

Smart Grid - Program Overview



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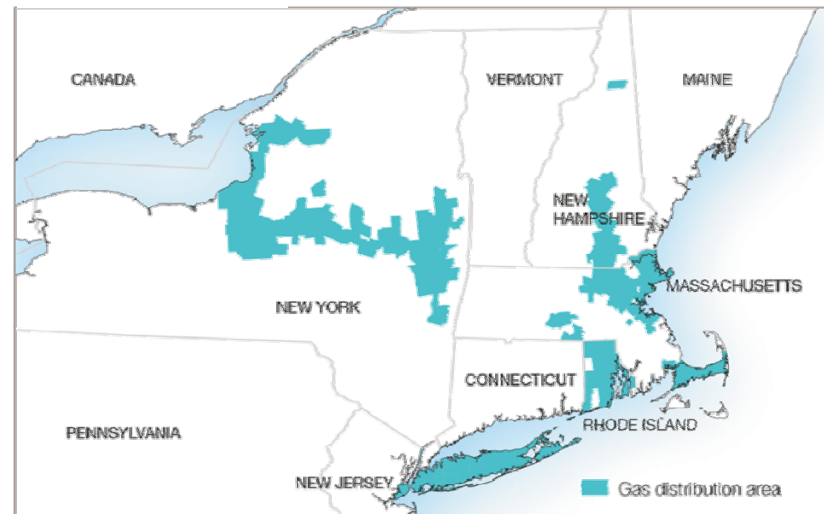
NIST January 20, 2010 Gaithersburg, MD

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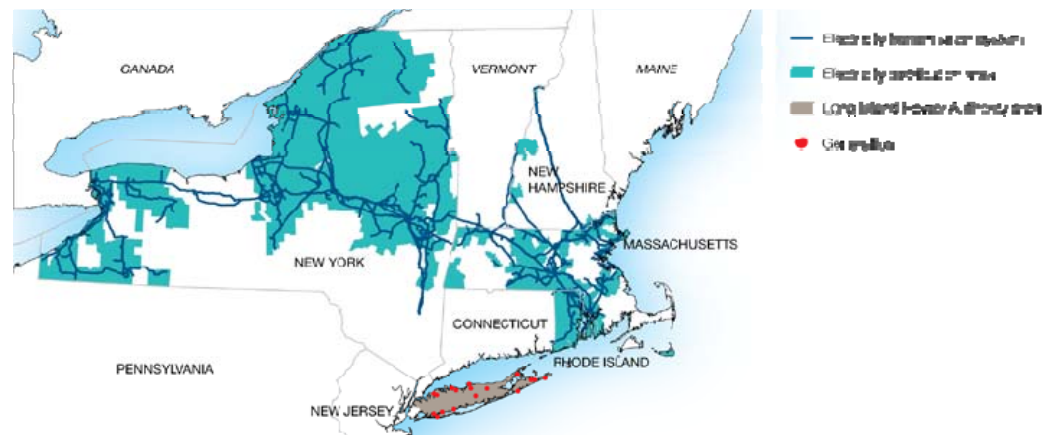
National Grid: an international electricity and gas company

- 50% US, 50% UK
- 27,000 employees
- Distributes electricity to 3.3 million customers
- Provides natural gas to 3.5 million customers
- Services 1.1 million customers of Long Island Power Authority (LIPA)
- Currently owns over 4,000MW of generation

Gas

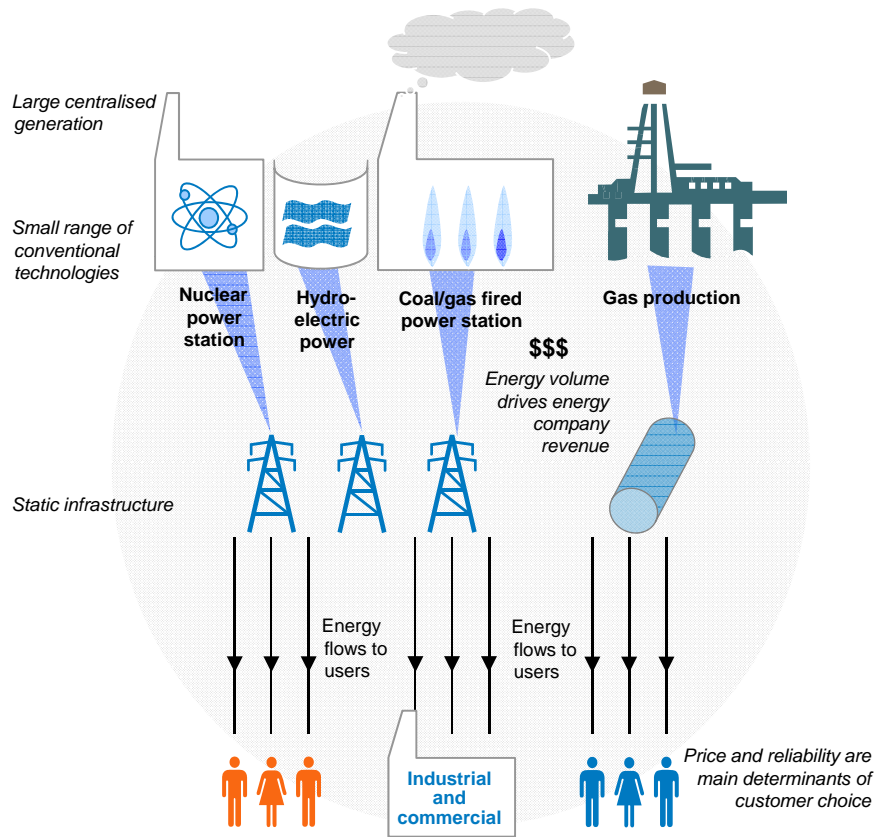


Electricity

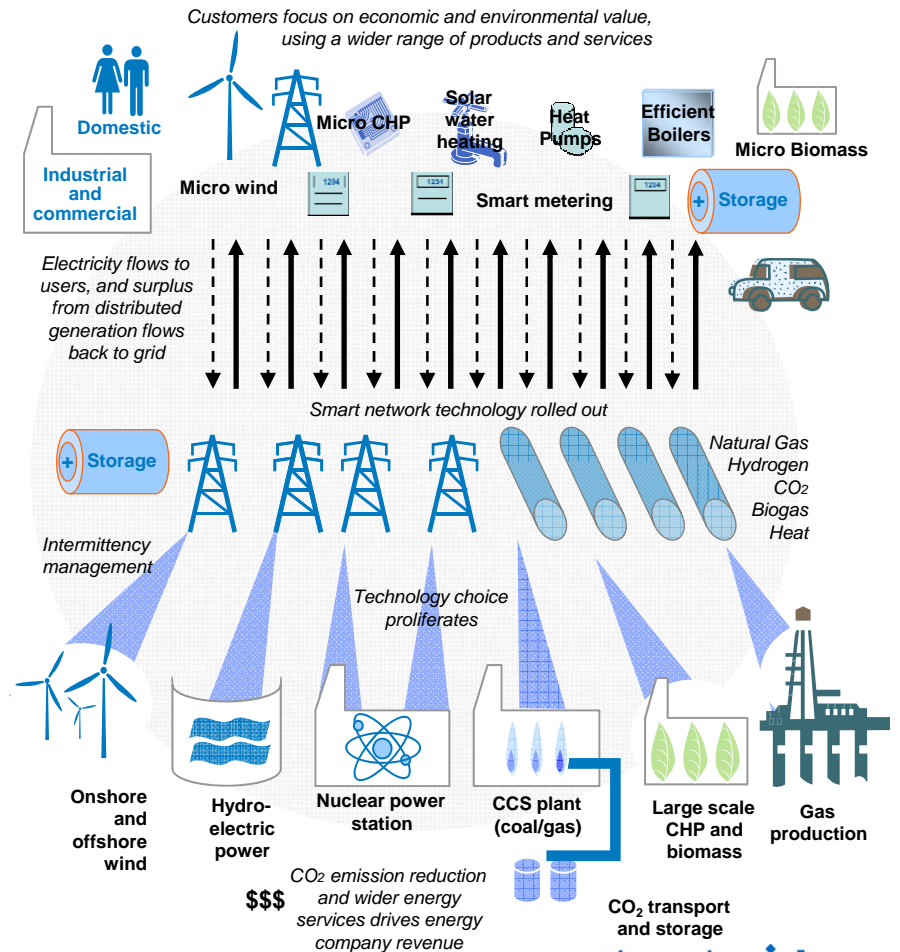


Energy Market is evolving - Smart Grid is an essential enabler

Traditional Energy Market - supply driven



Today's Evolving Market - customer driven



Smart Grid Drivers

Climate Change

- Societal awareness.
- Period of denial is over.
- Policymakers are reacting with incentives and mandates.
- Energy industry position in society is changing.



Customer Service

- Requirements increasing.
- Data revolution.
- Innovation enabler.
- Business development.



Strategy and Execution



Efficiency

- Operating cost.
- Reliability through automation.
- New Generation model.

The DOE (stimulus) and support by state regulators is a huge accelerator...

Smart technology means different things to different people – a common language and vision are essential for company alignment

Smart Technology Definition

Technology that provides advanced information, automation and control capabilities to help us to distribute, measure and use energy more efficiently, enable Renewables reliably, safely and sustainably – all the way from the point of generation to consumer appliances

What is Smart Technology?

Meter

- ♦ Meter that records interval data
- ♦ 2-way communications, remote configuration
- ♦ Informative display
- ♦ Meter Data Management System

Grid

- ♦ Sensors & measuring devices
- ♦ Analytical programs e.g. pattern recognition
- ♦ Automatic switches & controls
- ♦ Decision support tools & graphical interfaces

Home

- ♦ Customer portal & Home Area Network
- ♦ Automated thermostats, switches, plugs & appliances
- ♦ Load controllers e.g. PHEV controller

What does it allow you to do?

- ♦ Automatic meter reading
- ♦ Enable customer choice and control
- ♦ Choice of tariffs e.g. time of use – peak shifting
- ♦ Catalyst and validation of Energy Efficiency programs
- ♦ Remote configuration

- ♦ Enable Distributed generation
- ♦ Remotely detect, diagnose, predict and correct network problems & faults
- ♦ Condition-based, preventative maintenance
- ♦ Automatic fault prevention, isolation & restoration

- ♦ Automatically optimize selected home appliances
- ♦ Demand response programs
- ♦ Improve satisfaction levels

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We defined 22 smart technology enabling capabilities that address the business drivers

Communications

1. Two way communications

- Underlying communications to support the Smart technologies

Electric Gas

✓✓

Smart Meter

2. Automated meter reading

- Ability to remotely read the data contained in a smart meter

✓✓

3. Remote consumer price signals

- Metering devices which provide TOU pricing information

✓✓

4. Providing granular energy use information

- Metering devices with ability to collect, store and report residential energy use information for shorter time intervals

✓✓

5. Identify outage location, extent remotely

- Digital meters capable of sending signal when they go out/identifying themselves when power/gas is restored

✓✓

6. Remote connection/disconnection

- Digital meters capable of being remotely connected and disconnected

✓✓

7. Remote meter configuration

- Digital meters capable of being remotely configured for functionality changes, firmware and software updates

✓✓

8. Optimize retailer cash flow

- Ability for a retail energy service provider to manage its revenues through more effective cash collection and debt management

✓✓

Smart Grid

9. Remote network monitoring

- Installation of a series of sensors to monitor network parameters

Electric Gas

✓✓

10. Remote network control

- Ability for the the user to operate the devices (e.g., switches in the network from a remote location

✓✓

11. Automatic network control

- Pre-cursor to self-configuring; ability to identify source, extent of problems & suggest actions to be taken (e.g., switches to be activated)

✓✓

12. Optimize power flow/pressure mgmt & losses

- Sensing and control information converted into action to switch power to different feeders or phases improve loss profile

✓✓

13. Optimize power quality

- Ability to detect voltage fluctuations or other power quality issues (e.g., harmonics) and suggest solutions

✓x

14. Fault analysis

- Additional information from sensors to more precisely detect locations/extent of faults and suggest actions to reduce extent of faulted area

✓x

15. Real-time network planning

- Creating switching orders to support planned activities in the network/perform near-real-time actions

✓x

16. Network re-enforcement planning

- Better access to information, leading to better informed planning for future load

✓✓

17. Predictive monitoring

- Predict the failure of a power system component before it actually happens

Electric Gas

✓✓

18. Optimize crew management

- Ability to better coordinate and execute crew dispatch and field maintenance work based on better information about location, extent and cause of problem.

✓✓

19. Perform dispatch & reg services for all DG

- Ability to aggregate and dispatch distributed generation sources

✓x

20. Self-configuring grid

- Ability for the Grid identify the problem area and take independent actions to minimize the problem either on localized or centralized manner

✓x

Home Automation

21. Aggregated DSM

- Aggregation of demand to reduce peak load and help balance the system more efficiently

✓x

22. Control in-home demand

- Ability to control in-home appliances to switch off high-load components during periods of high demand

✓✓

Technology Aspects

1. Spine
2. Clean Technology Modules
3. Integration

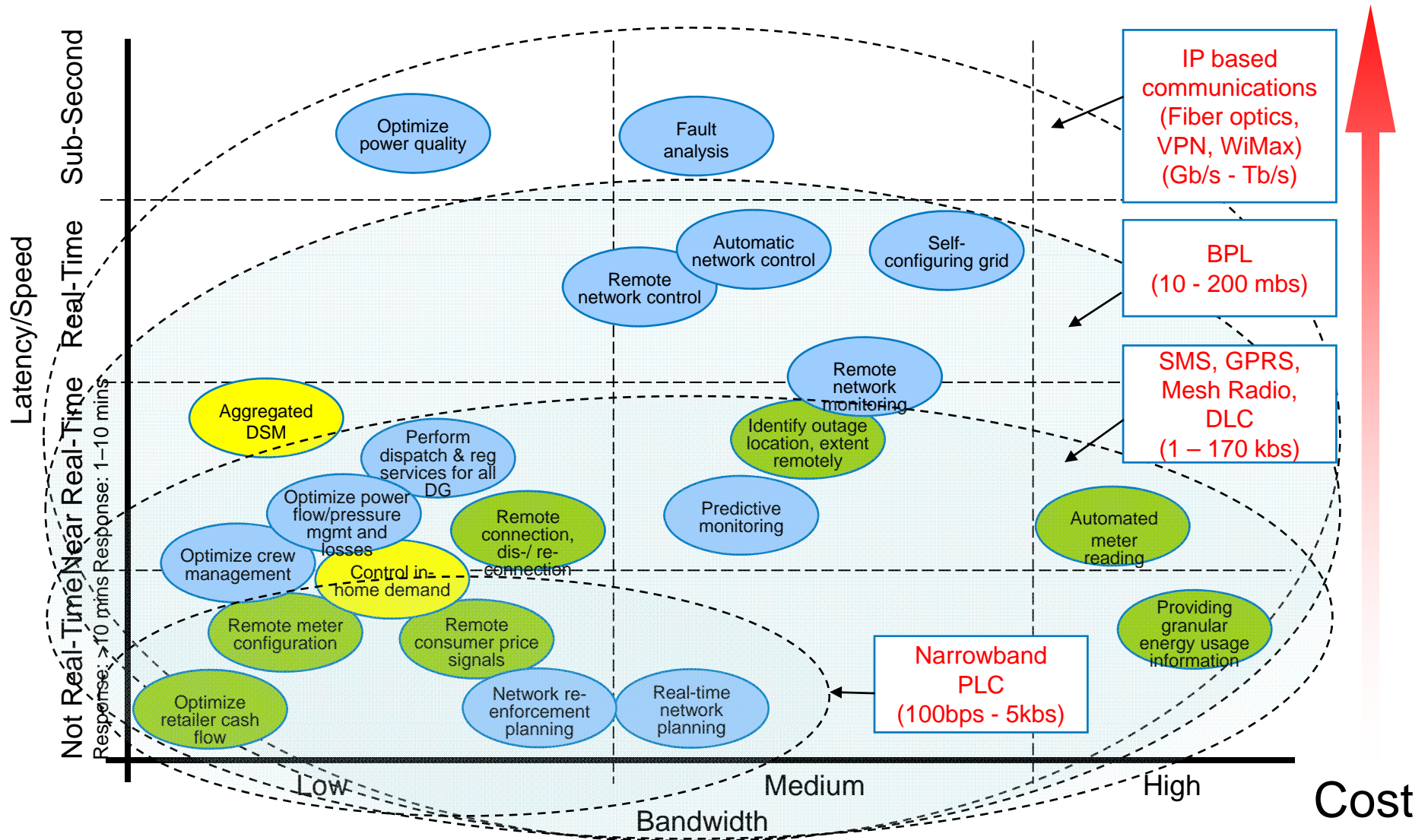
Our Smart Grid “Spine” would be ubiquitous within the pilot footprint (i.e., every customer is served)

- **At the core of the Smart Grid Spine is a common two-way communication system that enables advanced metering, new customer service offerings and distribution grid monitoring and control;**
 - Smart metering;
 - In-Home energy management;
 - Distribution grid monitoring and control.
- **Ubiquitous covers the entire footprint of Smart Grid pilots**
- **Supports all the potential functions of the Smart Grid**

Why did we choose the modules we did?

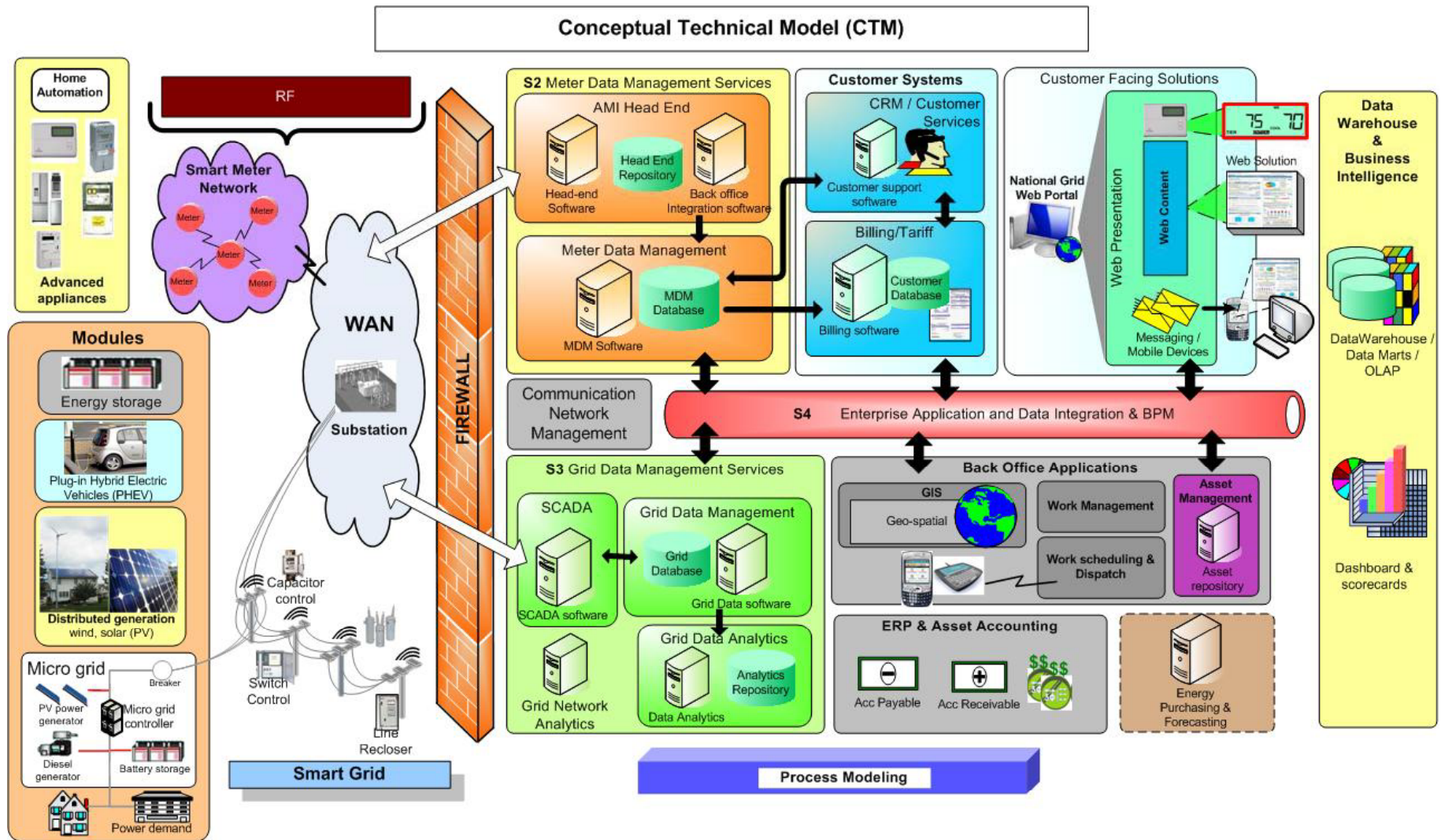
Rationale for Selecting the Clean Energy Modules							
Rationale	PV	PHEV/ EVs	Energy Storage	Wind Power	Micro- CHP	Microgrid	Holistic Homes
Leverages ongoing National Grid activities	●	◐	○	○	●	○	◐
Provides Climate change benefits	●	●	○	●	◐	◐	●
Potentially disruptive to network operations	●	●	○	●	○	○	○
Enables network optimization and increases efficiency of the network	◐	◐	●	○	●	●	●
Creates new business opportunities	●	●	●	○	◐	◐	●
Demonstrates “blue sky” (e.g., customer of the future)	◐	◐	◐	○	◐	●	●

Communications technology choices are huge – we need to take a balanced holistic, long term view

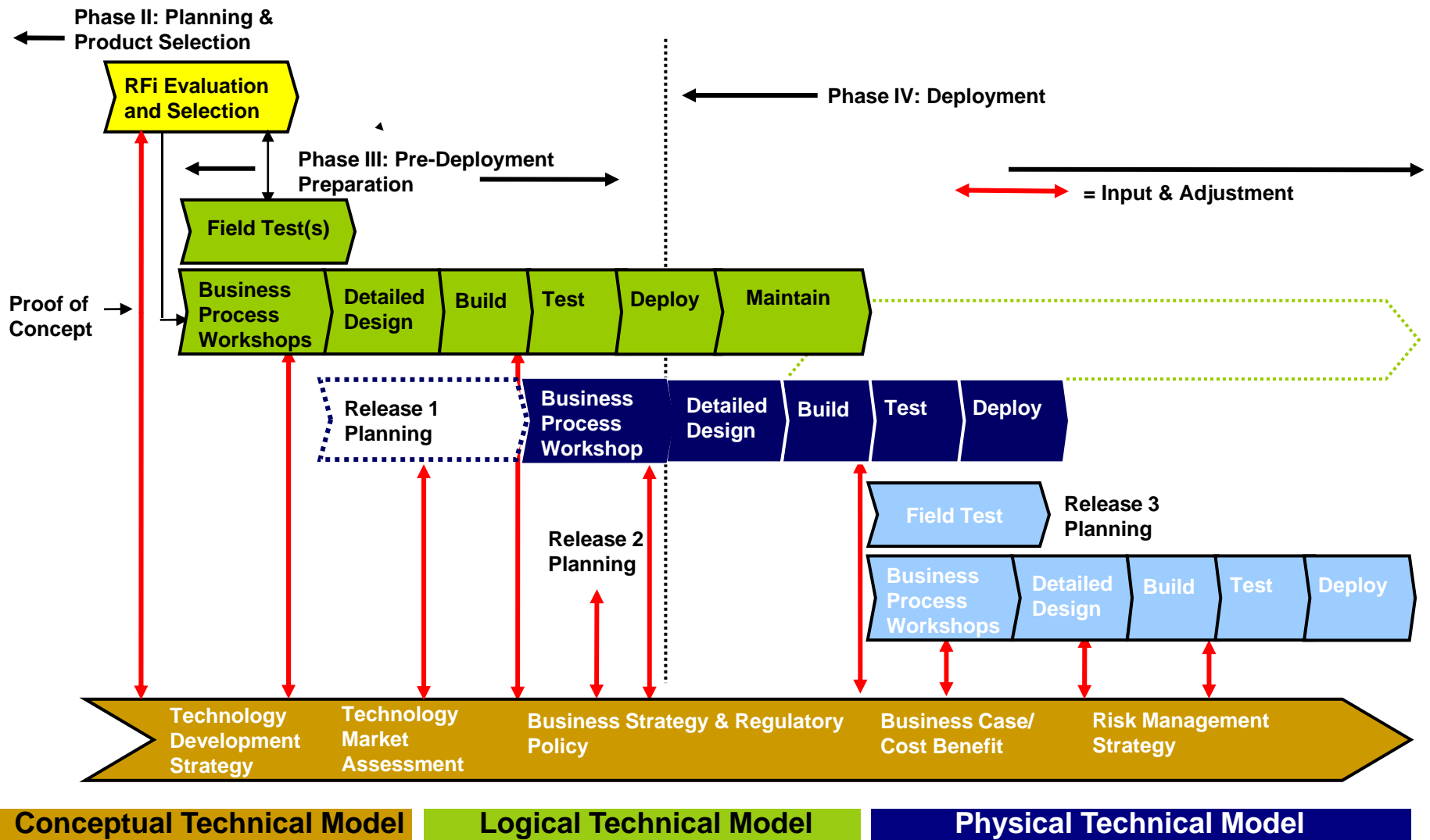


Work to Date..

Conceptual Technical Model – Level 0

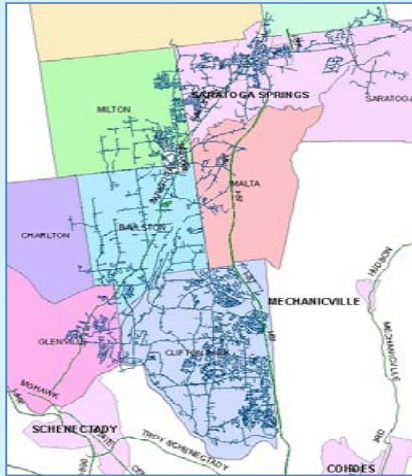


National Grids Approach to Smart Grid is designed to allow leadership to continuously assess risks and adjust course



Pilot Areas summary – what we are planning..

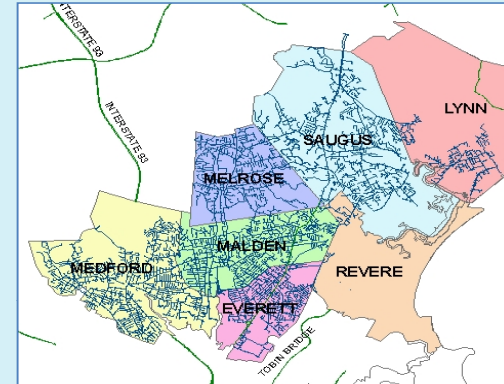
**Albany Capital District, NY
(42,000 customers)**



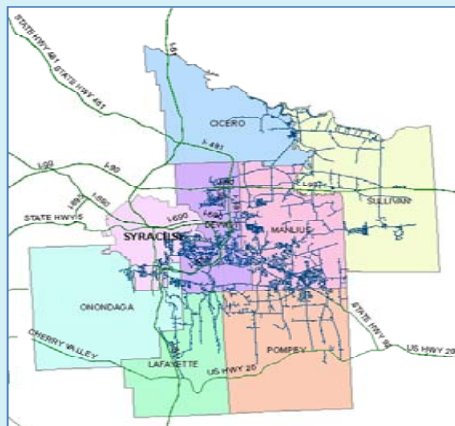
**Worcester, MA
(15,000 customers)**



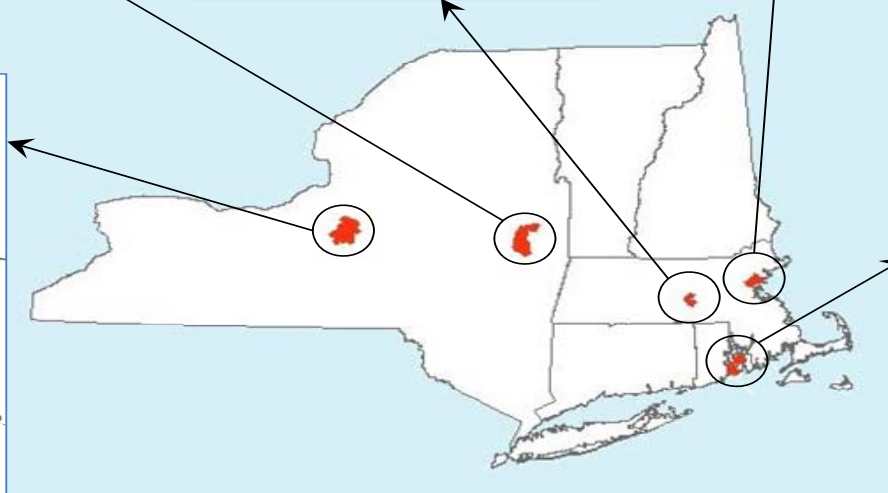
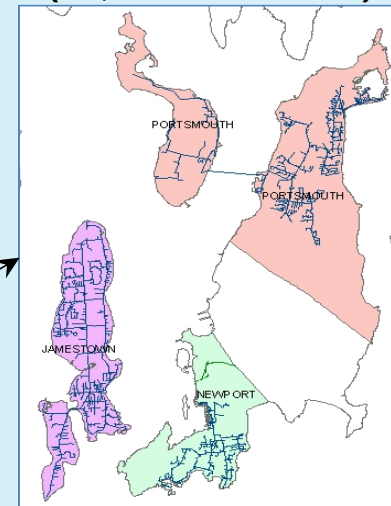
**North Metro Boston, MA
(95,000 customers)**



**Syracuse, NY
(40,000 customers)**



**Newport, Jamestown & Portsmouth, RI
(10,000 customers)**



National Grid's bid has key differentiation areas

State Differentiation	Green Communities Act, (MA) leadership in renewable's and energy efficiency, home to clean energy technology companies. NY Political muscle and aggression.
Commitment to Climate Change	National Grid has a corporate commitment to address climate change. Smart Grid is an enabling technology for customer involvement and enabling low carbon resources.
End to End solution	National Grid's technology solution would allow us to leverage same infrastructure for grid devices, smart meters, and modules. Many utilities are focusing only on AMI.
Clean Energy Modules	National Grid is deploying a Smart Grid that will be specifically designed to accommodate emerging clean energy technologies.
Proof of Concept	We have begun a robust proof of concept that will test interoperability and cyber security. Other utilities are taking larger risks by not taking this critical step.
Smart Tech Center	Center will support the near-term deployment, but will also look over the horizon at emerging technologies. Will work with local colleges and universities to develop qualified workforce.
Regional Deployment	National Grid is the only truly Northeast Regional Smart Grid deployment. Other utilities don't have our breadth in the Northeast. Allows us to leverage investment across the region.
World Class Team	We have pulled together a world class team of established vendors, start-ups, universities with the support of federal, state and local stakeholders

Conclusion

- **National Grid believe we are on the verge of a fundamental shift in the Energy Industry driven by market evolution and emerging customer requirements to meet environmental and service aspirations.**
- **This creates threats and opportunities.**
- **A review of the core Energy Industry infrastructure indicates a significant upgrade and radical redesign is necessary to meet current and future needs of customers and society in general.**

Thank You and Check Out Our Website

<http://www.nationalgridus.com/energy/>