Distributed Energy Resources:
Non-Wires Alternatives – Concepts and Approaches

Bill Kallock, Integral Analytics

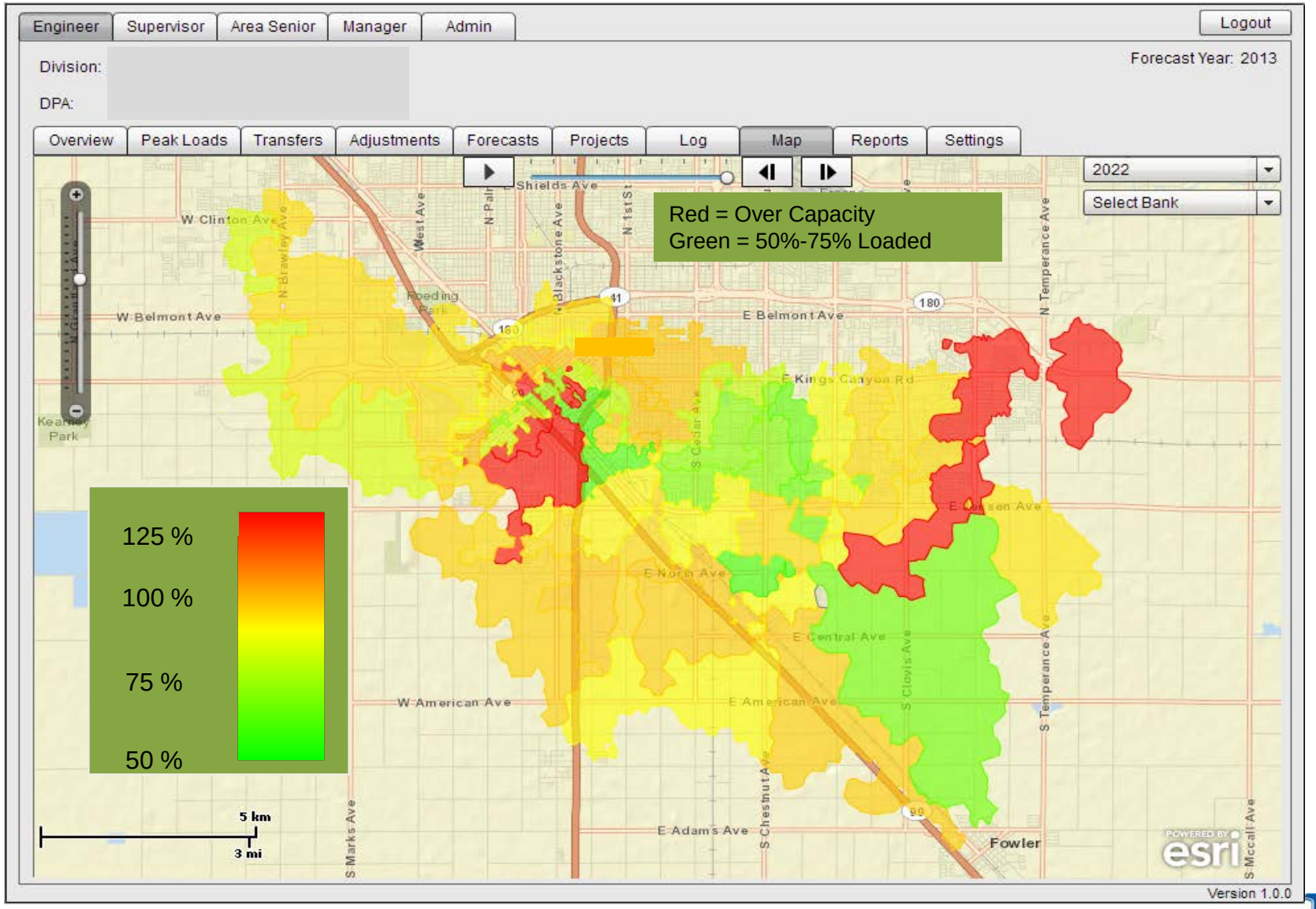
Non-wires Alternatives

Bill Kallock
VP, Customer Operations

NON-WIRES ALTERNATIVES

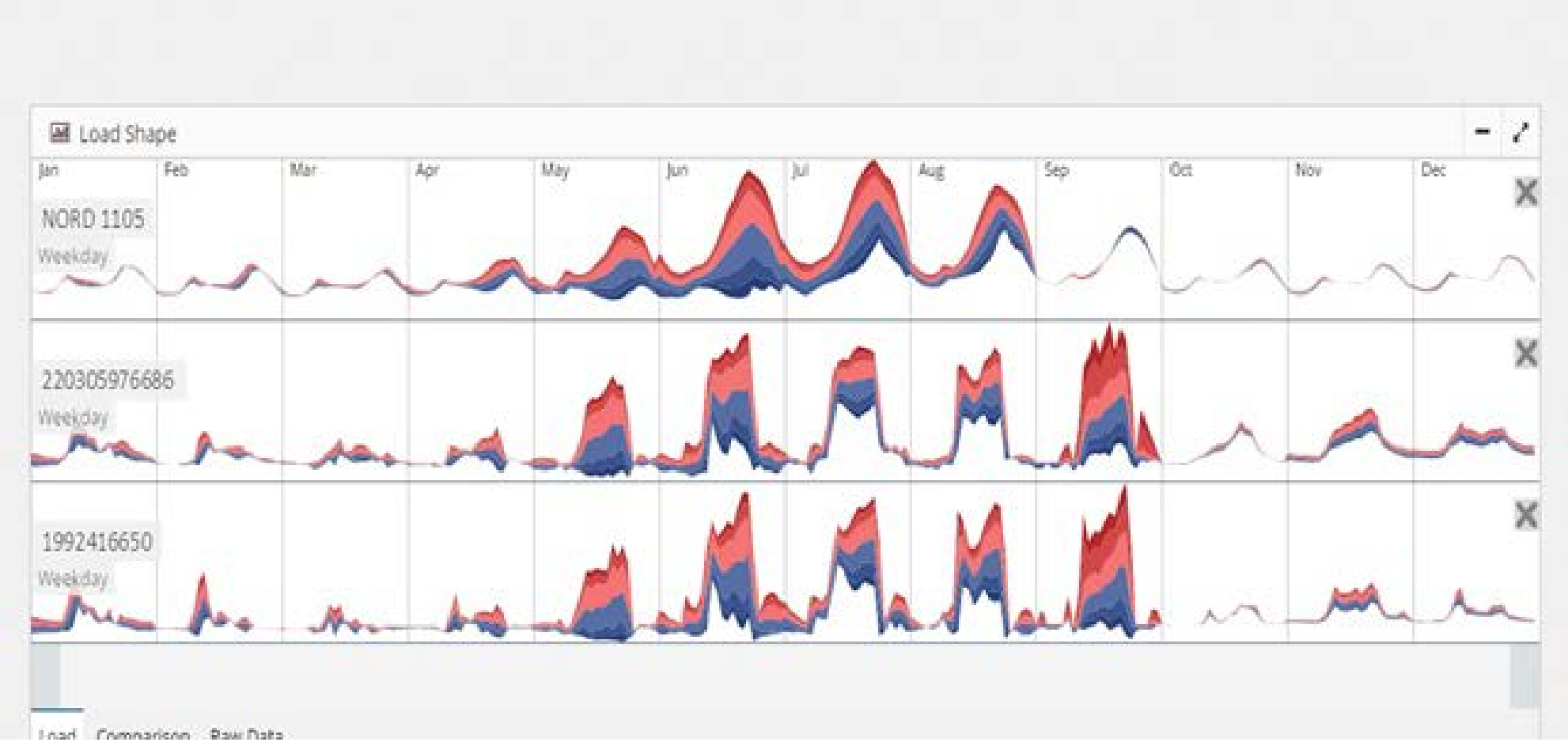
- Defer Capital Investment in Infrastructure
  - Upgrading substation or transformers
  - Reconductoring
- Deployment of Distributed Energy Resources (DER)
  - Energy Efficiency, Demand Response, Distributed Generation (renewables) and energy storage
  - Takes time to deploy
  - 20 year lifetimes
  - **Least-cost DER mix** (locational avoided costs)

WHERE WILL GRID BE CONSTRAINED?

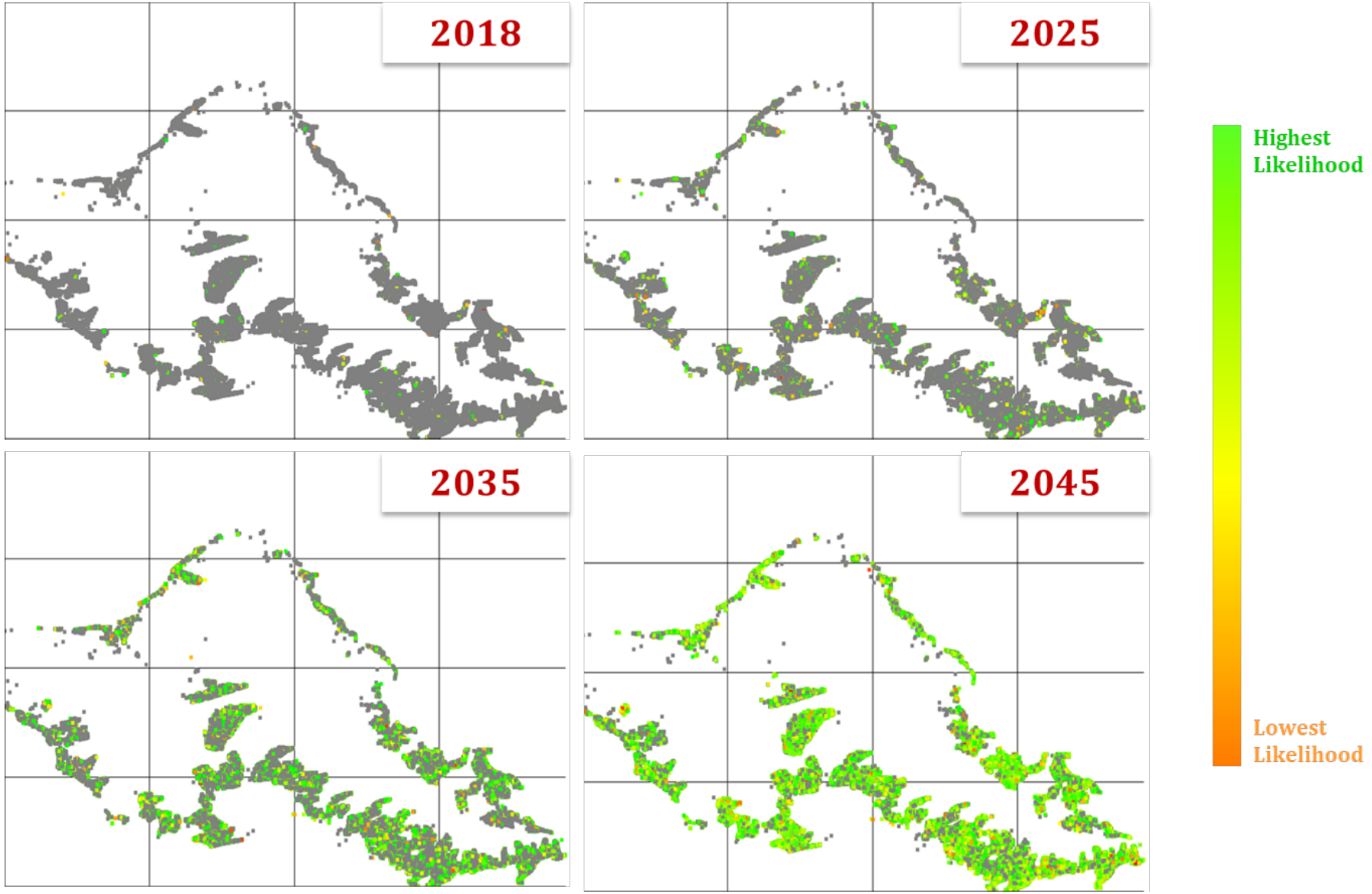


Integral Analytics

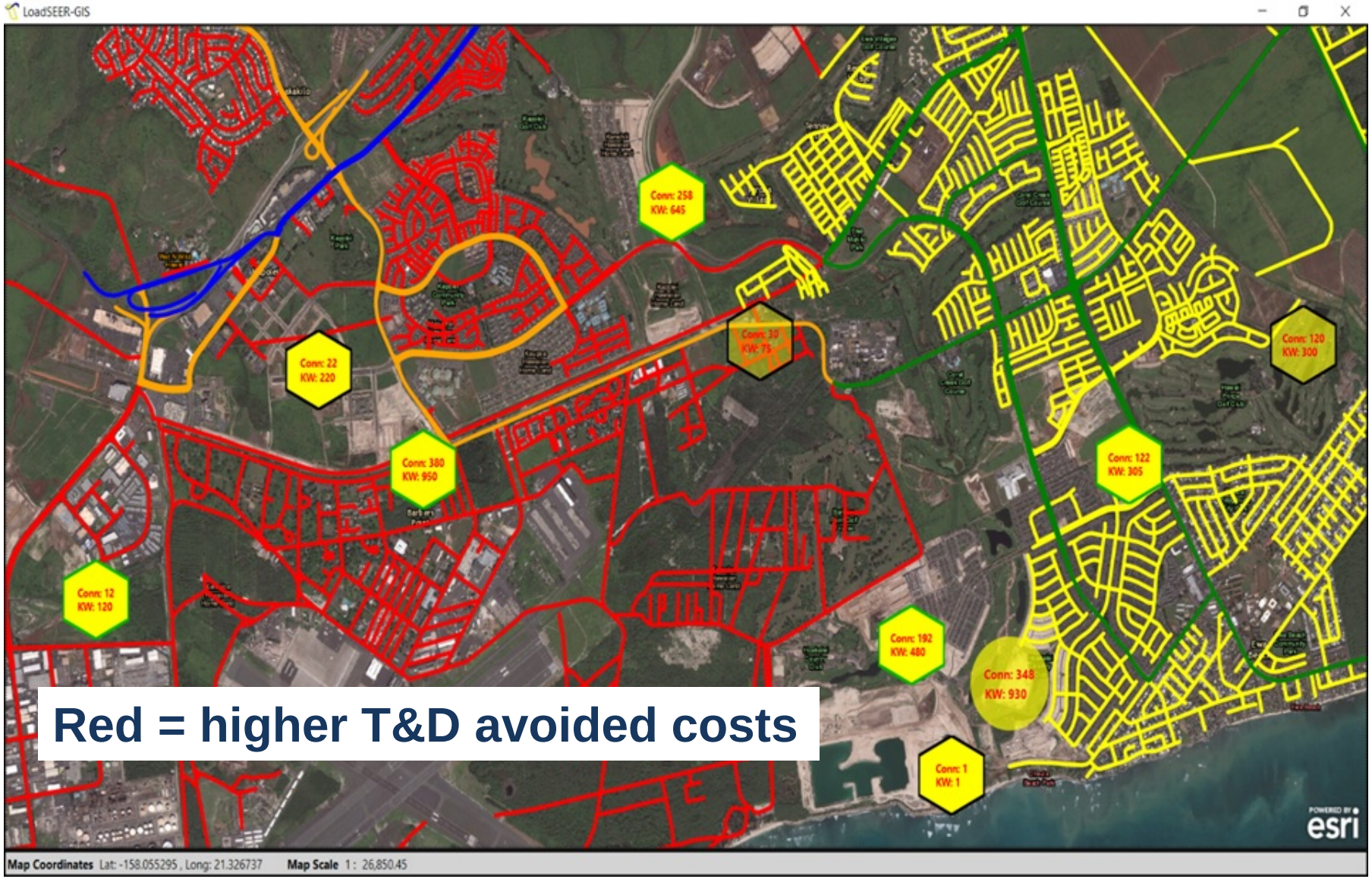
WHAT WILL THE LOADS LOOK LIKE?



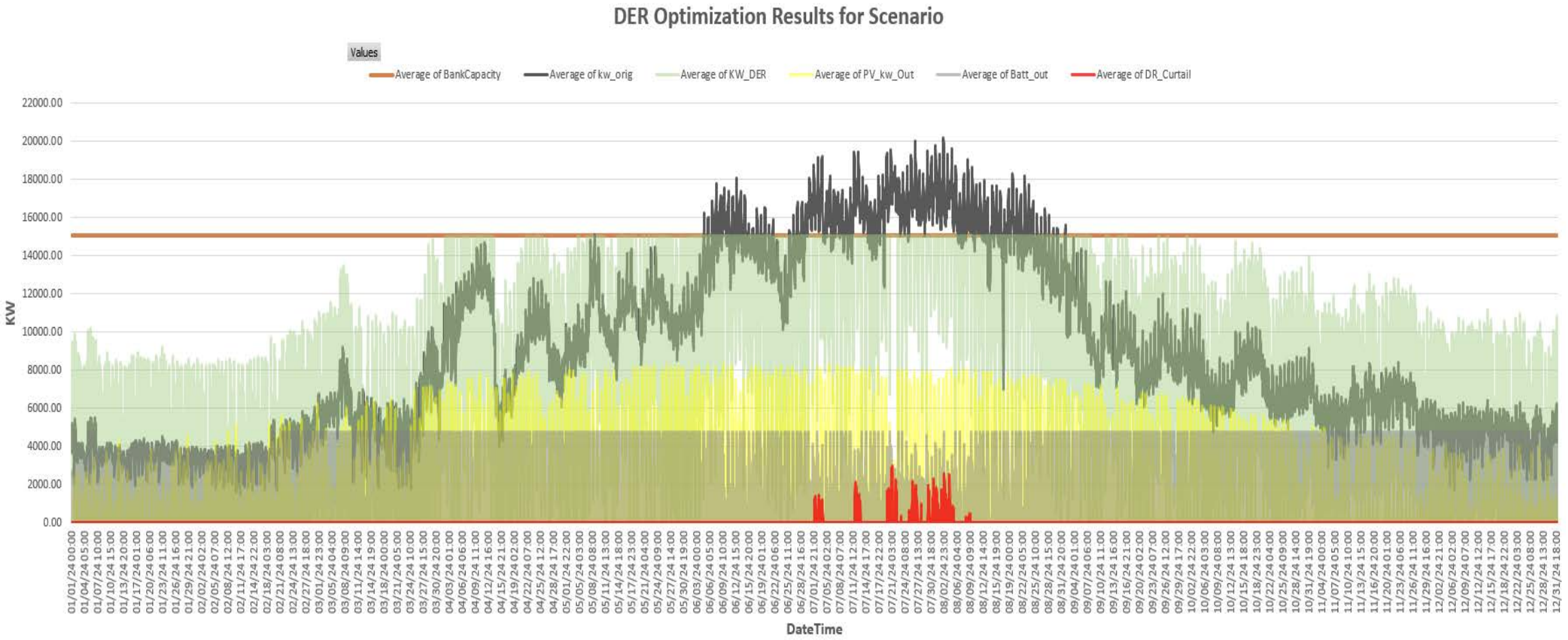
LOAD FORECAST: ELECTRIC VEHICLES



WHICH SPECIFIC FEEDERS WILL BE CONSTRAINED?



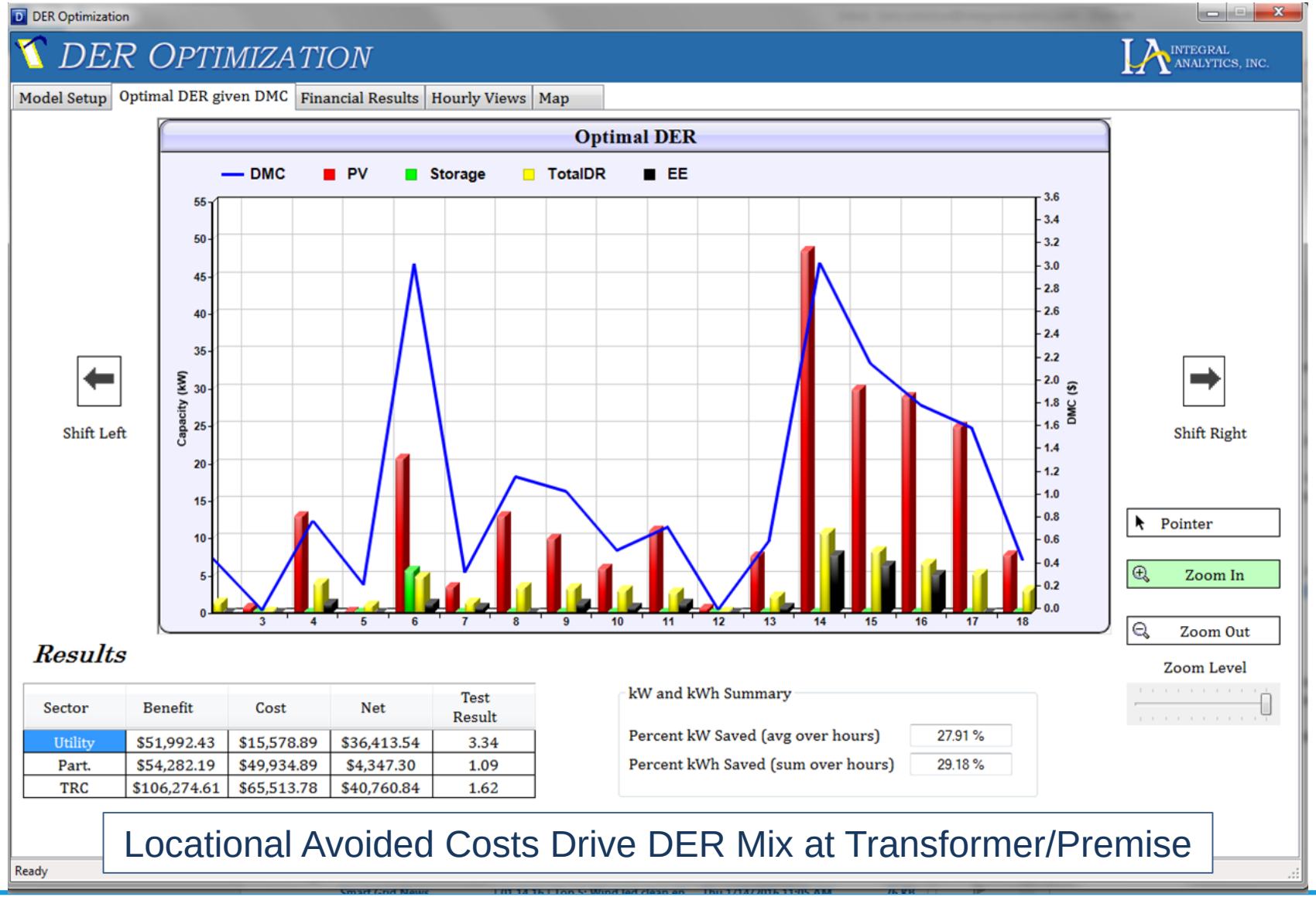
WHAT IS THE LEAST COST DER MIX BY LOCATION?



Simultaneously solve for grid integrity constraints **and** least-cost/economic optimization

INTEGRAL ANALYTICS

OPTIMAL LEAST COST DER MIX: TRANSFORMER



Locational Avoided Costs Drive DER Mix at Transformer/Premise

NON-WIRES ALTERNATIVES SUMMARY

- NWA is least cost planning at the distribution level
- Understand the load
  - Hourly load forecast by location
  - Changes over time 5, 10, 15, and 20 years
- Quantify avoided costs by location and hourly
- Calculate least cost mix of DER
  - Load shapes for each DER
  - Cost of each DER
  - Optimize on TRC for the node (circuit, feeder or premise)

Distributed Energy Resources: Storage – Research Methods, NY Market

Mike Hamilton, Energy Market Innovations
Cynthia Manson, Industrial Economics

Charting New Markets

Adapting Research Methods for the Fast-Evolving Storage Market

2018 NEEP EM&V Annual Meeting – Nashua, New Hampshire

Presented By:

EMI Consulting
Michael Hamilton

Industrial Economics
Cynthia Manson

8 May 2018

The Truth About Researching Emerging Technology Markets

"If there's one constant, it's that things are going to change"

…and sometimes our tried and true methods are just … too … slow

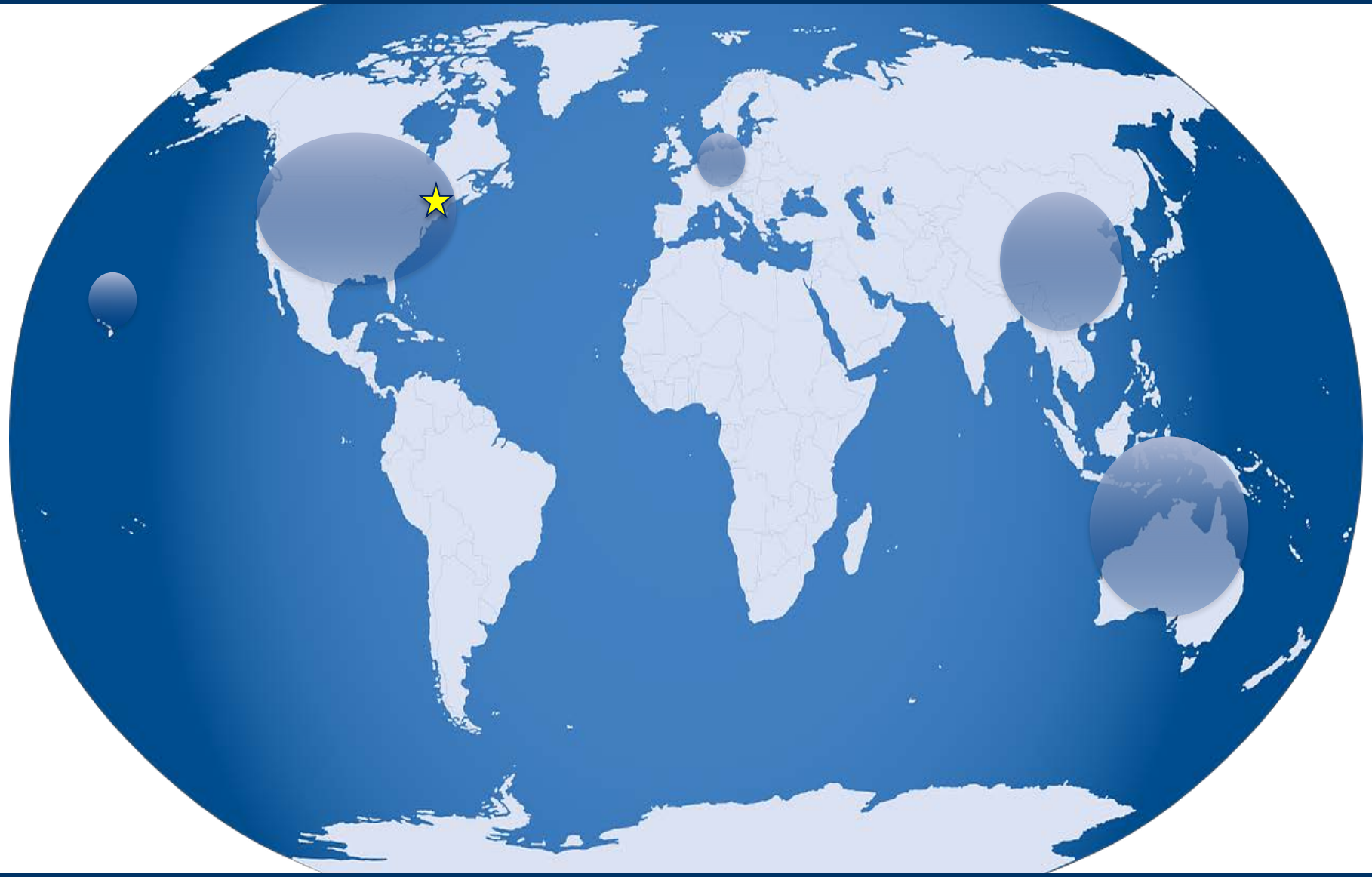
…and we're probably going to get it (somewhat) wrong

Three Take-aways

1. Evaluation of a consortium vs. R&D program
   Pay attention to WHO (not just WHAT) is happening
2. Market characterization with disparate sources
   Consistent classification; up-level when necessary
3. Economic forecasting in fast-changing market
   Use forecasting as a tool to support rapid evaluation

THE SITUATION

The Global Situation



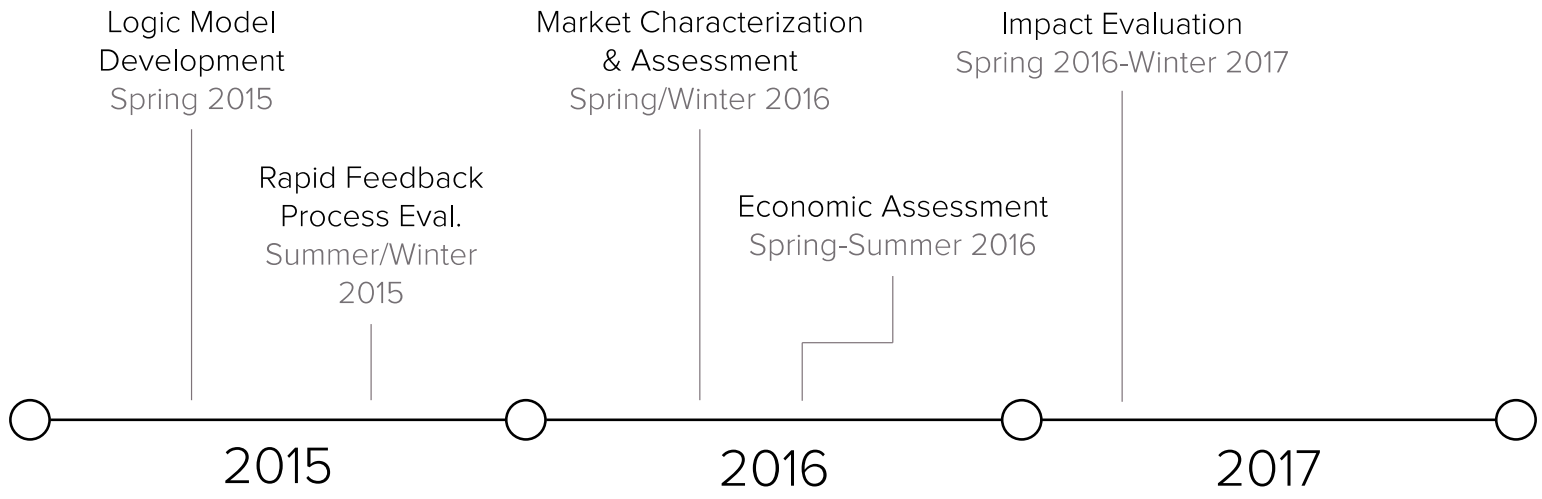
The New York State Situation

New York State Energy Storage

2012		2015
$598 million	→	$908 million
2,990 jobs		3,931 jobs

Program Evaluation Design

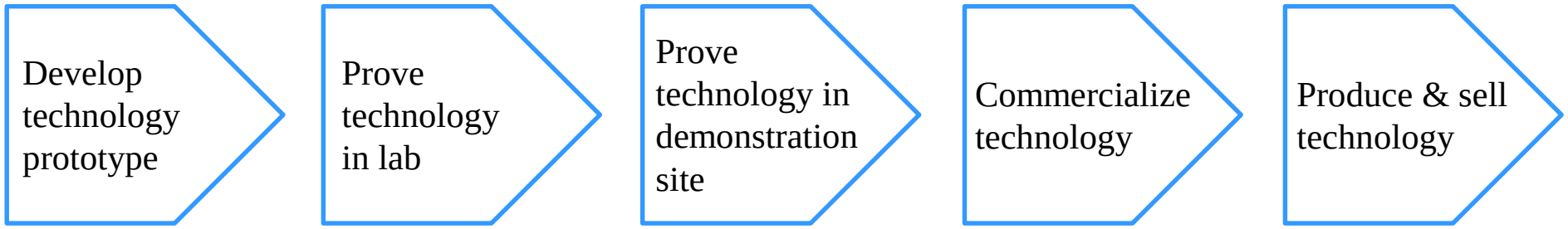
- Program evaluation design that seems fairly straightforward on the surface, but has some important modifications…



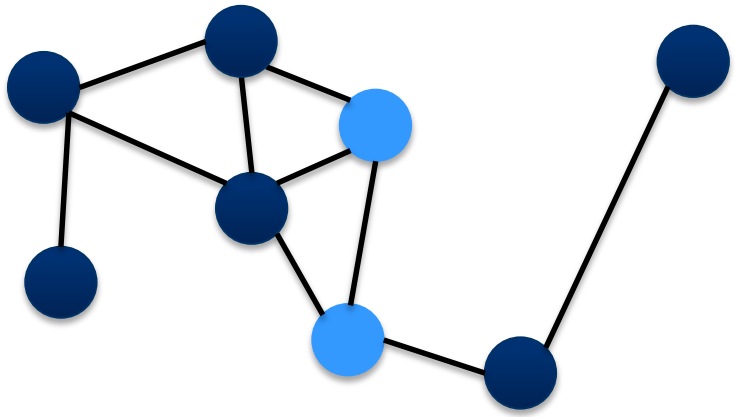
EVALUATION OF A CONSORTIUM VS. R&D PROGRAM

DIFFERENCES
It's About "Who," not just "What" is happening

R&D Project



Consortium



Market Transformation

- Invention
- Partnership
- Investment
- Supply chain connection
- Production
- New Applications
- Policy changes

ADAPTATION
Broaden the Goals and Metrics

R&D Program

- Accumulation of individual project effects
- Technology Readiness Level (TRL)
- kWh savings potential

NY-BEST Consortium

- Strength of network and new market connections
- Self-sustaining organization
- Regulatory barriers fall
- Economic benefits for New York State

MARKET CHARACTERIZATION WITH DISPARATE SOURCES

Traditional vs. Emerging Markets

Traditional Market

- Use well-defined data sources (e.g., ENERGY STAR sales data)
- Tether to agreed-upon classifications and terminology
- Monitor incremental market changes

Emerging Technology Market

- Gather disjointed data sources across multiple sectors
- Navigate evolving classifications & terminology with different meaning across sectors
- Track market information with a short life span

ADAPTATION
Anchor Sources, Clarify Terms, & Update Often

Too broad (usually) → **Just right! (mostly)** ← *Too specific (sometimes)*

Grid (Electricity) Storage	Behind-the-meter	Residential Energy Storage
		Commercial Energy Storage
	Front-of-the-meter	Energy Storage on the Grid
		Community Energy Storage
	Controls	Energy Storage Management Systems

ECONOMIC FORECASTING IN A FAST-CHANGING MARKET

CHALLENGE
Dealing with Immediate Obsolescence

2016 Economic Analysis for NYSERDA

- Assessed supply-side energy storage market in New York State
  - Employment
  - Revenue
- Measured progress from 2012 baseline
  - Validated/refined original 2012 method
- Considered key sources of uncertainty

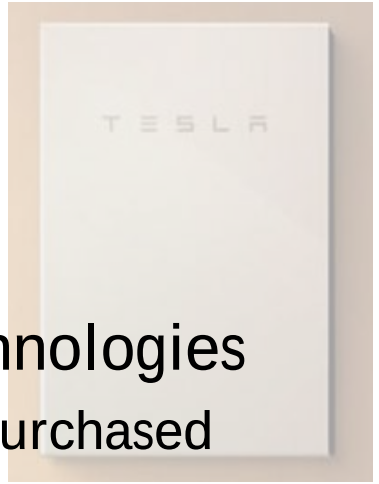
Requirement

Flexible tool to help program assess progress and identify/explore market shifts

ADAPTATION
Model of Two Markets

Traditional Market

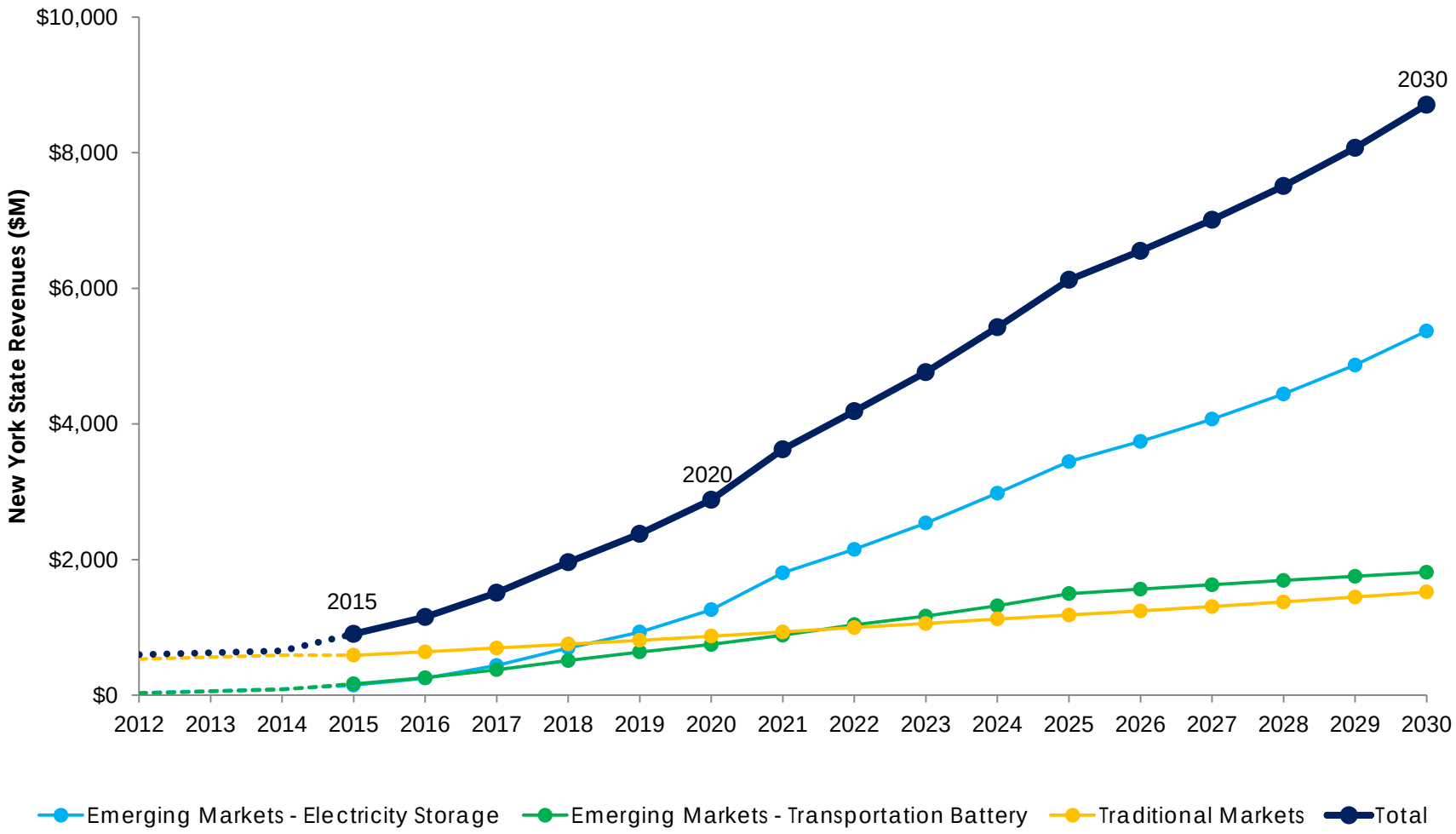
- "Bottom up" data from NY BEST members, Census
- Advantage: direct



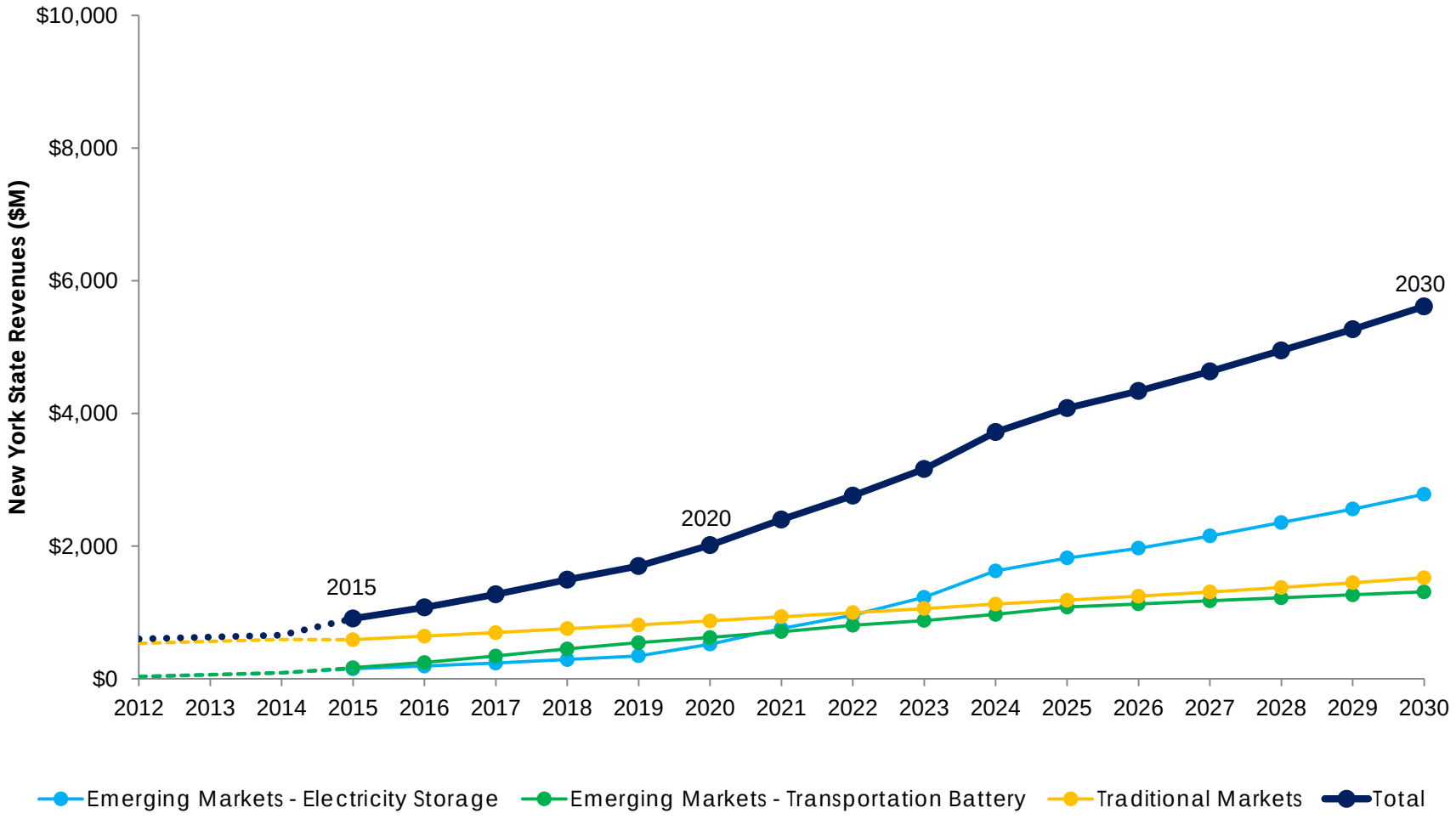
Emerging Technologies

- "Top down" purchased data
- Extrapolated from global, North American markets
- Advantage: simple.
- Disadvantage: unverifiable. Requires careful validation

Results, and Updates



Results, and Updates



What's Happened Since?

Key Retrospective Advantage: Modular Flexibility

- Model sub-sectors separately
- Can demonstrate effect of sub-sector-specific shocks on broader market
  - Employment
  - Revenue

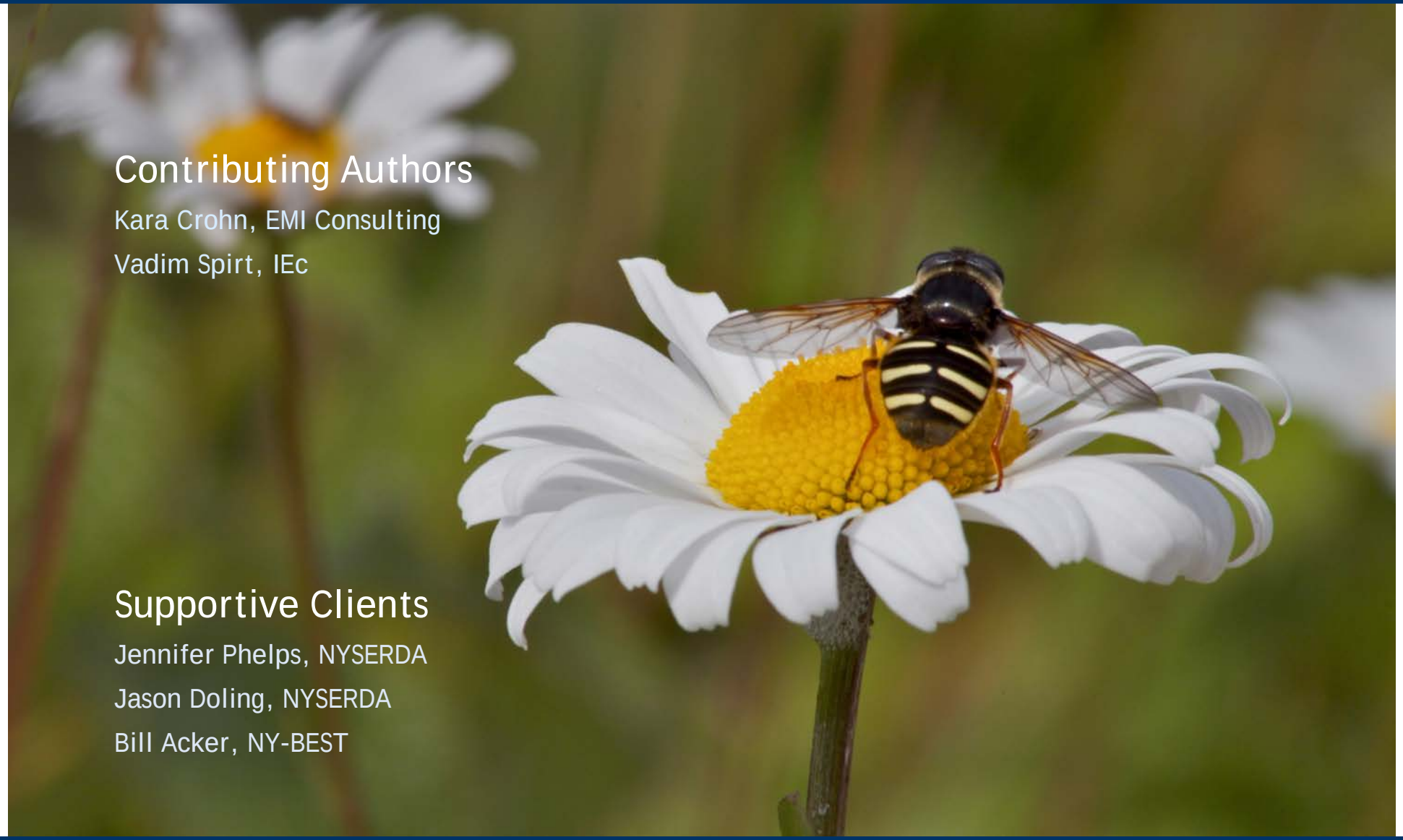
Example Recent Impacts

- Optimism for residential storage growth (EnergySage)
- Lebanon, NH solar+storage pilot
- Data availability less regular – more tied to specific developments

CONCLUSIONS
The Future Hasn't Happened Yet

- Good news:
  - New York's energy storage market is (still) poised for rapid growth.
- Bad news:
  - We're almost certainly wrong about how much.
- Evaluation of a consortium vs. R&D program:
  - Assess underlying social network
  - Assess external market forces
- Strength of economic forecasting in evaluation:
  - Ability to update quickly (real time evaluation)
  - Ability to run sensitivity analyses (strategy)

Questions?



Contributing Authors

Kara Crohn, EMI Consulting

Vadim Spirt, IEc

Supportive Clients

Jennifer Phelps, NYSERDA

Jason Doling, NYSERDA

Bill Acker, NY-BEST

Distributed Energy Resources: Power Sector Transformation & DR in Rhode Island

Carrie Gill, RI OER

Power Sector Transformation (PST) & Demand Response in Rhode Island

Carrie A. Gill, Ph.D.
Rhode Island Office of Energy Resources
2018 NEEP EM&V Fall Forum
May 8, 2018

STATE OF RHODE ISLAND
OFFICE OF ENERGY RESOURCES

March 2017 – Governor requests state agencies develop PST recommendations

November 2017 – PST report released

November 2017 – National Grid files rate case and PST proposals

September 2018 – Rate case and PST decisions by RI Public Utilities Commission

3 Benefits of Modernizing the RI Electric Grid

Give customers more energy choices.

Clean energy technologies are **more affordable now than ever**. Our utility rules should allow consumers to access and enjoy creative solutions to manage their energy production and use.

Build a flexible grid to integrate more clean energy.

The Governor's goal of **1,000 megawatts of clean energy by 2020** will bolster our growing local clean jobs economy and help us meet state climate goals.

Control the long-term costs of the electric system.

Today's electric grid is built for peak usage. That's like constructing a **100-lane highway for Thanksgiving traffic**. New technology provides us with more ways to right-size the system to Rhode Islanders' needs.

March 2017 – Governor requests state agencies develop PST recommendations

November 2017 – PST report released

November 2017 – National Grid files rate case and PST proposals

September 2018 – Rate case and PST decisions by RI Public Utilities Commission

March 2017 – Governor requests state agencies develop PST recommendations

November 2017 – PST report released

November 2017 – National Grid files rate case and PST proposals

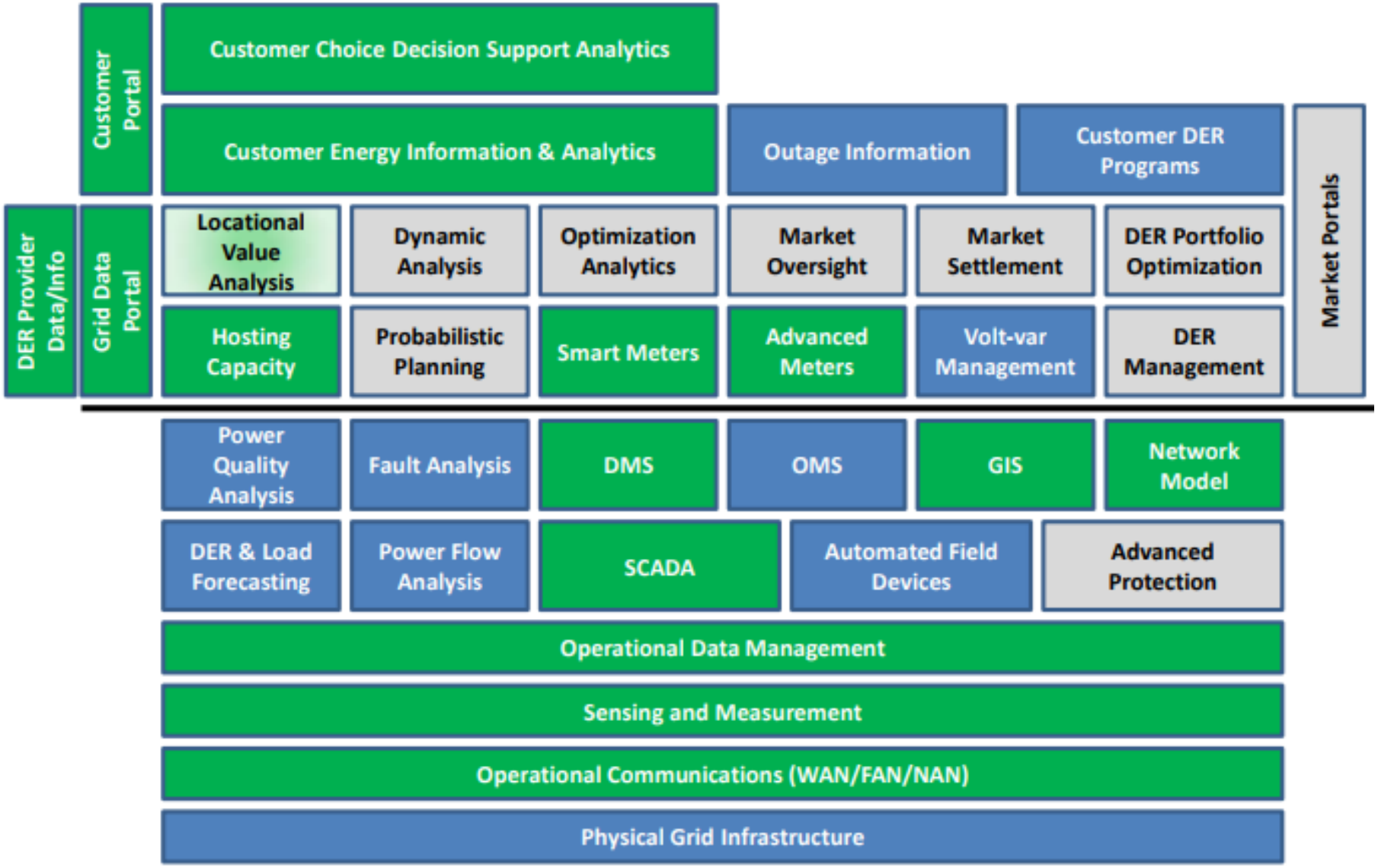
September 2018 – Rate case and PST decisions by RI Public Utilities Commission

National Grid Rate Case and PST Proposals

- Grid Modernization
- Advanced Metering Functionality (AMF)
- Performance Incentive Mechanisms (PIMs)
- Program Initiatives
  - Electric transportation
  - Electric heat
  - Energy storage
  - Low income/Solar
  - *Demand response*

Grid Modernization Project Proposals

Applications

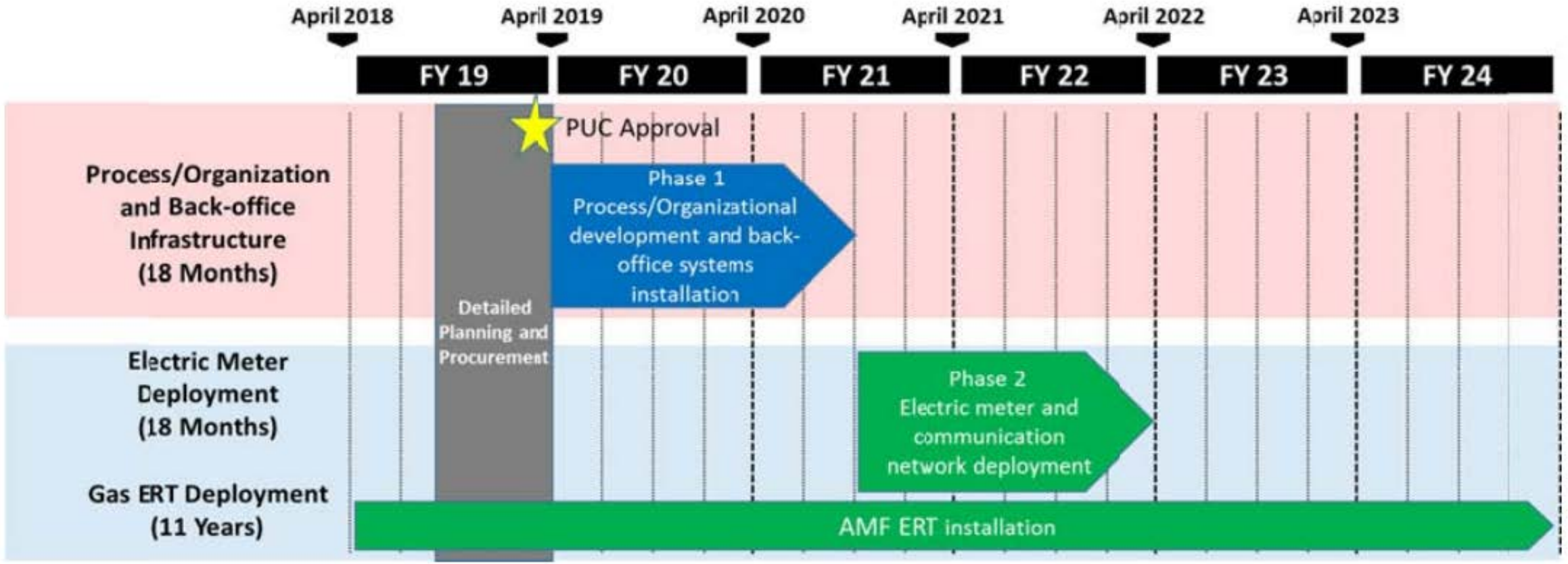


Core Components

- Existing Capability
- PST Enhancement Area
- Potential Area of Focus

Advanced Metering Functionality (AMF)

Proposed Timeline for Deployment



Performance Incentive Mechanisms (PIMs)

Proposed PIMs

Category and Supporting Metrics	2019	2020	2021
System Efficiency	**23.5**	**23.5**	**23.5**
Monthly Transmission Peak Demand Reduction	3	3	3
Forward Capacity Market Peak Demand Reduction	18	18	18
EV Off-Peak Charging Rebate Participation	2.5	2.5	2.5
Distributed Energy Resources	**29.5**	**29.5**	**29.5**
DG-Friendly Substation Transformers	10	10	10
DR -- Connected Solutions Participation	5	5	5
DR -- C&I Participation	5	5	5
Electric Heat Initiative	2	2	2
Electric Vehicles	3.5	3.5	3.5
Behind-the-Meter Storage	2	2	2
Utility-Owned Storage	2	2	2
Network Support Services	**22**	**22**	**22**
VVO Pilot Impacts	2	2	2
AMF Customer Engagement and Deployment	2	2	2
Interconnection -- Time to ISA	6	6	6
Interconnection -- Avg days to system modification	6	6	6
Interconnection -- Estimated vs actual costs	6	6	6
Total	**75**	**75**	**75**

Ongoing and Proposed Demand Response

+ 2018: Explore small business direct load control DR

+ Regional: ISO-NE FCM DR Program

+ Proposed: Off-peak EV charging rebate pilot program

+ Future Proposal: DR through rate structure

Technology-agnostic PIMs

Connected Solutions = controllable wifi thermostats

C&I DR = offers customers monthly incentives

Category and Supporting Metrics
System Efficiency
Monthly Transmission Peak Demand Reduction
Forward Capacity Market Peak Demand Reduction
EV Off-Peak Charging Rebate Participation
Distributed Energy Resources
DG-Friendly Substation Transformers
DR -- Connected Solutions Participation
DR -- C&I Participation
Electric Heat Initiative
Electric Vehicles
Behind-the-Meter Storage
Utility-Owned Storage
Network Support Services
VVO Pilot Impacts
AMF Customer Engagement and Deployment
Interconnection -- Time to ISA
Interconnection -- Avg days to system modification
Interconnection -- Estimated vs actual costs
Total

www.ripuc.org
PST – docket 4780

www.energy.ri.gov/electric-gas/future-grid/
PST Overview

Danny.Musher@energy.ri.gov
OER's PST Expert

Carrie A. Gill, Ph.D.
Rhode Island Office of Energy Resources
Carrie.Gill@energy.ri.gov

STATE OF RHODE ISLAND
OFFICE OF
ENERGY RESOURCES