California
Energy Commission
Research & Development

Increasing Reliability and Resiliency with Microgrids

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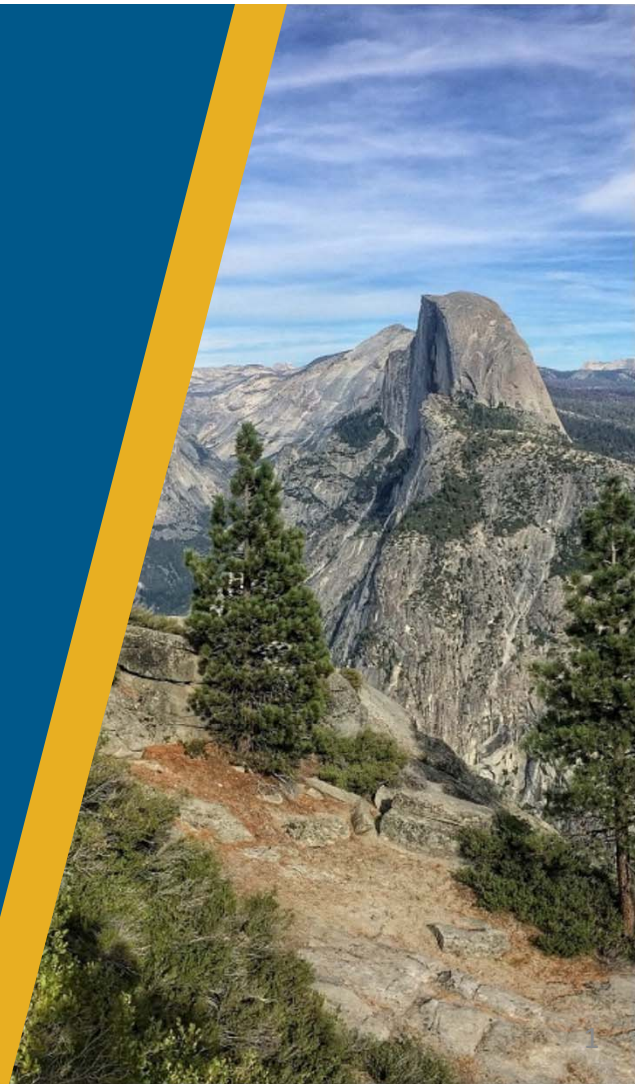
BayREN March Forum
March 27, 2018



Topics

- Policy Context
- Microgrid Roadmap Update
  - Microgrid Basics
  - Why Microgrids are Important to California
  - Key Issues Facing Commercialization
- Microgrid Demonstration Examples in the Bay Area

Climate & Energy Goals

- California's pursuit of a low-carbon future will hit a critical milestone in 2030.
  - The Clean Energy and Pollution Reduction Act (SB 350) sets targets for energy efficiency and renewable generation for 2030.
  - SB 32 updated the Global Warming Solutions Act to require GHG reductions of 40 percent below 1990 levels by 2030.
- To reach these targets, the pace of technological progress in the energy sector will need to increase exponentially.
- California's leaders are developing and implementing policies to create the needed "market pull" for clean energy technologies.

GHG Reductions Require Significant Energy System Transformation

Progressive GHG and Renewable Portfolio Goals

- Intermittent Renewables vs Dispatchable Generation
- Increased Distributed vs Central Station Generation
- Predictable vs Transactive Loads
- Incorporating Two-way Distribution Flow
- Maximizing Electric/Alt. Fuel vs Gasoline/Diesel
- Electrification of Industry, Commercial, Residential

Addressing Climate Risk, Resiliency, Safety, Costs, and Aging Infrastructure

Microgrid Roadmap

Joint effort:

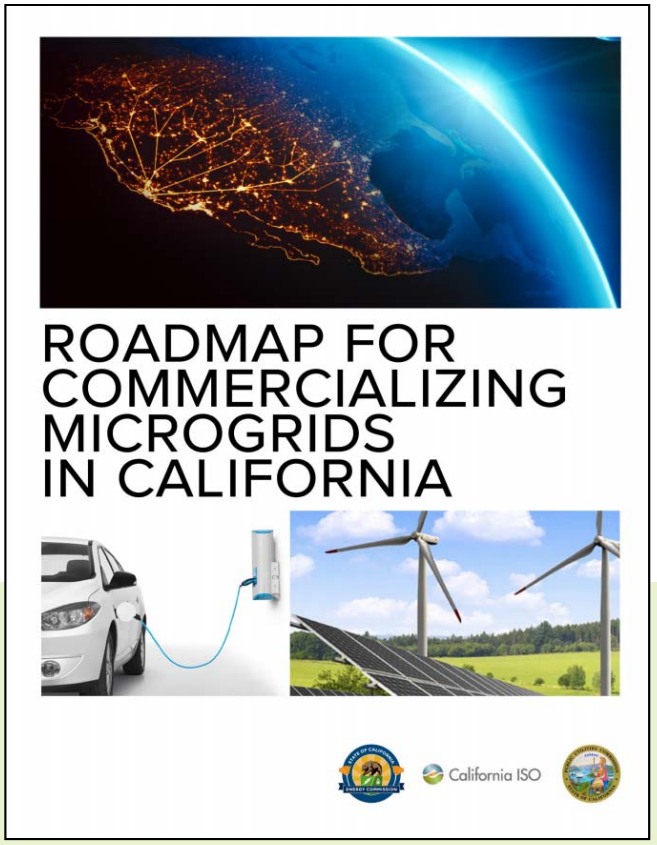
- California Energy Commission
- California Public Utilities Commission
- California Independent Systems Operator

Microgrids have the potential to provide benefits to both the grid and the end-user

Challenges remain to broad implementation of microgrids

Roadmap provides a strategy to address those challenges

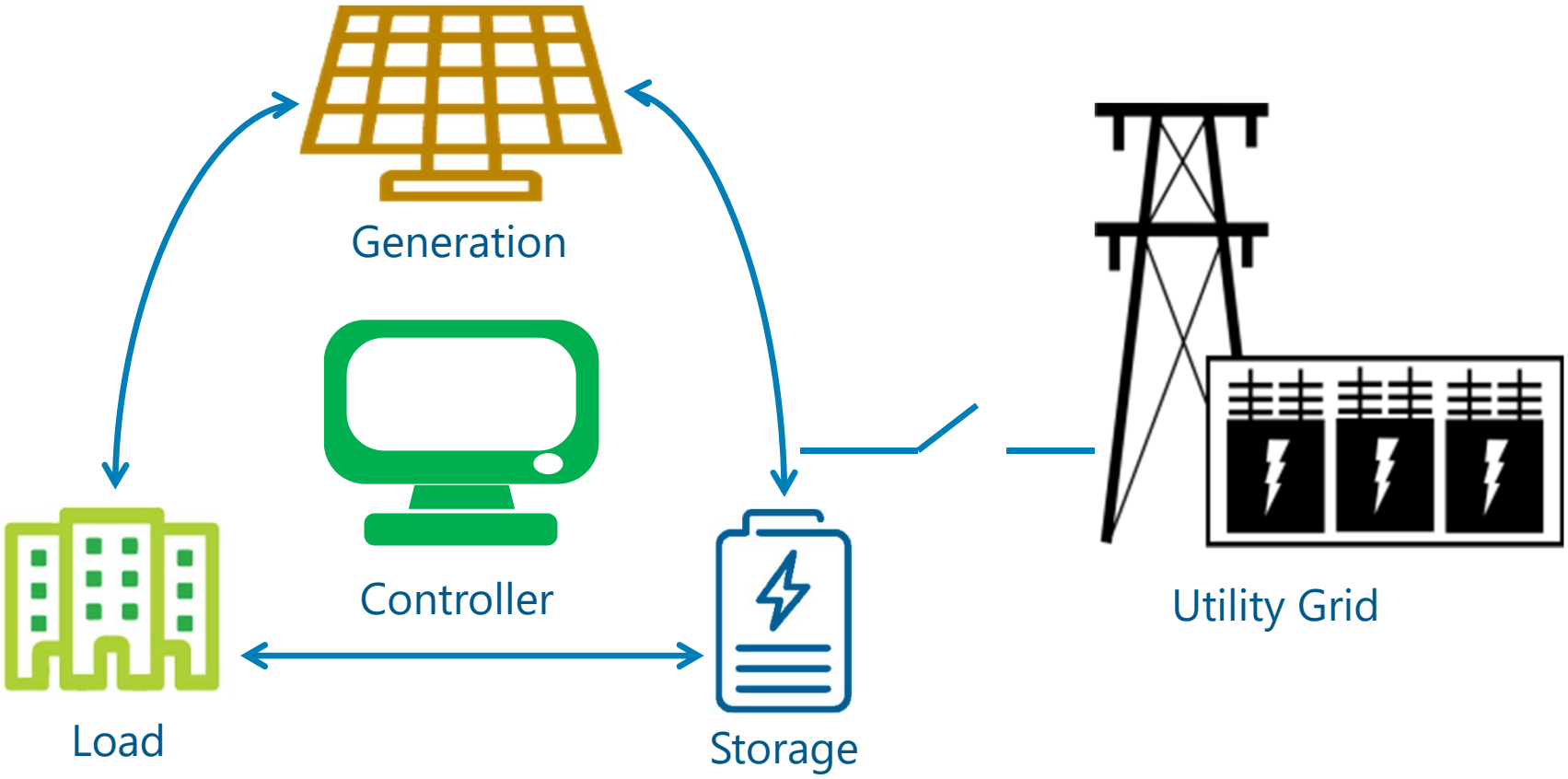
Expected release: April/May 2018



Microgrid Basics

A group of interconnected loads and distributed energy resources (DER) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. Additionally, a microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode. Finally, microgrids can also manage customer critical resources and provide the customers, utilities and grid system operators different levels of critical services and support as needed.

Microgrid Basics



Microgrid Benefits

- Flexibility for integrating multiple DER technologies
- Resilience and reliability in the event of disconnect from the grid
- Ancillary grid services between microgrid and main grid
- Bill savings/demand charge abatement

Integrating Distributed Energy Resources

Load

Lighting
HVAC
Plug Loads
IoT
Demand Response

Generation

Solar PV
Wind
Geothermal
Biomass

Storage

Li-ion Battery
Flywheel
Flow Battery
Pumped Hydro
Compressed Air

Resilience and Reliability

- Increasing concern on reliability in the face of natural disasters
- Islanding capability allows for operation of connected facilities when disconnected from the grid
  - Communities often prioritize critical facilities: fire stations, hospitals, community centers
- Duration of island will depend on generation capacity, storage capacity, and load

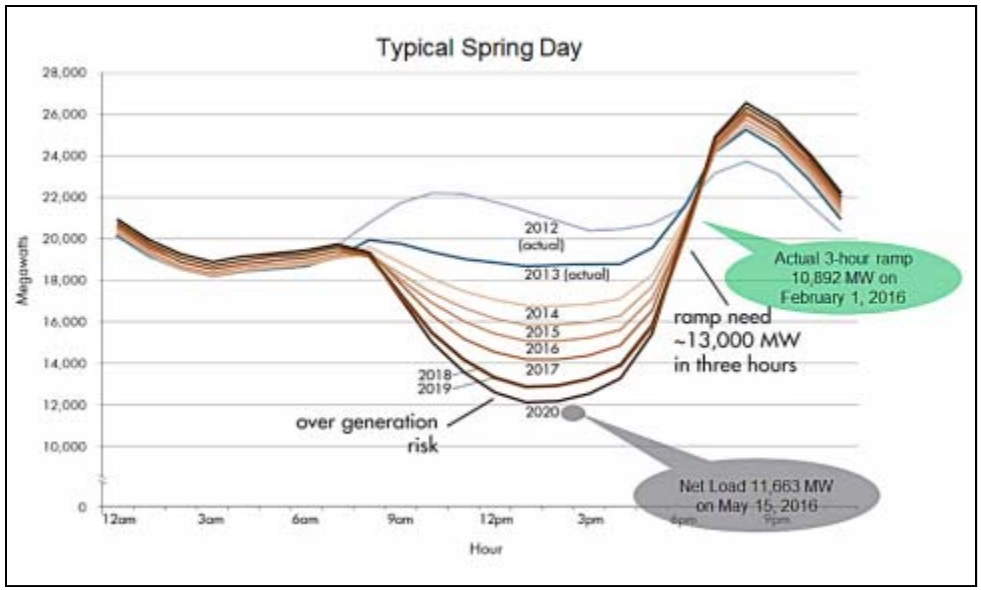
Supporting the Grid

Renewable resources increasingly satisfy the state's electricity demand

Grid conditions are continuously changing

Grid reliability requires flexible resource capabilities

Microgrids can help provide the needed flexibility



Reducing Energy Costs

- Integration of multiple DERs allow greater offset of onsite load
- Microgrid providing utility grid support can be a revenue stream
- Avoid need for new transmission/generation infrastructure

Microgrid Challenges

- Technical Challenges
  - Recognized state and national standards for key functions provided by microgrids
  - Standardized designs
  - Software models to provide analysis and comparison of different microgrid configurations
  - Training materials for installation, maintenance, and operation
  - Cybersecurity

Microgrid Challenges

- Economic Challenges
  - An expensive proposition
  - Clear and understandable business cases/revenue streams
  - How to value resiliency and reliability
  - Departing load/standby charges
  - Financing models
  - Owner/operator models

Going Forward

CEC:

- Demonstrate microgrid planning, installation, and operation across various use-cases
- Fund technical research to address current regulatory issues facing microgrid deployments
- Develop and validate new benefit metrics for system resiliency
- Develop a relevant and feasible cyber security controls framework within which microgrids can be deployed and operate

Going Forward

CPUC/CAISO:

- Clarify the microgrid participation rules and requirements to provide true multiple applications for new revenue streams.
- Clarify the requirements under which microgrids can participate in wholesale markets
- Define the role of microgrids in future grid management with higher concentrations of DER

Microgrid Demonstrations

Electric Program Investment Charge

- EPIC was established by the CPUC in 2011 to address a critical gap in California's clean energy policy.
- EPIC provides ~ $162 million annually for projects to advance new technologies that will benefit electric ratepayers in PG&E, SCE and SDG&E service territories.
  - The Energy Commission administers 80% of the funding.
    - The three utilities collectively administer 20%.
      - SB 350 provides additional direction to the CEC in its administration of EPIC funding.

Microgrid Solicitation (2014)

Demonstrating Secure, Reliable Microgrids and Grid-linked Electric Vehicles to Build Resilient, Low-carbon Facilities and Communities

Released July 2014
Funds Available: $26.5 million

Solicitation Goals
Demonstrate the reliable integration of energy efficient demand-side resources, distributed clean energy generation, and smart grid components to enable energy-smart community development

10 projects funded


PROGRAM OPPORTUNITY NOTICE

DEMONSTRATING SECURE, RELIABLE MICROGRIDS AND GRID-LINKED ELECTRIC VEHICLES TO BUILD RESILIENT, LOW-CARBON FACILITIES AND COMMUNITIES

PON-14-301
http://www.energy.ca.gov/contracts/index.html
State of California
California Energy Commission
July 2014

Microgrid Demonstrations

Location: Richmond, CA
Grant Amount: $4.8m
Host Site: Kaiser Permanente Hospital

- 250 kW solar PV on garage roof
- 1 mWh battery storage
- Microgrid Controller developed by Charge Bliss

Microgrid Demonstrations

Location: Fremont, CA
Grant Amount: $1.8m
Host Site: Fire Stations (3)

- 25 – 55 kW solar PV carports
- 95 – 100 kWh battery energy storage system
- Cloud-based predictive distributed energy resource management software, developed by Grid Scape

Microgrid Demonstrations

Location: Livermore, CA
Grant Amount: $1.5m
Host Site: Las Positas Community College

- 2.35 MW solar PV
- 100 kW/500 kWh vanadium flow battery
- Large-scale thermal energy storage
- Software integration provided by Geli

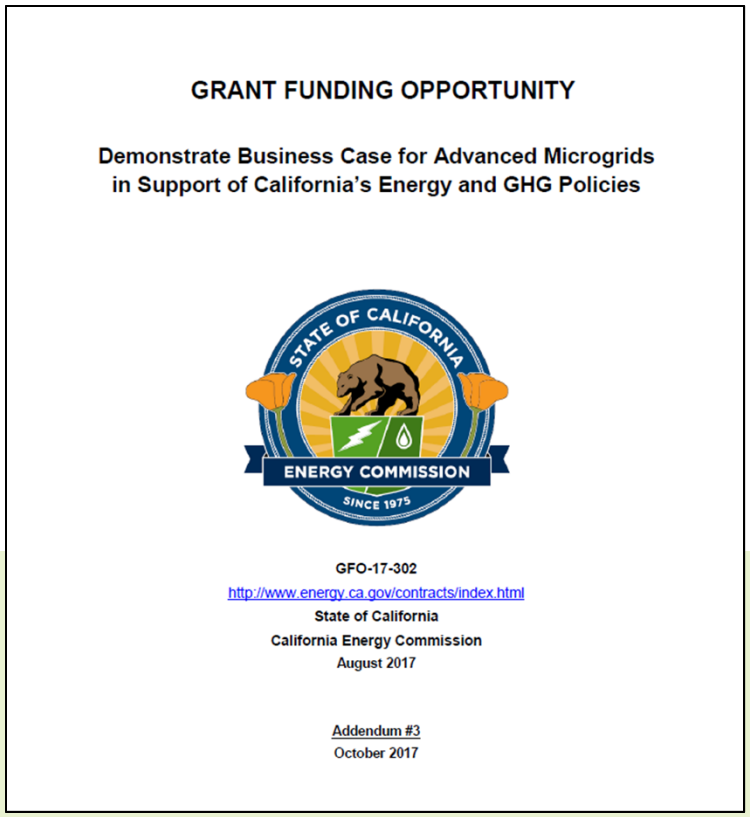
Advanced Energy Communities

The EPIC Challenge: Accelerating the Deployment of Advanced Energy Communities

Released: November 2015
Available Funding: $48 million

Two phase competition to develop innovative ways to plan and develop community-scale DER projects.

12 projects funded



GRANT FUNDING OPPORTUNITY

Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies

GFO-17-302
http://www.energy.ca.gov/contracts/index.html
State of California
California Energy Commission
August 2017

Addendum #3
October 2017

Advanced Energy Communities

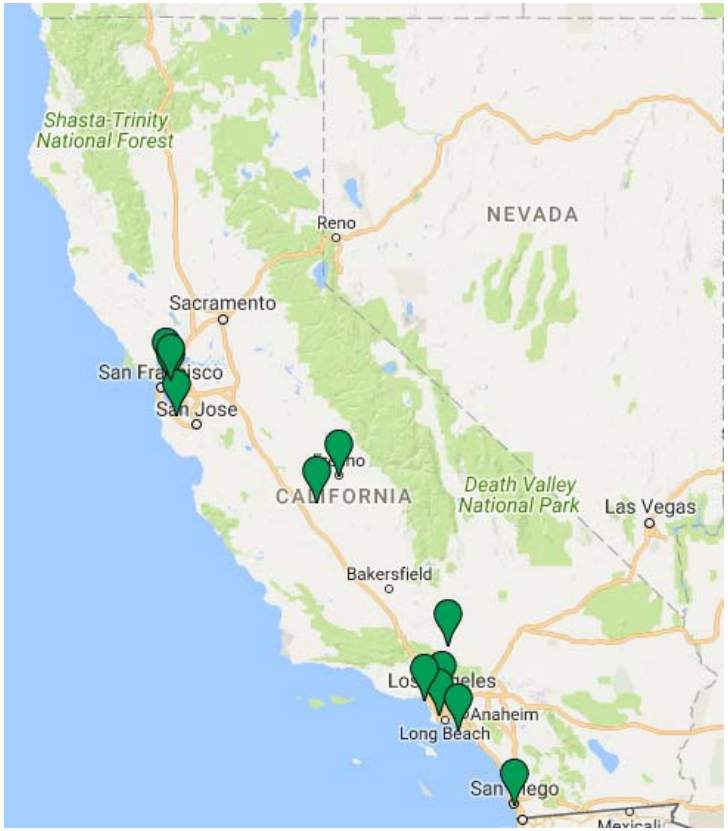
Statewide effort to support local governments with planning, permitting, and financing of Advanced Energy Communities

Phase I:

- Help local governments develop clean energy plans, regulations, and codes for community-scale developments
- A real-world concept for an Advanced Energy Community

Phase II:

- Build-out of the most promising designs and plans to demonstrate execution of plans



Microgrid Solicitation (2017)

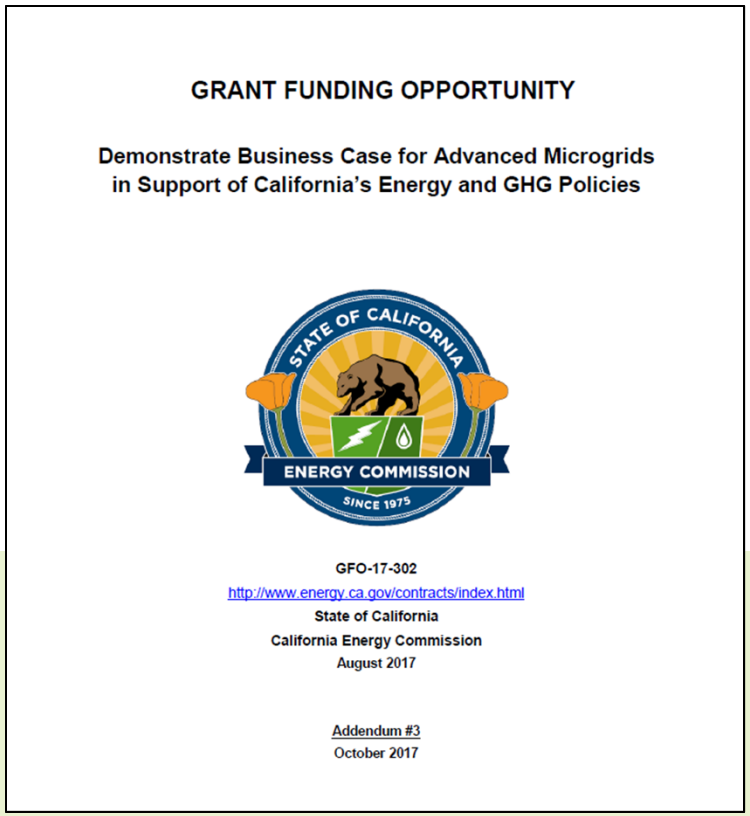
Demonstrate Business Case for Advanced Microgrids in Support of California's Energy and GHG Policies

Released: August 2017
Available Funding: $44.7 million

Identify opportunities to:

- Standardized microgrid configurations that are easily repeatable
- Defined methodologies to measure and quantify the benefits

9 projects funded



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Microgrid Solicitation (2017)

Grant Recipient	Project Title	Site Location	Energy Commission Grant Amount
Gridscape Solutions, Inc.	Commercializing Virtual Wide Area Urban Microgrids for Grid Resilience & Disaster Readiness	Fremont, CA	$5 million
Lawrence Berkeley National Lab	Power Begins at Home – R2M2 Resilient Replicable Modular Microgrids: Assured Energy Security for Military Bases	Dublin, CA	$5 million
Sonoma County Junior College District/ Santa Rosa Junior College	Santa Rosa Junior College Urban Microgrid Project	Sonoma, CA	$5 million

Takeaways

Microgrid Benefits:

- Help integrate multiple DER technologies into a single system – supporting state energy policy
- Provide valuable services to the larger grid as it becomes greener
- Provide users energy savings, reliability and resiliency in the face of grid disconnect, and potential revenue streams

Microgrid Challenges:

- Technical – standardized designs, and protocols; cybersecurity
- Economic – clear business cases/revenue streams, valuing reliability and resiliency

Questions?

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