

# Electric Grid Modernization

## A New Vision for Distribution Systems

Carol Sedewitz

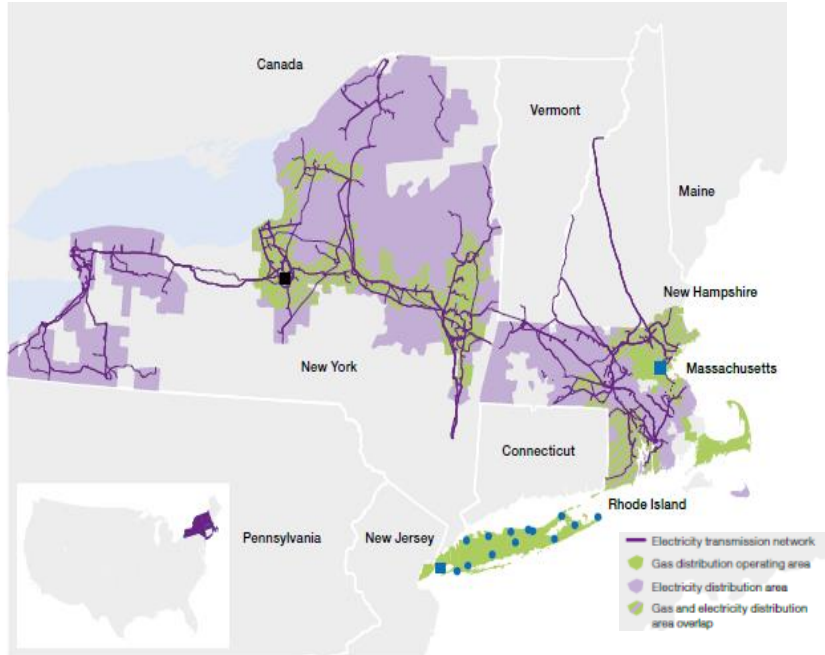
national**grid**



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# National Grid's U.S. Business

*National Grid is one of the world's largest investor owned utilities, with more than 7 million gas and electricity US customers and 22,000 employees in the U.S. and U.K.*



## National Grid U.S. by the numbers

- 3.5 million electric customers
- 81,500 miles of transmission and distribution lines in New York, Massachusetts, Rhode Island
- 3.6 million gas customers
- Gas network of 35,000 miles of gas distribution pipeline; 490 miles of gas transmission pipeline

# Why pursue a more modern grid?

**...safe, reliable, clean, and economic**

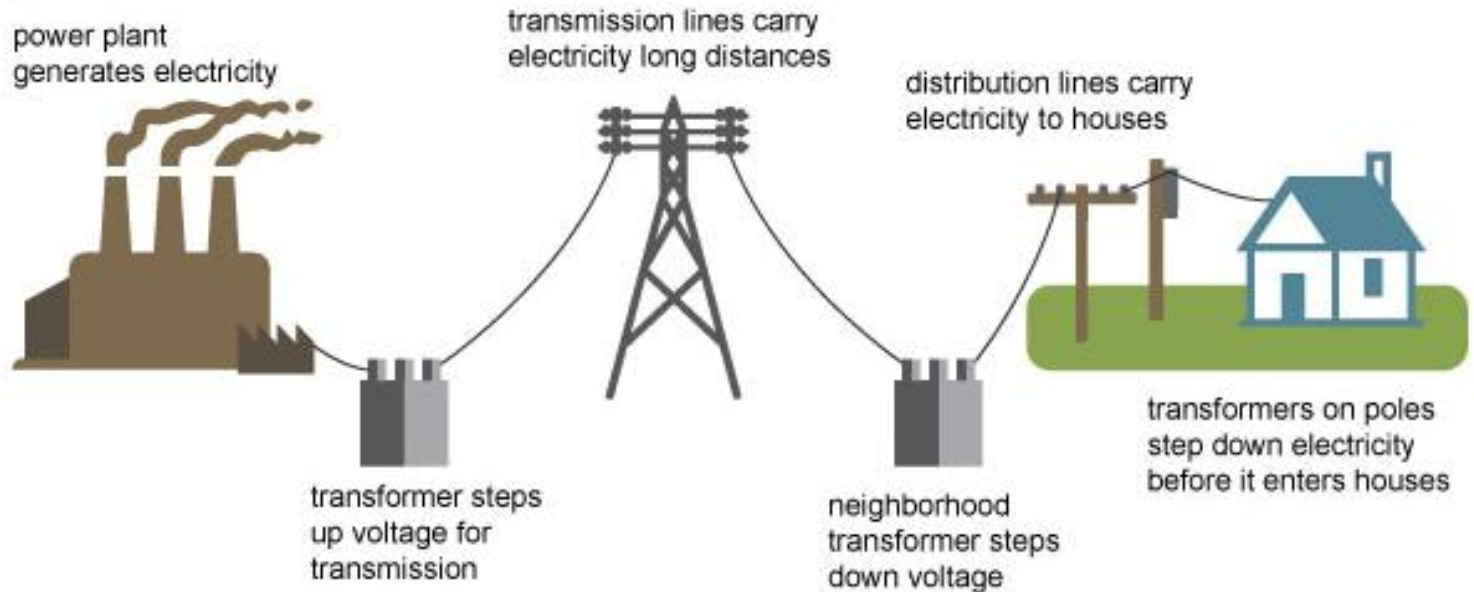
- Increasing customer expectations
- New technologies
- Renewable generation
- Energy storage
- Electric vehicles
- Electric heating conversions
- Energy efficiency
- Demand response

Northeast  
80x50  
Pathway



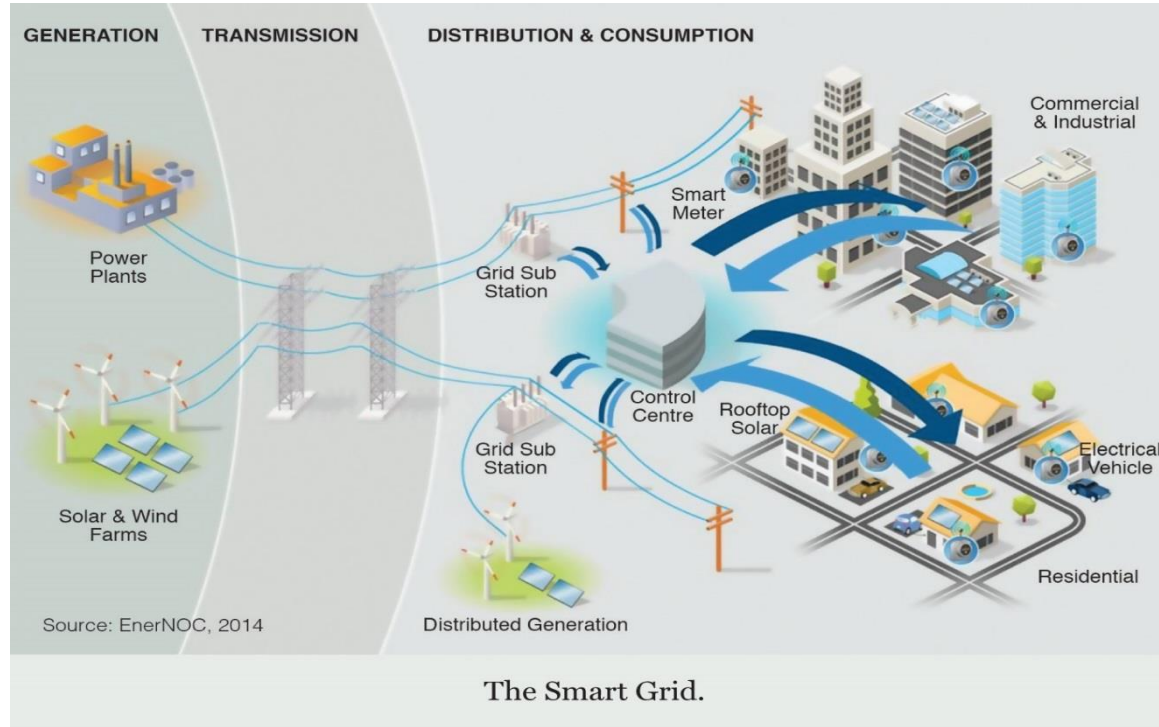
# The traditional grid – one way power flow

## Electricity generation, transmission, and distribution



Source: Adapted from National Energy Education Development Project (public domain)

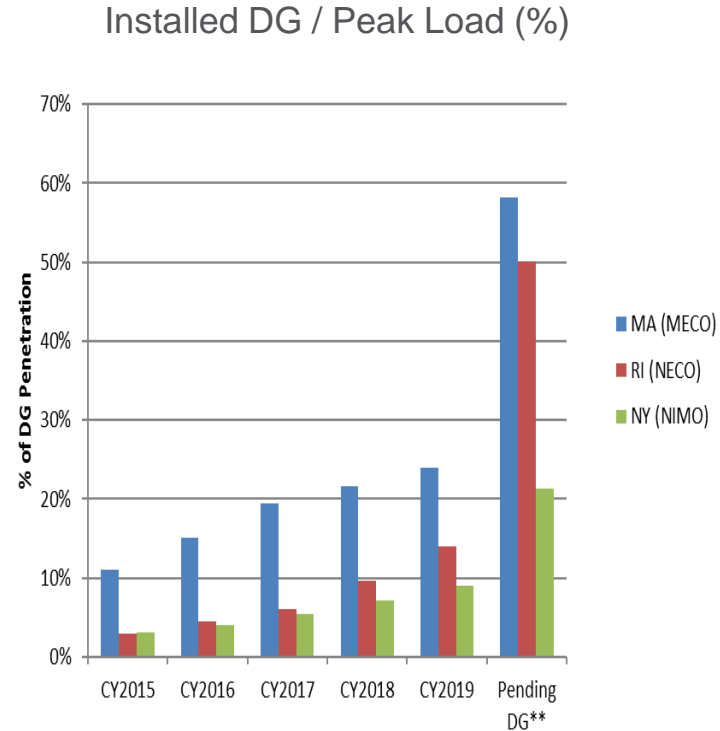
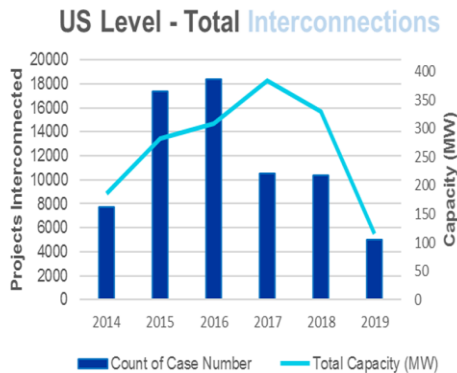
# The modern grid — power flow in two directions



## Technical challenges

- Balancing load
- System stability
- Capacity
- Voltage
- Protection schemes
- Control schemes

# DG applications received and interconnected in National Grid US electric service territory

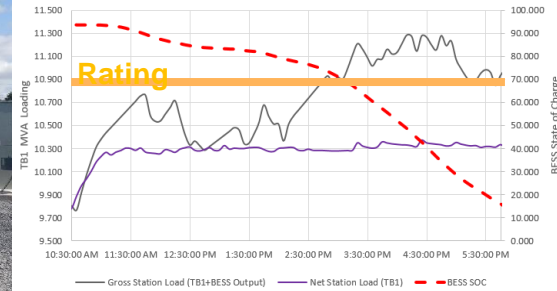


\*DG Penetration equals the Cumulative DG Interconnected/Annual Summer Peak Load

\*Pending DG assumes all DG in the queue will be interconnected



# Battery Energy Storage System (BESS)



## Nantucket, MA



# New capabilities to success

## Digitalization advances

“Big data” & data analytics

Sensors

AMI/AMF

Smart inverters

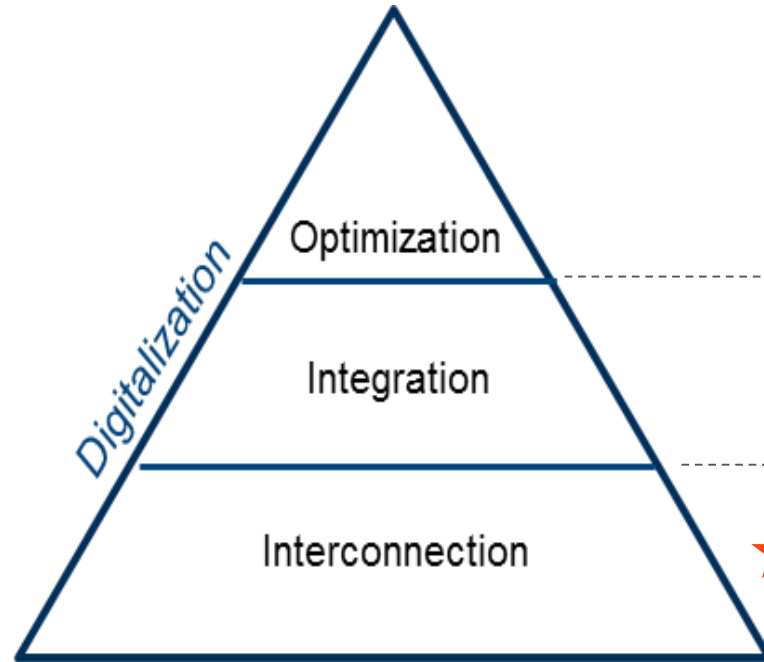
Service bus architecture

Adaptive relay/control settings

Field area networks

Fiber optics

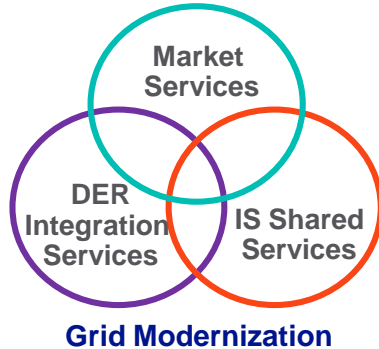
Cyber security





# New engineering, operations, and marketing model for National Grid

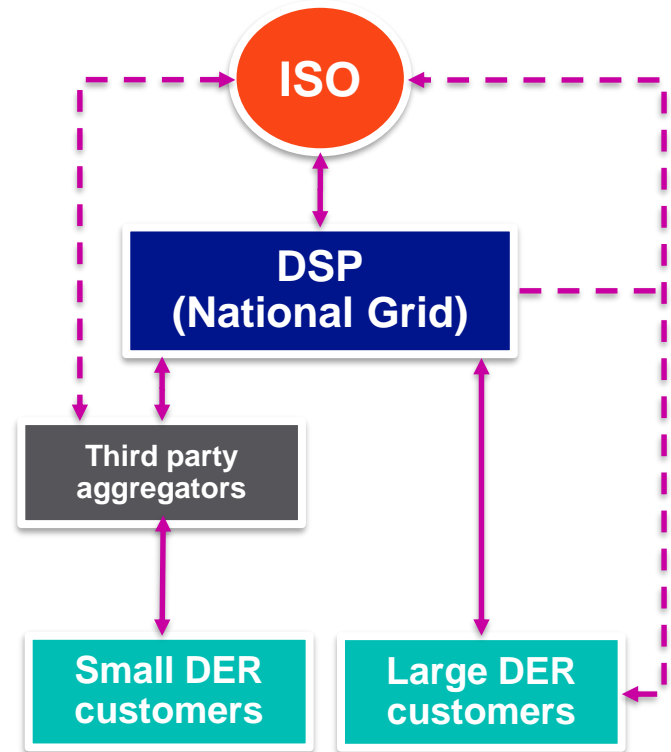
What is  
National Grid's  
new role?



**Responsibilities as the Distributed System Platform (DSP) owner:**

- Locational marginal pricing for DER
- Transaction and clearing services
- Active Distributed System Operations (DSO)

National Grid



# Future is here now

*We are developing DSP capabilities and investing across all jurisdictions*

## Market Services

Non-Wires Alternatives  
Electric Vehicles  
Energy Storage



## DER

Interconnections  
Streamline  
Interconnections



## Information Sharing

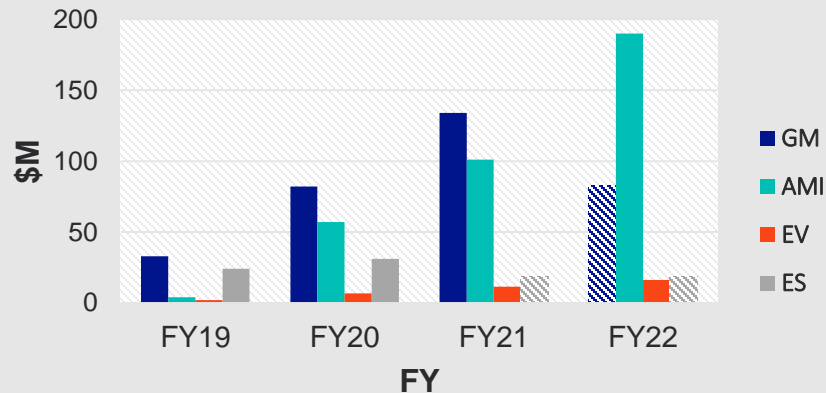
System Data  
Customer Data

## Grid Mod Investments

Field Deployments  
AMI  
CC Enhancements  
Operational Data Mgmt

National Grid

Summary Spend (\$M) and Schedule Profile for  
First Four Years of GM, AMI, EV, and ES



The diagonal striped bars in FY21 and FY22 represent projections

# The way forward... requires new skills



## **Industry partnerships & influence** — streamline interconnections

- Making our system “Plug and Play”
- Electric Power Research Institute (EPRI), Sandia National Laboratories
- Set industry standards; e.g. IEEE 1547, IEC 61850 (smart substation)



## **Engineering & Operations expanded capabilities** — future proofing our system and our role in industry

- Information sharing — customer data and system data
- Application & data portals, load forecasting, data analytics, integrated planning, volt/VAR optimization, etc.
- Technology at edge and distributed along the D grid



## **Grid mod investments** — developing DSP capabilities

- Through initiatives such as grid modernization, Advanced Metering Infrastructure (AMI), Electric Vehicles (EV), and energy storage requires managing more granularly spatially and temporally
- OpTel strategy