

# Smart Grid - Program Overview



**Martin Cook**

National Grid US

**nationalgrid**  
The power of action.™

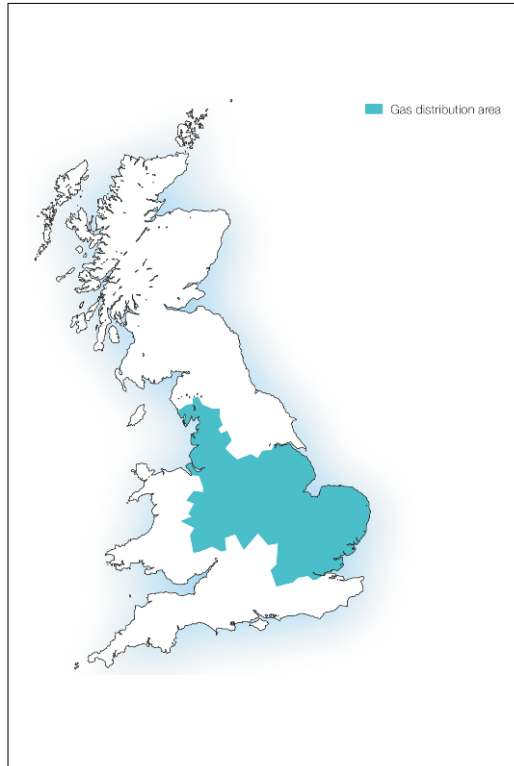
# Agenda

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- **National Grid Company overview**
- **Smart Grid definition / market drivers**
- **Program approach**
- **Technology Model – Spine & Modules**
- **Overview of current Smart Grid Pilot proposals**
- **ARRA – “stimulus”**
- **Conclusions**

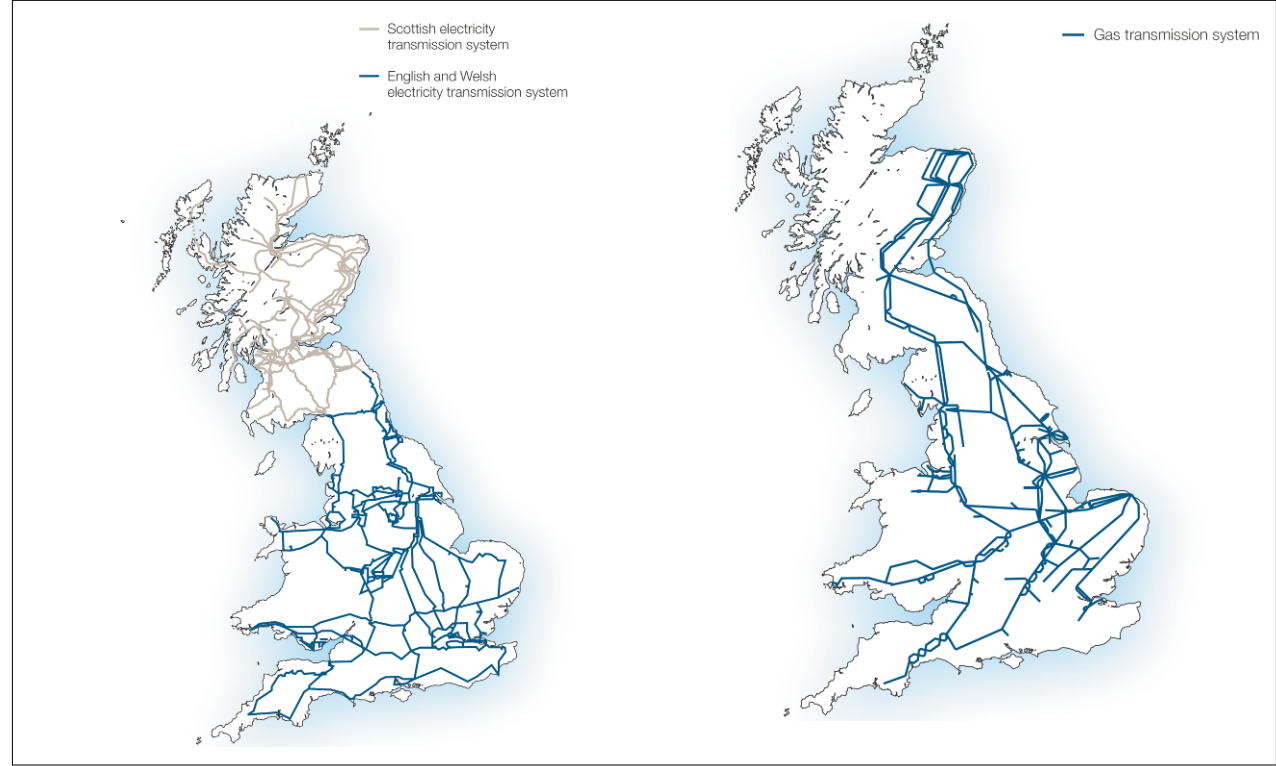
# National Grid: An international electricity and gas company

## Gas Distribution - UK



**Operates the UK gas distribution system; distributes gas on behalf of shippers and suppliers to 11 million consumers but has 20m+ meters**

## Transmission – Electricity and Gas - UK

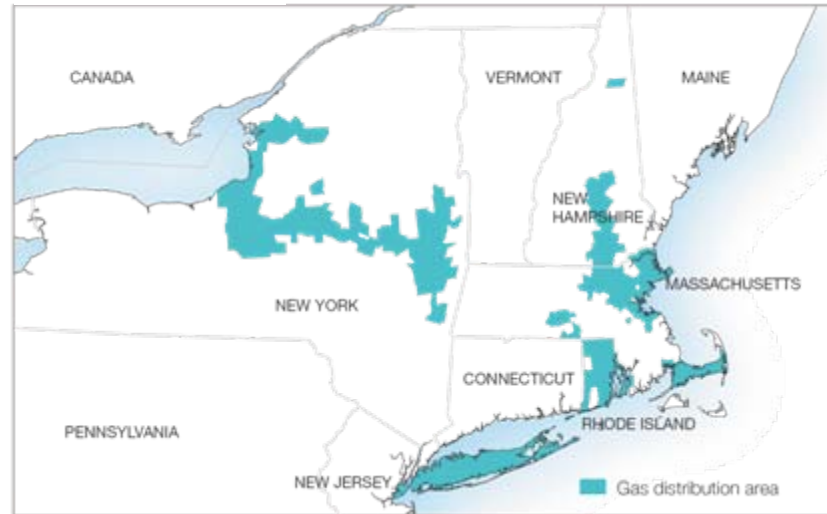


**Owns the high-voltage electricity transmission system in England and Wales and operates the system across Britain. Also owns and operates the high pressure gas transmission system in Britain.**

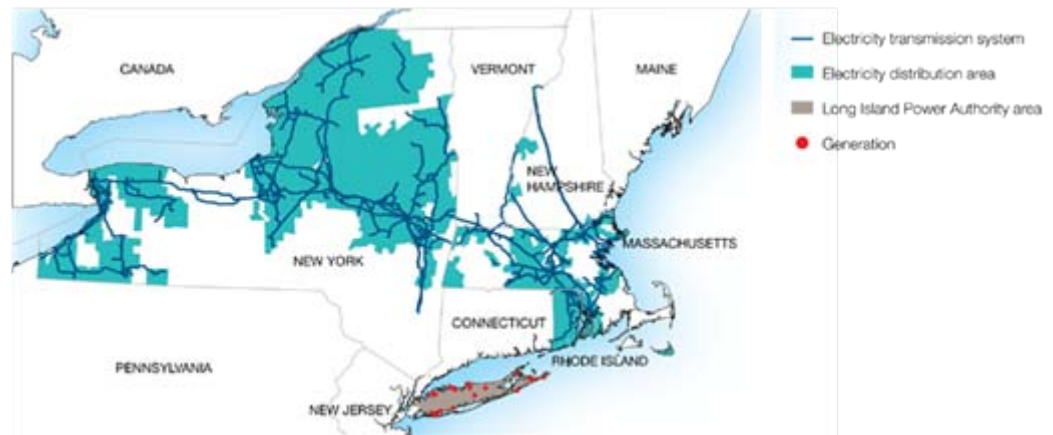
# National Grid: an international electricity and gas company

- 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





# 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

# 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 ARRA (stimulus) is a huge accelerator - The choice for State Government and energy companies is how progressive to be and in what timeframes, early adopters face enhanced risks but potentially higher rewards.

# Customer behavior evolution

The deployment of Smart Grid technologies will enable the shift in customer behavior towards Energy Efficiency, Energy Management and increase Customer Service levels.

With increasing volatility in energy prices, and climate change becoming a more prominent public concern, customer needs are changing.

Customers need the “tools” to play their part in the shift towards a new energy future.

The trend to increased consumer choice and control will be different for customers dependent upon their circumstances and needs – more segmentation will occur.

The “one ratepayer” approach to serving residential and small business customers must evolve, we will have to be more innovative to satisfy customers going forward.

# NG Smarter propositions will link with society Megatrends

## Emerging Technology

- More technologically savvy consumers
- Increase in internet use & adoption by older generations



## Rising Expectations

- Rise in customer expectations
- Erosion in customer loyalty



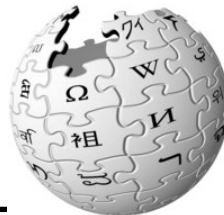
## Environmental Sustainability

- Growing interest in sustainable products & services
- Increasing commodity prices amplify focus on conservation



## Mass Collaboration

- Increasing consumer participation
- Community and collaborative behavior through media and social networks

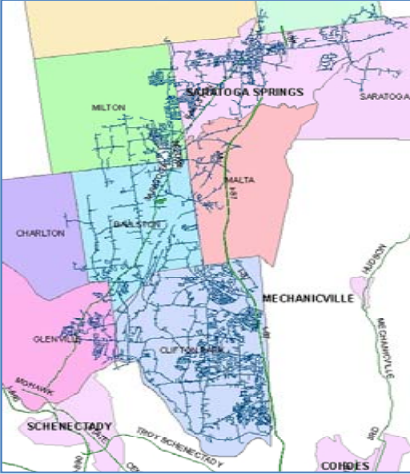


## Implications for Smart Grid

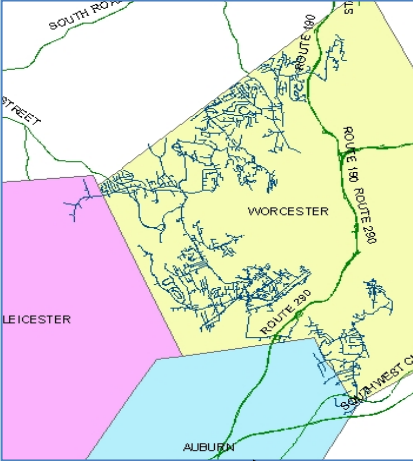
- Drive linkage with applications customers value.
- Managing costs will be at the forefront of customer concerns as energy and commodity prices rise
- Customers will demand less service disruptions and better services from their utilities
- Customers will look to the internet for more information on reducing bills and carbon footprint
- Collaborative communities may emerge to influence the utilities industry

# DoE Pilot Areas summary – what we are planning..

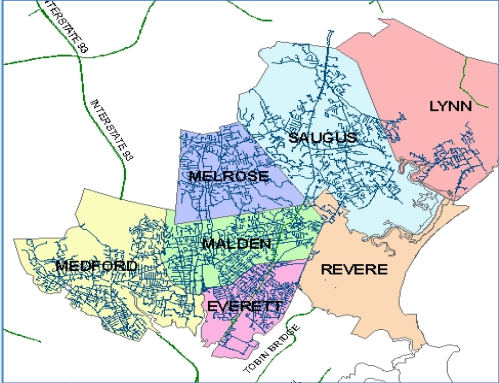
**Albany Capital District, NY  
(42,000 customers)**



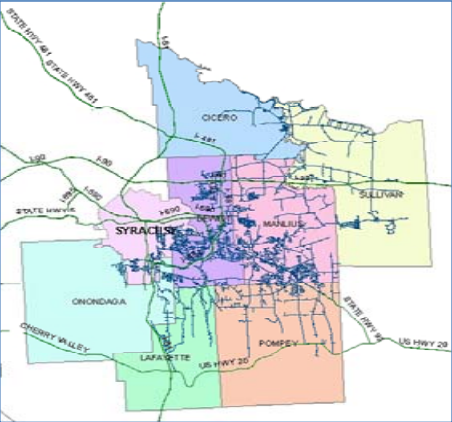
**Worcester, MA  
(15,000 customers)**



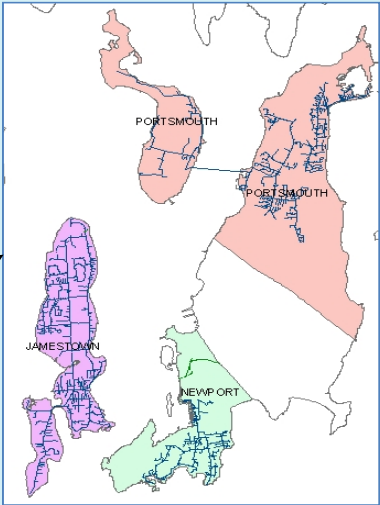
**North Metro Boston, MA  
(95,000 customers)**



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



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



# Technology Aspects

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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)**

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- **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**

# What are clean energy modules?

- Targeted and concentrated deployment of energy technologies on the distribution system
- **Concentrated:** to simulate high levels of market penetration while controlling overall costs and minimizing risks
- **Targeted:** at carefully chosen sites to demonstrate integration with the grid and maximize learning
- Distributed energy generation with low or no GHG emissions
- Technologies that are potentially disruptive to the current utility business model
- Strong Synergies with the Smart Grid Spine
- The Spine is essential for integrating large quantities of module technologies (i.e., the Spine enables the modules)
- The value of the module investments is enhanced by Spine functionality (i.e., the modules strengthen the business case for the Spine)

# 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)	◐	◐	◐	○	◐	●	●

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

## Communications

- 1. Two way communications
- Underlying communications to support the Smart technologies



## Smart Grid

- 9. Remote network monitoring
- Installation of a series of sensors to monitor network parameters



- 17. Predictive monitoring
- Predict the failure of a power system component before it actually happens

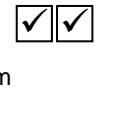


## Smart Meter

- 2. Automated meter reading
- Ability to remotely read the data contained in a smart meter



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



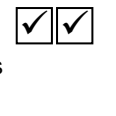
- 18. Optimize crew management
- Ability to better coordinate and execute crew dispatch and field maintenance work based on better information about location, extent and cause of problem.



- 3. Remote consumer price signals
- Metering devices which provide TOU pricing information



- 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)



- 19. Perform dispatch & reg services for all DG
- Ability to aggregate and dispatch distributed generation sources



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



- 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



- 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



- 5. Identify outage location, extent remotely
- Digital meters capable of sending signal when they go out/identifying themselves when power/gas is restored



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



## Home Automation

- 6. Remote connection/disconnection
- Digital meters capable of being remotely connected and disconnected



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



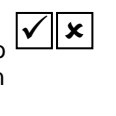
- 21. Aggregated DSM
- Aggregation of demand to reduce peak load and help balance the system more efficiently



- 7. Remote meter configuration
- Digital meters capable of being remotely configured for functionality changes, firmware and software updates



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



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



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



- 16. Network re-enforcement planning
- Better access to information, leading to better informed planning for future load



# The final DOE solicitations for Smart Grid Grants and Demonstrations

	Smart Grid Investment Grants (SGIG)	Smart Grid Demonstrations (SGDP)
Due Date	August 6, 2009	August 26, 2009
Funding	\$3.4 billion	\$615 million (including \$200 million for storage)
Max Award	\$200 million	\$100 million
Period of Performance	3 years, but strongly prefer shorter	3-5 years
Goals	“accelerate the modernization of the nation’s electric transmission and distribution systems	“demonstrate novel technologies in regions across the US
Scope	Limited to specific “qualifying investments”	New and Novel technologies or applications
Topic Areas	<ul style="list-style-type: none"> <li>▪ Electric Grid components</li> <li>▪ Distrn / transn</li> <li>▪ Integrated or crosscutting systems</li> </ul>	<ul style="list-style-type: none"> <li>▪ Regional Demonstrations</li> <li>▪ Grid-Scale Energy Storage Demonstrations</li> </ul>
Approvals	State Approval ideally	Technology logic / state Approval

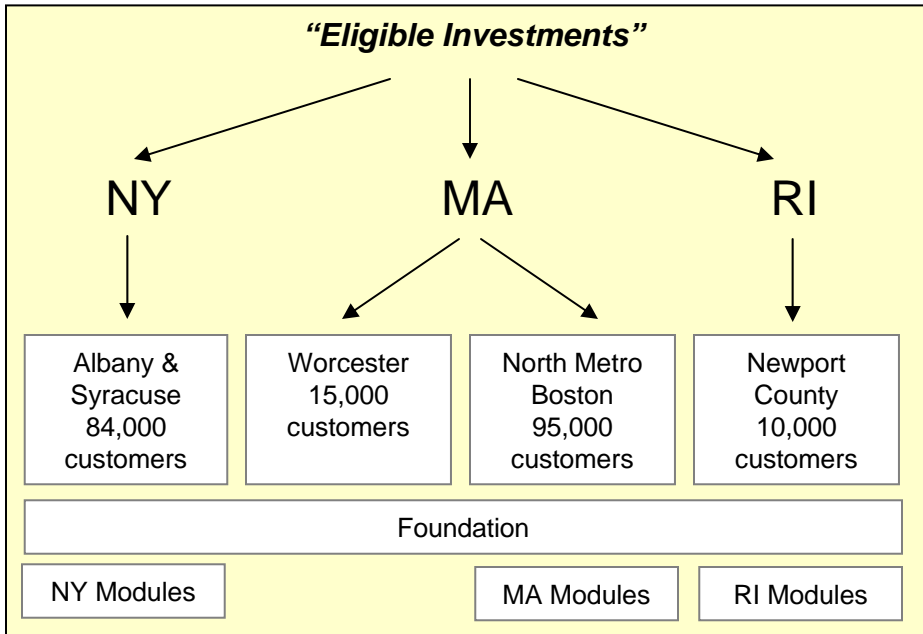
# We submitted one grant application that included our entire Smart Grid Program in all three states.

## Smart Grid Investment Grants (SGIG)

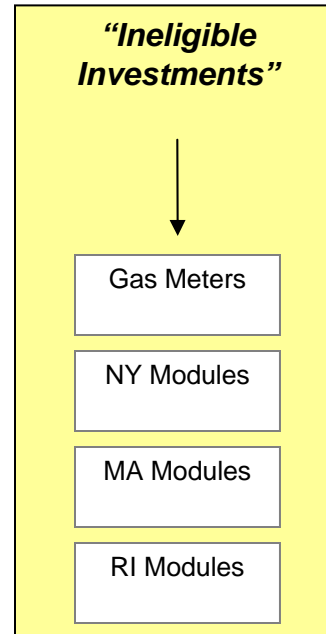
### "Spine and Modules"

Northeast Regional Smart Grid Deployment Proposal  
(National Grid USA Services)

#### "Eligible Investments"



#### "Ineligible Investments"



Approval Gained  
July 24, 2009

Support 8/6/09  
Approval Nov 4

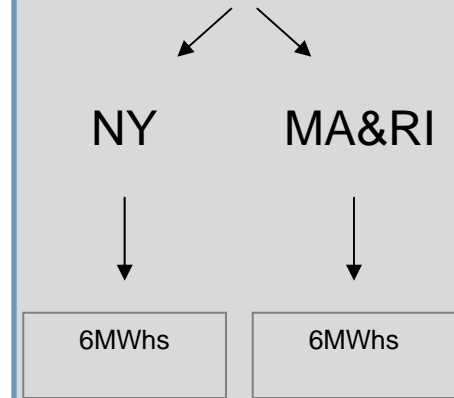
Support by letter?  
Approval?

Governor Support by letter July 31  
Approval?

## Smart Grid Demonstrations (SGDP)

### "Energy Storage Module"

Northeast Regional Energy Storage Demonstration Proposals  
In discussions to be a participant on another party's proposal



## Regulatory Approval Timelines

# National Grid's bid has key differentiation areas

<b>State Differentiation</b>	Green Communities Act, (MA) leadership in renewable's and energy efficiency, home to clean energy technology companies. NY Political muscle and aggression.
<b>Commitment to Climate Change</b>	National Grid has a corporate commitment to address climate change. Smart Grid is an enabling technology for customer involvement and enabling low carbon resources.
<b>End to End solution</b>	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.
<b>Clean Energy Modules</b>	National Grid is deploying a Smart Grid that will be specifically designed to accommodate emerging clean energy technologies.
<b>Proof of Concept</b>	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.
<b>Smart Tech Center</b>	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.
<b>Regional Deployment</b>	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.
<b>World Class Team</b>	We have pulled together a world class team of established vendors, start-ups, universities with the support of federal, state and local stakeholders

# Conclusion

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- **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.**
- **The ARRA “stimulus” bill will accelerate this process and create a framework for investments.**
- **National Grid is excited by the opportunity and has proposed significant projects for the ARRA program.**

**Thank You**

# How we are representing National Grid and Smart

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## Rethinking Energy

### VIDEO DESCRIPTION:

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This video explains how National Grid's Smart Grid strategy will give customers the right tools and technology.

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

<http://www.us.capgemini.com/resources/videos/plink.asp?vid=421FFFE8-B7B6-4D13-8327-68490525709C>