 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)

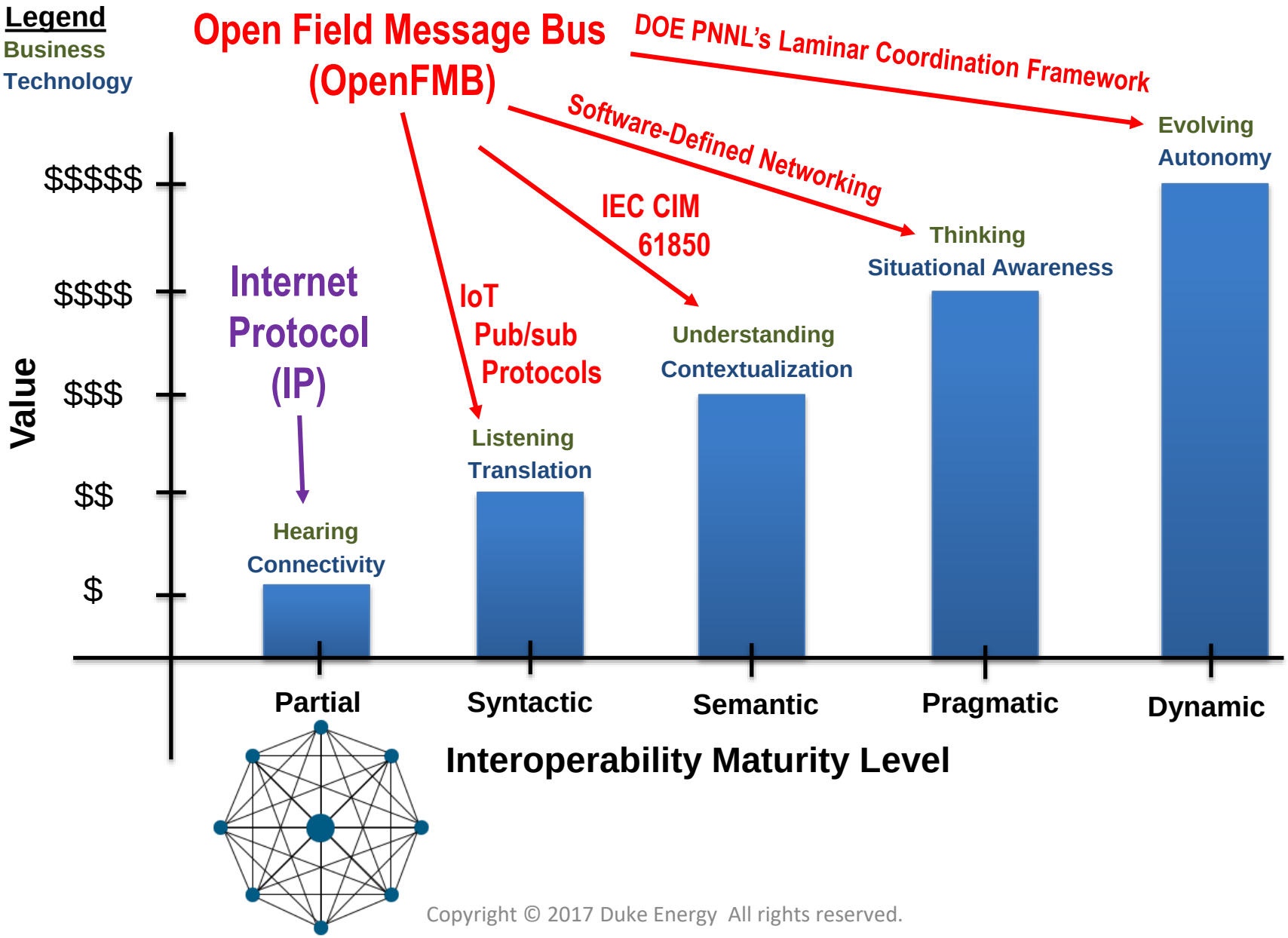



**PNNL-25480 (Courtesy of JD Taft)**
**Available at** http://gridarchitecture.pnnl.gov/

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

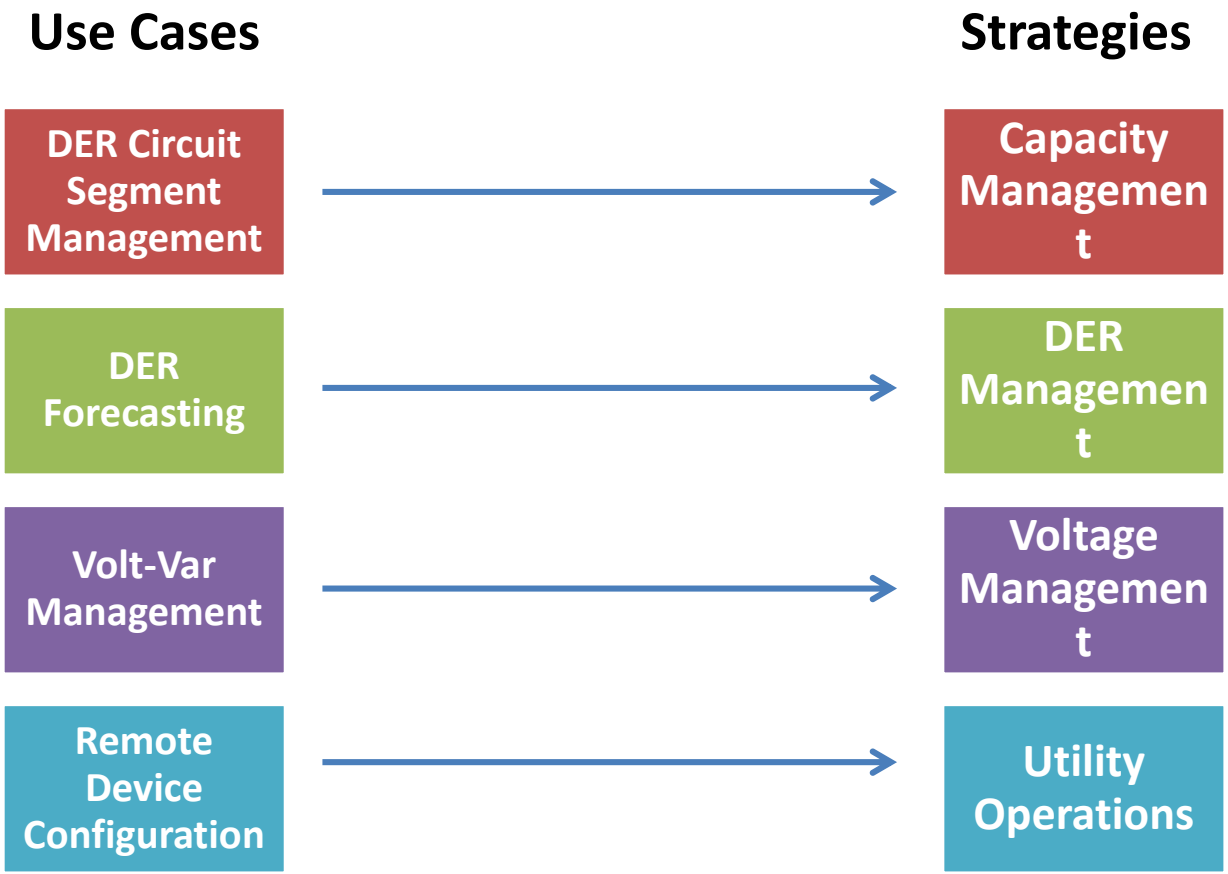

**NAESB RMQ.26 Version 3.1**
**Please contact** naesb@naesb.org

# OpenFMB & DI: Maximizing Value of Interoperability Maturity



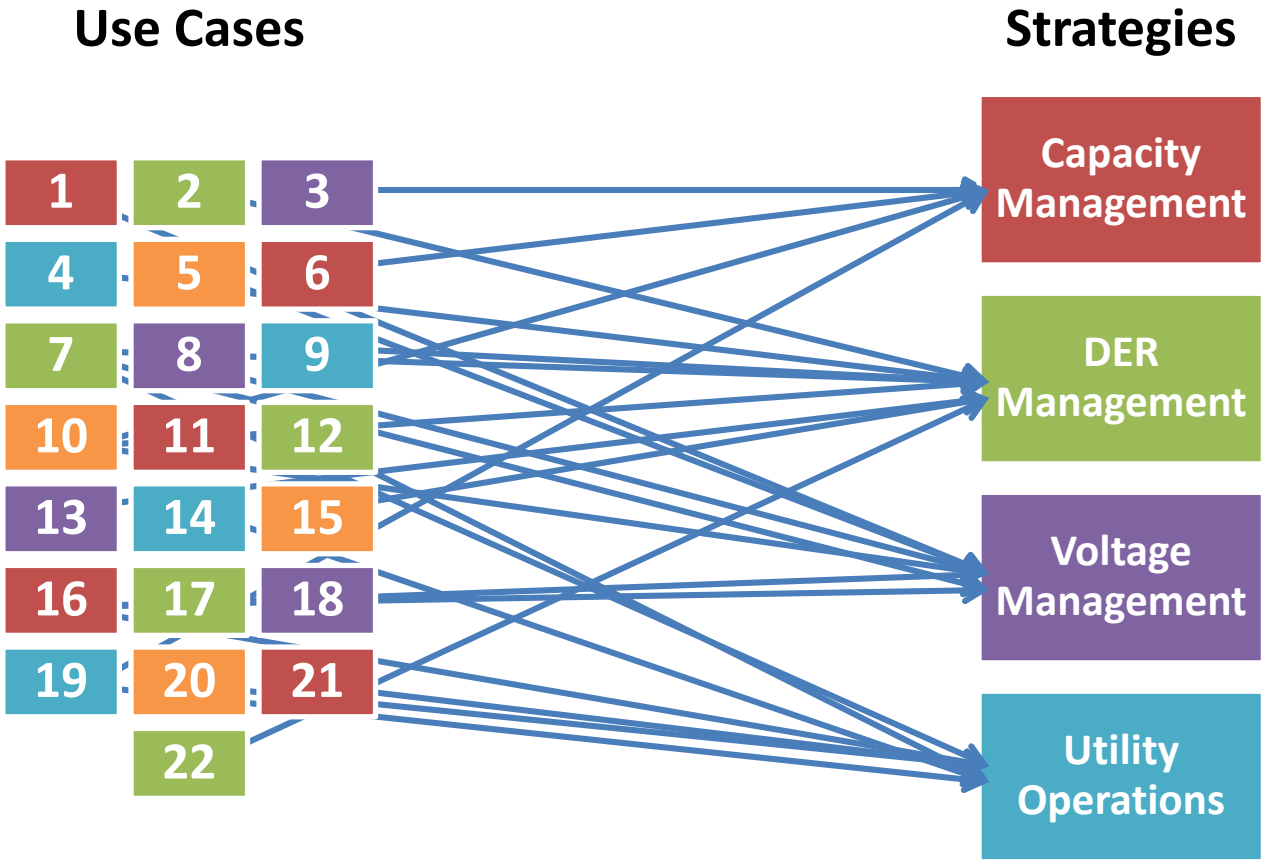
# *Traditional Approach*

*Conventional deployed assets support a single use case and outcome*



# *Proposed Approach*

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



# Thank You!

For more information contact:

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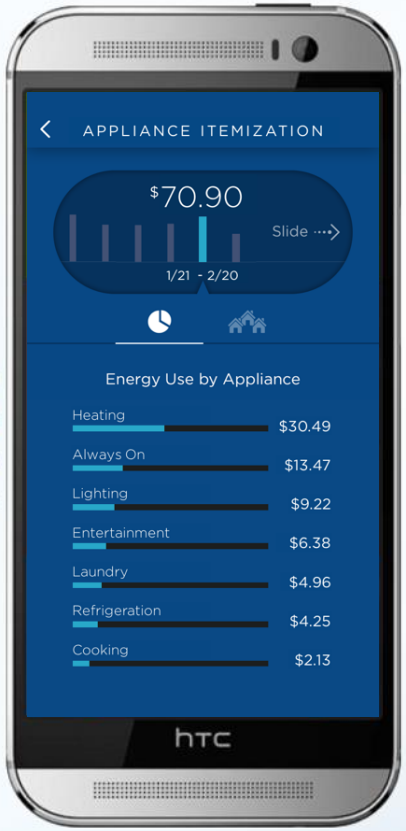
# Putting Data to Work via Disaggregation

Shishir Saraiya

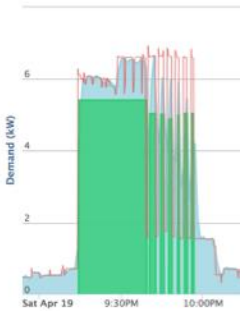
Head of Data Science

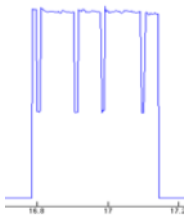
NARUC - July 2017

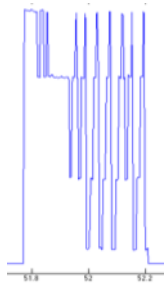
# Energy Disaggregation

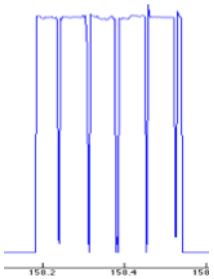


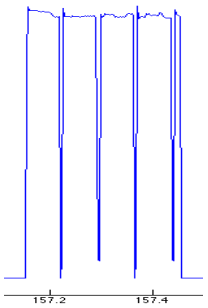

- Machine Learning Algorithms
- Leverages AMI data
- Adopted by 25+ utilities

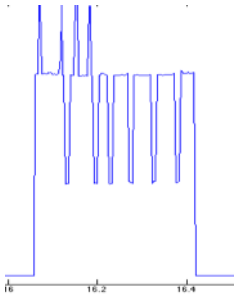


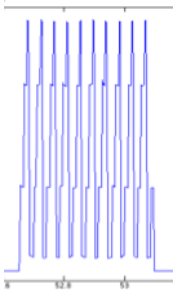





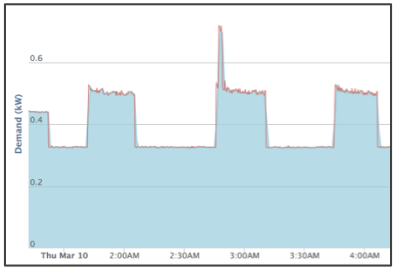




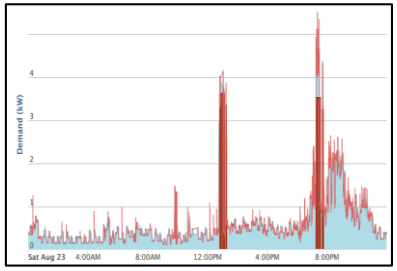





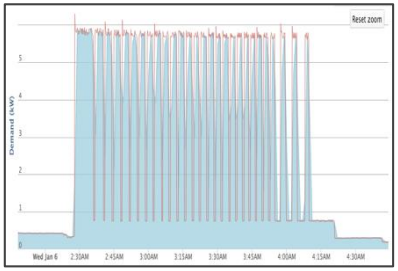
# Appliance Fingerprints



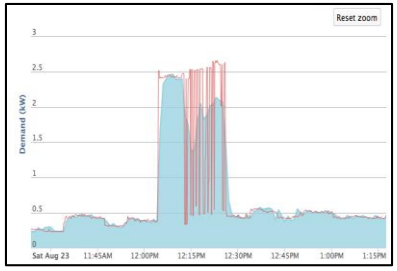

Refrigerator



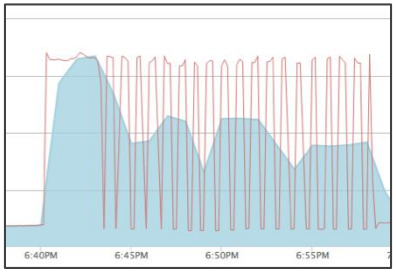

Water Heater



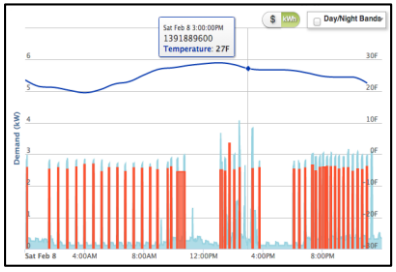

Dryer



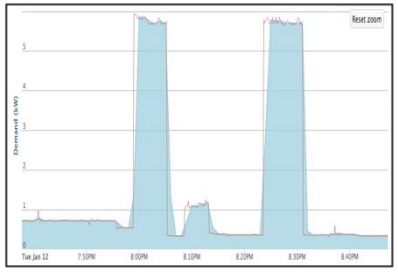

Stove



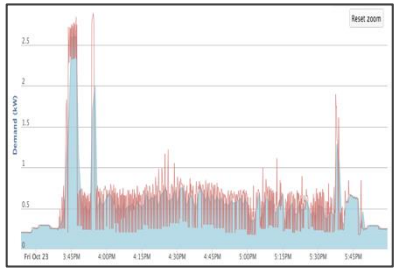

Oven




Electric Heating




Dishwasher




Washing Machine

# Our Energy Future:

# *Integrated Energy Network*

Anda Ray

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

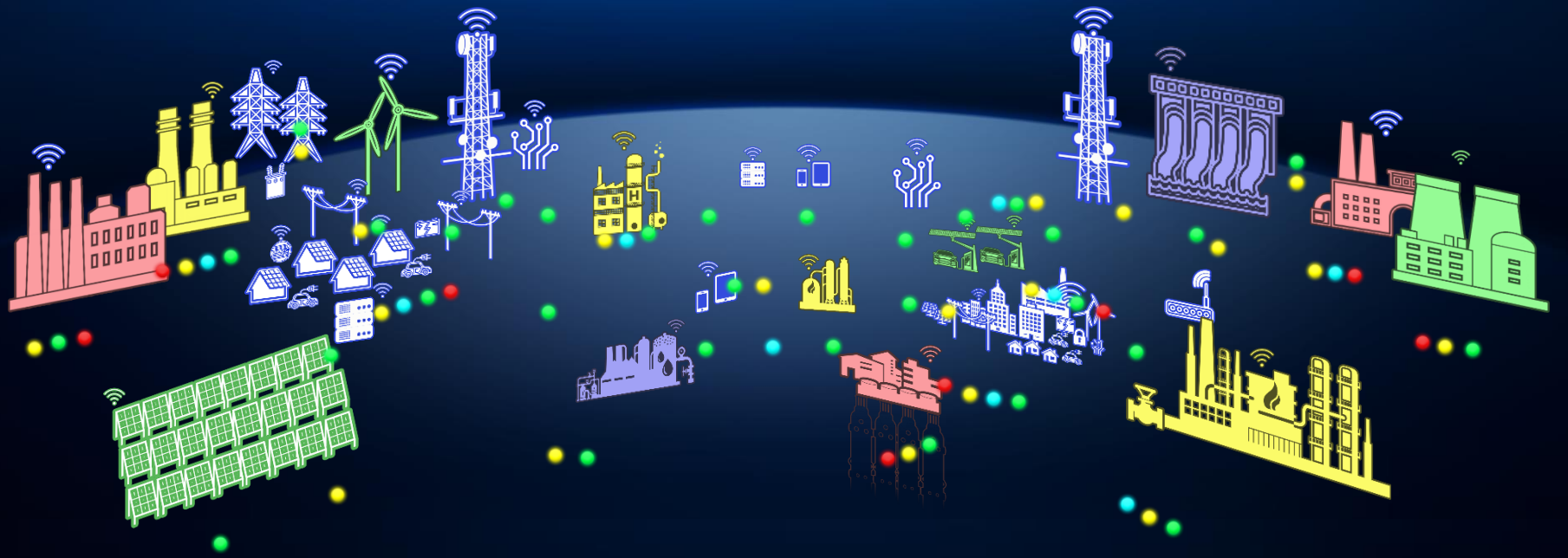
SVP, External Relations and Technical Resources

**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

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