Demand Response, Dynamic Pricing, and the Smart Grid in New York

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Objectives

- Report progress on Dynamic Pricing and Demand Response initiatives
- Report on recent actions taken by the NY PSC
- Report on pilot projects at Con Edison
- Provide overview of Smart Grid Initiatives within NY State

Defining terms:

- **Market Based Demand Response – typically involving changes in customer load in response to prices, whether fixed or dynamic.**
- **Dispatchable demand response –typically involves customer commitments to modify loads when needed by utility or ISO – either energy or capacity – treated much like generation**
- **Demand Side Management – term used since early 80's to describe actions taken by utilities or other load serving entities to modify customer loads to meet system or public policy objectives – typically through rebates, education, etc.**

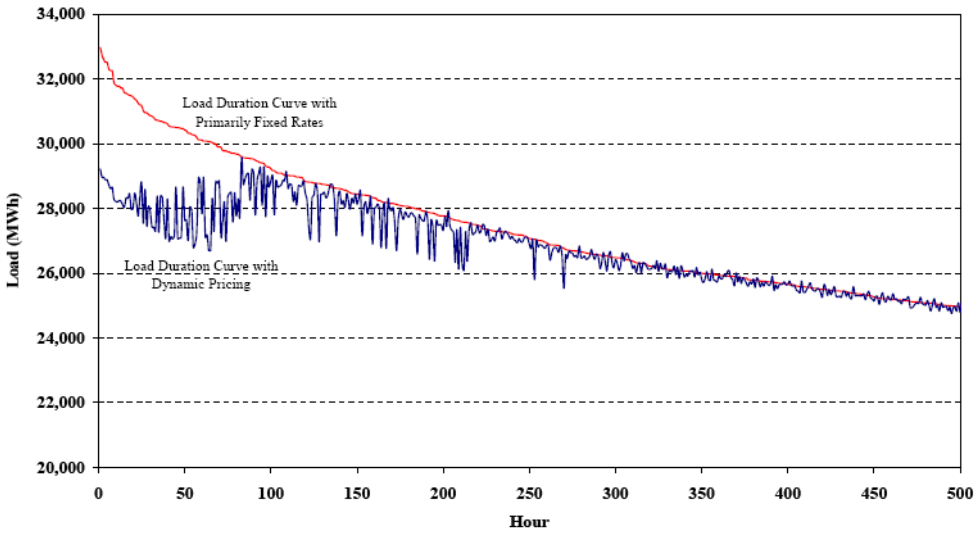
Demand Response in NYISO Markets

- **Expanded demand-side participation identified as a Strategic Initiative in NYISO 2009 Strategic Plan**
  - *Dynamic Pricing added to Strategic Initiatives in 2010 Strategic Plan*

- **Several NYISO studies to evaluate benefits and market potential for demand response**
  - *Brattle White Paper on Dynamic Pricing*
  - *Brattle Study on Demand Response Aggregation Market Potential*
  - *KEMA Study on Modeling Dynamic Pricing and Dispatchable Demand Response*

Dynamic Pricing White Paper

Impact of Dynamic Pricing on Hourly Loads



- Dynamic rates encourage shift to off-peak usage
- Reduced capacity requirement drives savings: potential 10-14% reduction in system peak
- Additional benefits with significant Plug-In Electric Vehicle (PEV) deployment
- Supports renewable resource integration

Effects of Dynamic Pricing on Peak and Average Demand

Dynamic Pricing Scenario	Change in System Peak		Change in New York City Peak		Change in Long Island Peak		Change in Average Load			
	All Hours		*All Hours*		*All Hours*		*All Hours*		*150 Hours w/Max Δ Load*	
	(MW)	(%)	(MW)	(%)	(MW)	(%)	(MW)	(%)	(MW)	(%)
Base Case	(3,418)	(10%)	(1,514)	(13%)	(590)	(11%)	84	0.4%	(1,897)	(6%)
Conservation	(3,751)	(11%)	(1,514)	(13%)	(604)	(11%)	(288)	(1.5%)	(2,158)	(7%)
High Capacity Price	(4,282)	(13%)	(1,671)	(14%)	(776)	(14%)	176	1.0%	(3,147)	(11%)
High Elasticity	(4,603)	(14%)	(1,961)	(16%)	(779)	(14%)	130	0.7%	(3,606)	(12%)

Demand Response Aggregation Study

- **With the assistance of The Brattle Group, the NYISO analyzed demand response potential in New York and came to the following conclusions**
  - *Commercial and Industrial (C&I) customers represent over 70% of the demand in NY*
  - *C&I customers provide the largest opportunity for aggregators*
  - *Retail customers have significantly lower penetration rates for aggregation*

	Coincident Peak Load in NYCA	Customers Engaged	DR Already Captured	Easiest Remaining DR Potential thru Aggregators	Next-Tier Remaining DR Potential thru Aggregators	Remaining Potential thru State/Utility Initiatives	Total
Large C&I (> 400 kW)	8,900	~5,000	2,053*	Minimal	0 – 1,300	Minimal	2,053 – 3,350
Capacity (MW)							
Energy (MW) @$500/MWh		2,400	170	180	120	Minimal	470
Small C&I (< 400 kW)	14,300	~500	183**	Minimal	Minimal	280 – 880	460 – 1,060
Capacity (MW)							
Energy (MW) @$500/MWh		Minimal	Minimal	Minimal	Minimal	30 - 300	30 - 300
Residential	7,600	Minimal	Minimal	N/A	N/A	140 - 780	140 – 780
Capacity (MW)							
Energy (MW) @$500/MWh		Minimal	Minimal			30 - 370	30 - 370
Total	30,800	5,500	2,236	Minimal	0 – 1,300	420 - 1,660	2,650 – 5,190
Capacity (MW)							
Energy (MW) @$500/MWh		2,400	170	180	120	60 - 670	530 – 1,140

Largely from Aggregators

Aggregator Potential

Potential from Aggregators and State Initiatives

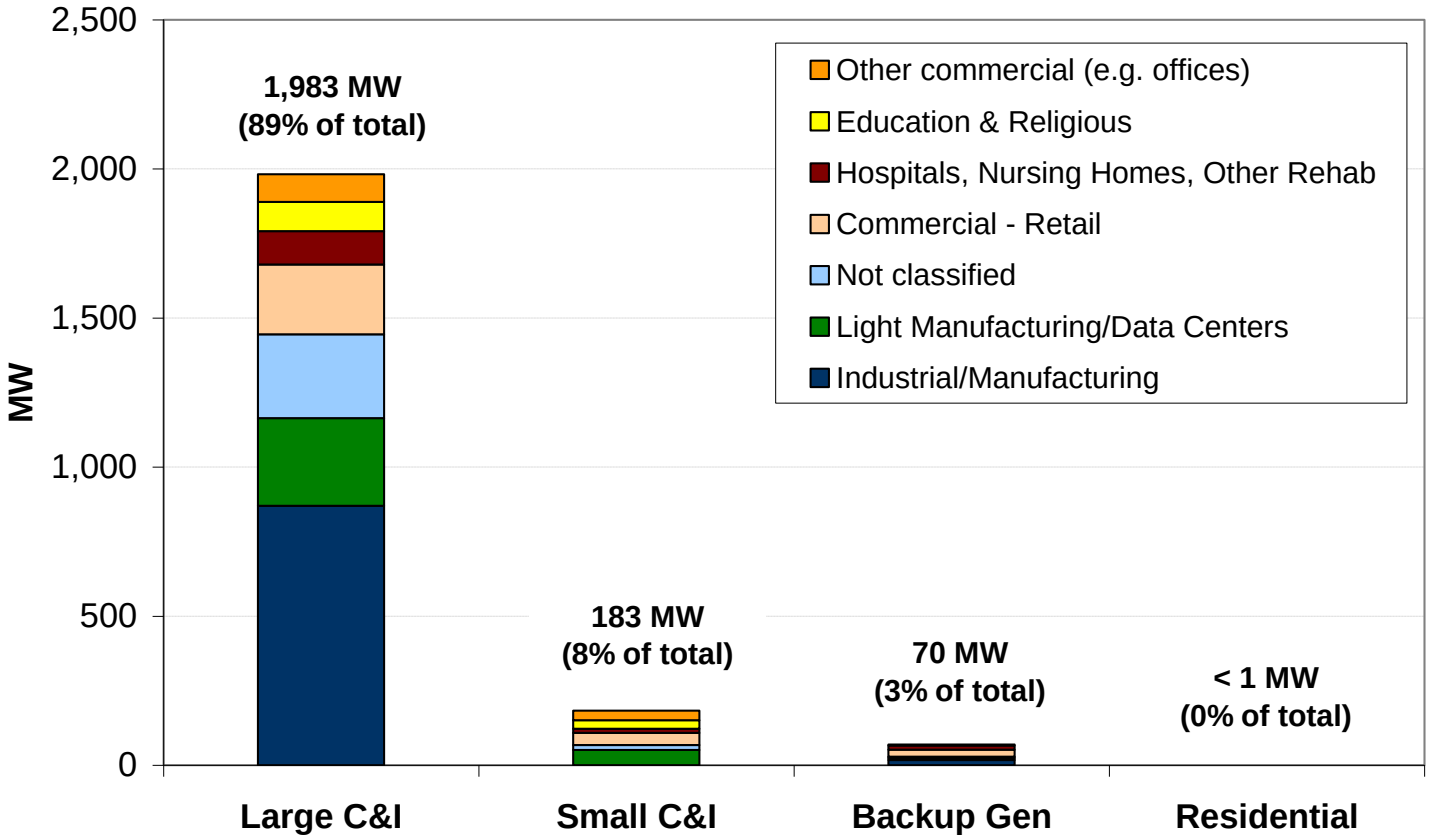
*** Assumes that all reported backup generation is from large C&I customers**
****Aggregators have obtained small amounts of DR capacity from chain stores (e.g., supermarkets) in this load range; there is also some participation from light manufacturing facilities, schools, and hospitals**
§The amount available is small because the large chain stores that aggregators might capture are a small fraction of this segment
"DR already captured" is based on NYISO analysis of SCR baseline data; allocation of SCR enrollment was scaled up proportionally to include EDRP participation. Nearly all A/S potential is with large C&I customers

Aggregation Study Segment Analysis

- **Large C&I (>400 kW)**
  - *The "easiest" DR potential to capture because the per-customer size of the DR resource can justify the fixed costs of enrolling the customer.*
  - *Low "non-monetary" challenges (e.g., regulatory/policy constraints)*
- **Small C&I (<400 kW)**
  - *Below 50kW the higher cost DR that is unattractive to aggregators; would require policy initiatives to develop*
  - *Least price-responsive*
- **Residential**
  - *Mass market DR will primarily be obtained through state and utility initiatives*
  - *Financial cost can be low ($5 to $150 per kW), but non-monetary challenges for this segment are very significant*

The vast majority of DR (capacity) market participation now comes from large C&I customers

NYISO Enrolled DR (Load Reduction Capability)



Notes:

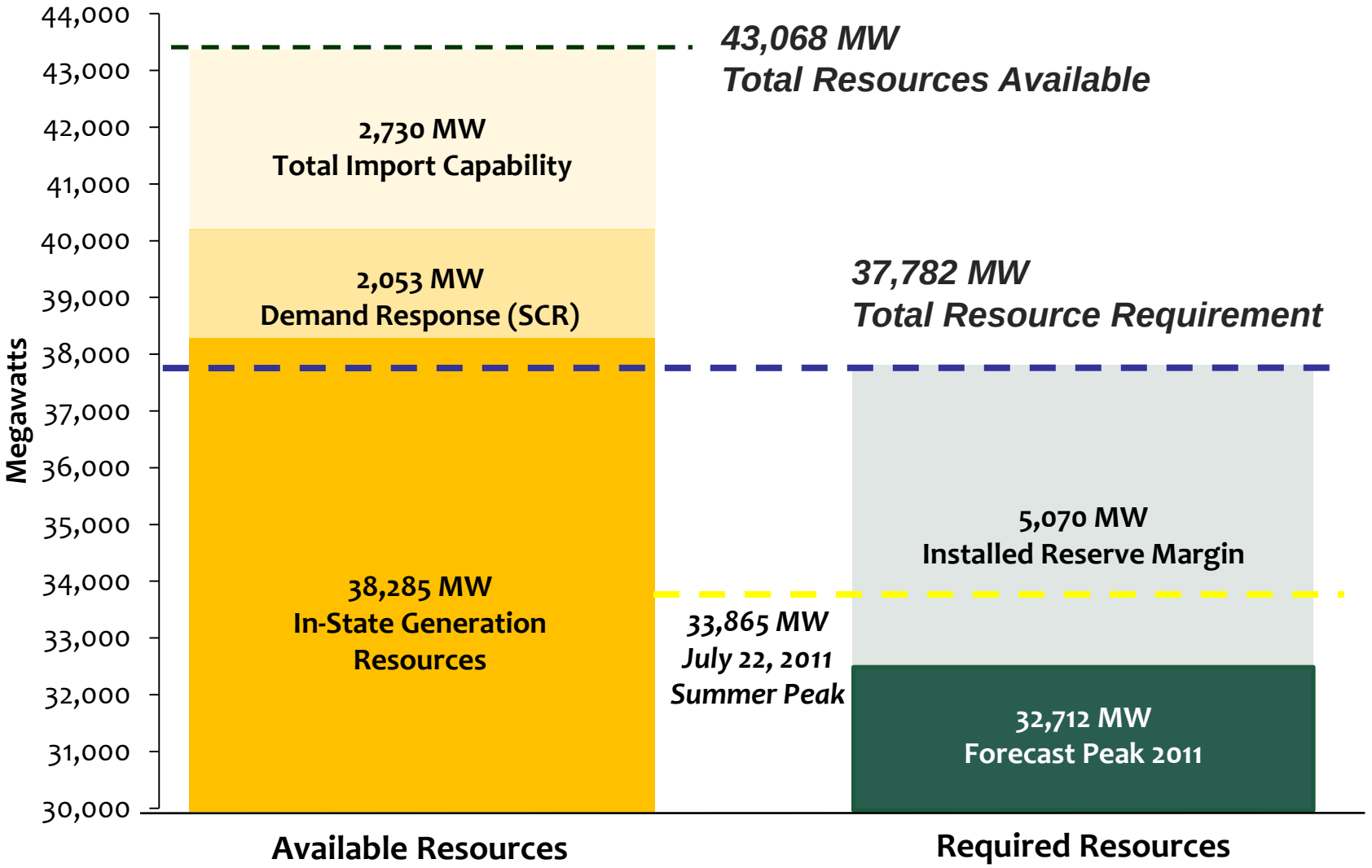
(1) Based on NYISO analysis of SCR baseline data.

(2) Allocation of SCR enrollment was scaled up proportionally to include EDRP participation (from 2,109 MW to 2,236 MW) .

(3) Backup generation is presented separately in this figure, but is included as Large C&I for the purposes of the remainder of the presentation unless otherwise noted.

Resource Availability

Summer 2011



NY PSC Activities

- **Mandatory Hourly Pricing (MHP)**
  - *Customers with over 250 kW demand phased in as their default energy supply tariff*
  - *Over 7,600 MW with MHP when phase-in complete*
  - *The majority of MHP customers have chosen to take fixed or variable prices from ESCOs, however, the ESCOs themselves are still subject to hourly pricing*
- **Variable Pricing**
  - *All utilities required to offer voluntary TOU rates to residential customers (NY Public Service Law does not allow Commission to mandate TOU rates for residential)*
  - *Class-specific demand charges for certain customers to incentivize peak load shift. Cost allocation next focus.*
  - *Electric vehicle charging will require updated tariffs*

NY PSC Activities (continued)

- **Advance Metering Infrastructure (AMI) proceeding**
  - *Established minimum functional requirements for meters*
  - *Analysis of benefits and costs based on results of utility pilot programs*
  - *PSC decided not to mandate system-wide AMI (wait and see)*
- **Utility load control pilot programs: mostly in ConEd territory and event-driven**
  - *Direct Load Control Program*
  - *Critical Peak Rebate Program*
  - *Residential Smart Appliance Program*
- **ARRA Funding**
  - *Commission authorized $390 million in ratepayer matching funds for smart grid investments*

NYISO is Participating in Several Innovative Pilot Projects in NY State

- **Con Edison:**
  - *DOE Stimulus Smart Grid Demonstration Grant with City of New York and Private Sector Participants*
  - *Comprehensive Home Area Network Demonstration in Long Island City*
- **Brookhaven National Lab "Demand Response in a Dense Urban Environment"**
- **NYSERDA Demand Response R&D**

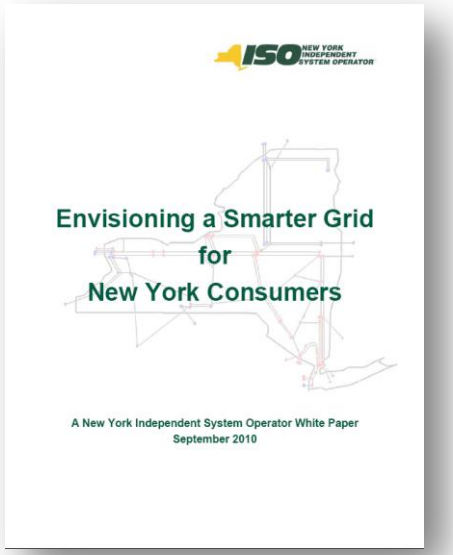
Ongoing NYISO Activities in the Demand Response Arena

- *Enhancement of the baseline and measurement and verification methodologies for Demand Response capacity market products implemented in Qtr1 2011*
- *Enhancement of the Day ahead Energy Market Product implemented 3rd Qtr 2011 (in response to FERC Order 745)*
- *Market Design discussions being initiated for Real Time Demand Response product for the Energy Market for implementation in the 2012-2013 time frame*
- *Closely working with the NY PSC on implementation of voluntary Dynamic Pricing mechanisms /EV Tariff Design*
- *Involved as a key technical advisor on a number of important Dynamic Pricing Pilot Projects*

Overview of NY Smart Grid and Dynamic Pricing Projects)

Smart Grid Vision

- **In PSC Smart Grid proceeding, NYISO comments focused on need for Smart Grid to:**
  - ***Lower costs and expand consumers' understanding and control of their electricity use***
  - ***Enhance the reliability and efficiency of the power system by improving grid operators' situational awareness and control***
  - ***Assist the growth of renewable resources and complementary energy storage resources***



The Smart Grid – both Transmission and Distribution- should:

- *Anticipate & respond to system disturbances*
- *Operate resiliently against cyber attack and natural disasters*
- *Optimize asset utilization and operate efficiently*
- *Enable active participation by consumers*
- *Accommodate all generation and storage options*
- *Enable new products, services and markets*

ISO Smart Grid Investment

- **Smart Grid Investment Grant (SGIG)**
  - ***NYISO and New York Transmission Owners***
  - ***Three-Year project -- $75.7 Million***
    - DOE funding -- $37.4 Million to cover 50% of project cost
- **Project components**
  - ***Creation of a statewide Phasor Measurement Network***
  - ***Installation of Capacitor Banks throughout the state***
- **Enhanced reliability**
  - ***PMU Installation among DOE recommendations from 2003 blackout study endorsed by FERC and NERC***

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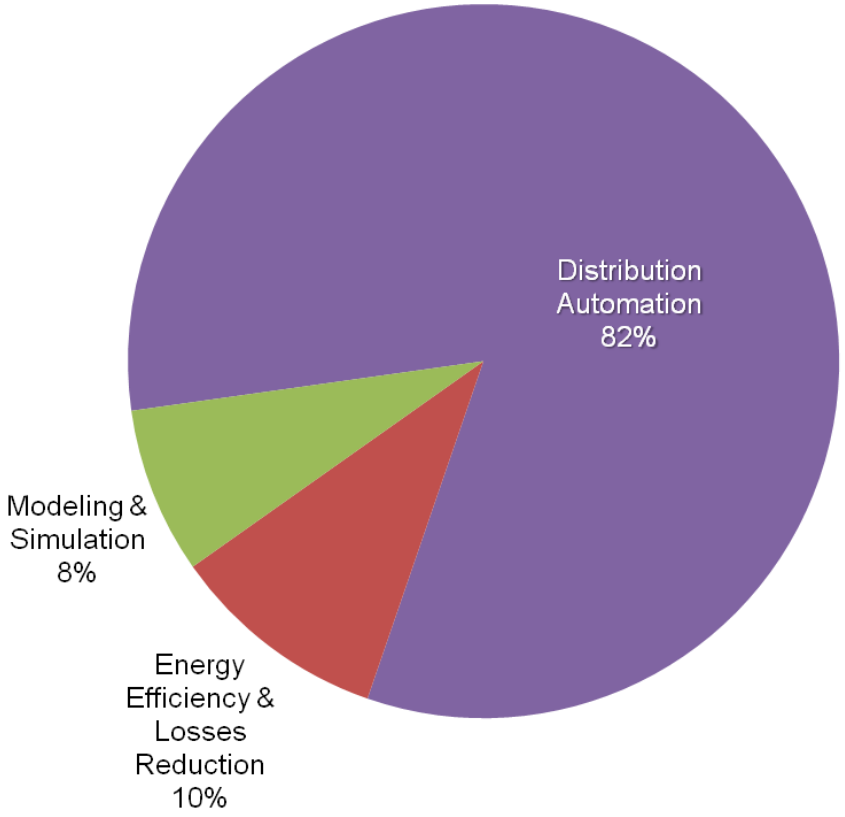
The Smart Grid in New York City

Challenges of the Smart Grid in NYC

- The unique terrain of New York City
- The location of the electrical infrastructure
- The density of existing infrastructure
- Extending a secure telecommunications infrastructure

A: Con Edison Smart Grid Deployment Project

- **Smart Grid Investment Grant**
  - ***$251 million for Smart Grid Deployment at Con Edison***
  - ***$21 million for Smart Grid Deployment at O&R***



Con Edison Smart Grid Investment Grant Projects

Generation

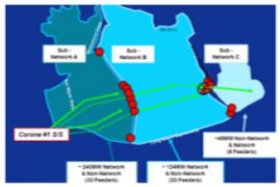
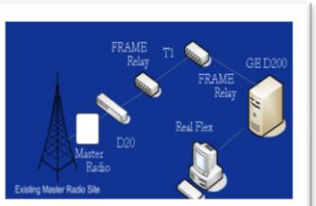
Transmission

Substation

Distribution

Customers

T & D Automation

Phasor Measurement Units	Smart Switches	Distribution Capacitors	SCADA Systems	DG Integration
				

Con Edison/NYC Smart Grid Demonstration Project ($92 M)

- Advanced management and communication systems for distributed PV, energy storage, customer EMS, electric vehicles and demand response to create a "virtual demand side power plant"

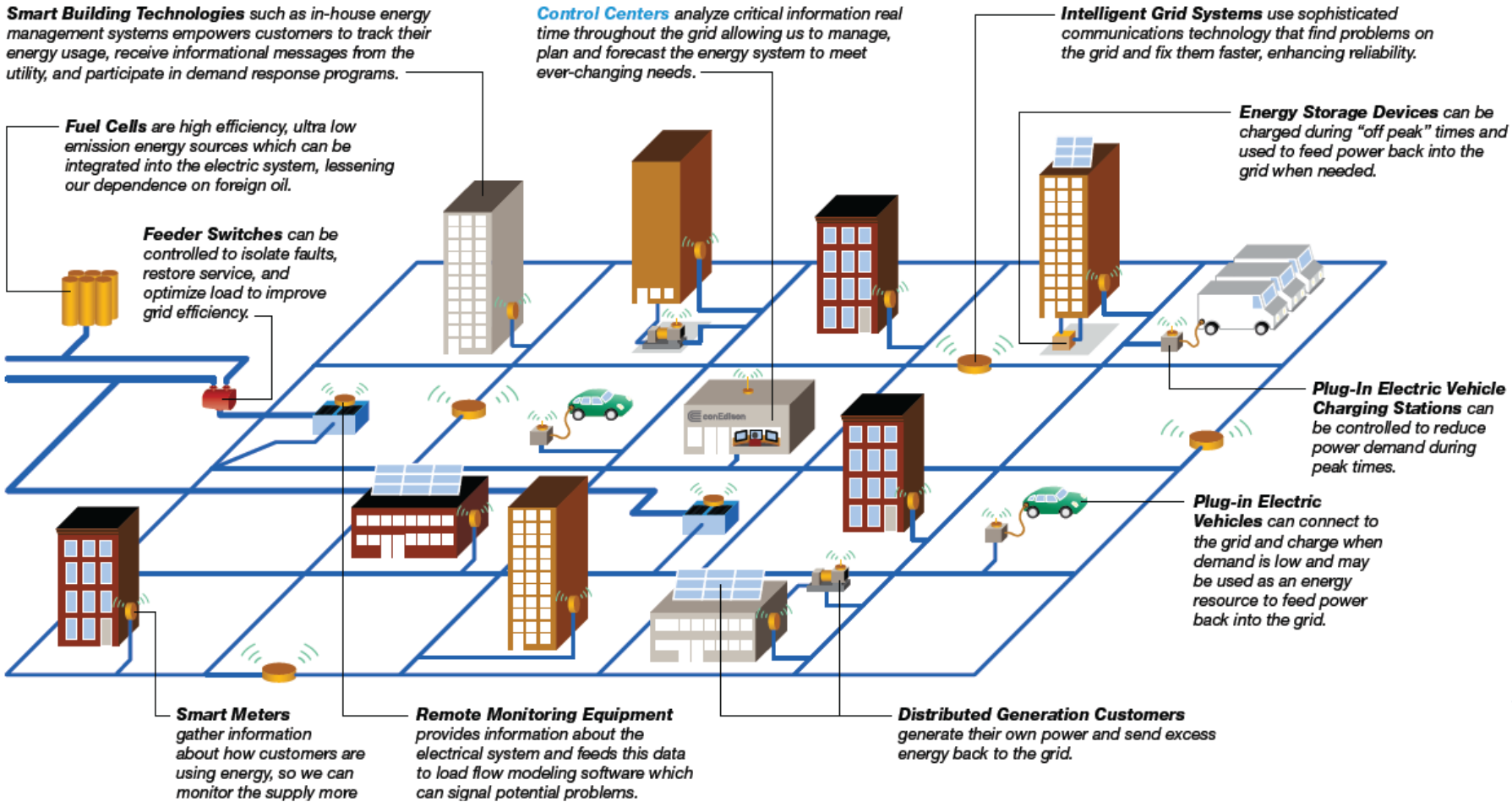
- Emphasize interoperability and cybersecurity

(Note: Boeing since replaced by Siemens)

NYC/Con Edison Smart Grid Demonstration Project Goals will be achieved through:

- Integrating new smart grid technology and leveraging existing systems (e.g. asset monitoring and load analysis)
- Deploying and integrating residential and commercial energy management systems
- Deploying and integrating distributed resources
- Integrating additional load from electric vehicles using existing capacity
- Implementing Cyber Security across Smart Grid Assets and infrastructures to support secure monitoring and control for Smart Grid systems.

The Con Ed Smart Grid Demonstration Project will implement technologies and infrastructures to enable optimized electric service delivery through secured and enhanced asset monitoring and control.



NYC "Virtual Generator" Pilot
6 Identified Buildings, 4 TBD

Viridity Energy's Network Operations Center Conshohocken, PA

VPower™

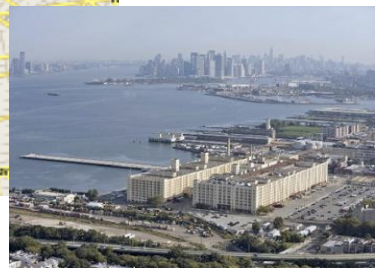
conEdison Control Center
Siemens (middleware)

Lower Manhattan
2 Rudin & 1 telecommunications

2 Buildings in Long Island City

Banking Headquarters

Community college



NYCEDC 3 Bldgs
Brooklyn Cruise Terminal,
Brooklyn Army Terminal,
Brooklyn Meat Terminal

New York ISO Control Center

Project Participant: - Brooklyn Army Terminal

(5 million sq. ft, built in 1915 and Owned by NYC. Occupied by over 70 private companies. Retrofitted with building energy management systems, PV generation, battery backup, and real time interface to NYISO wholesale markets)

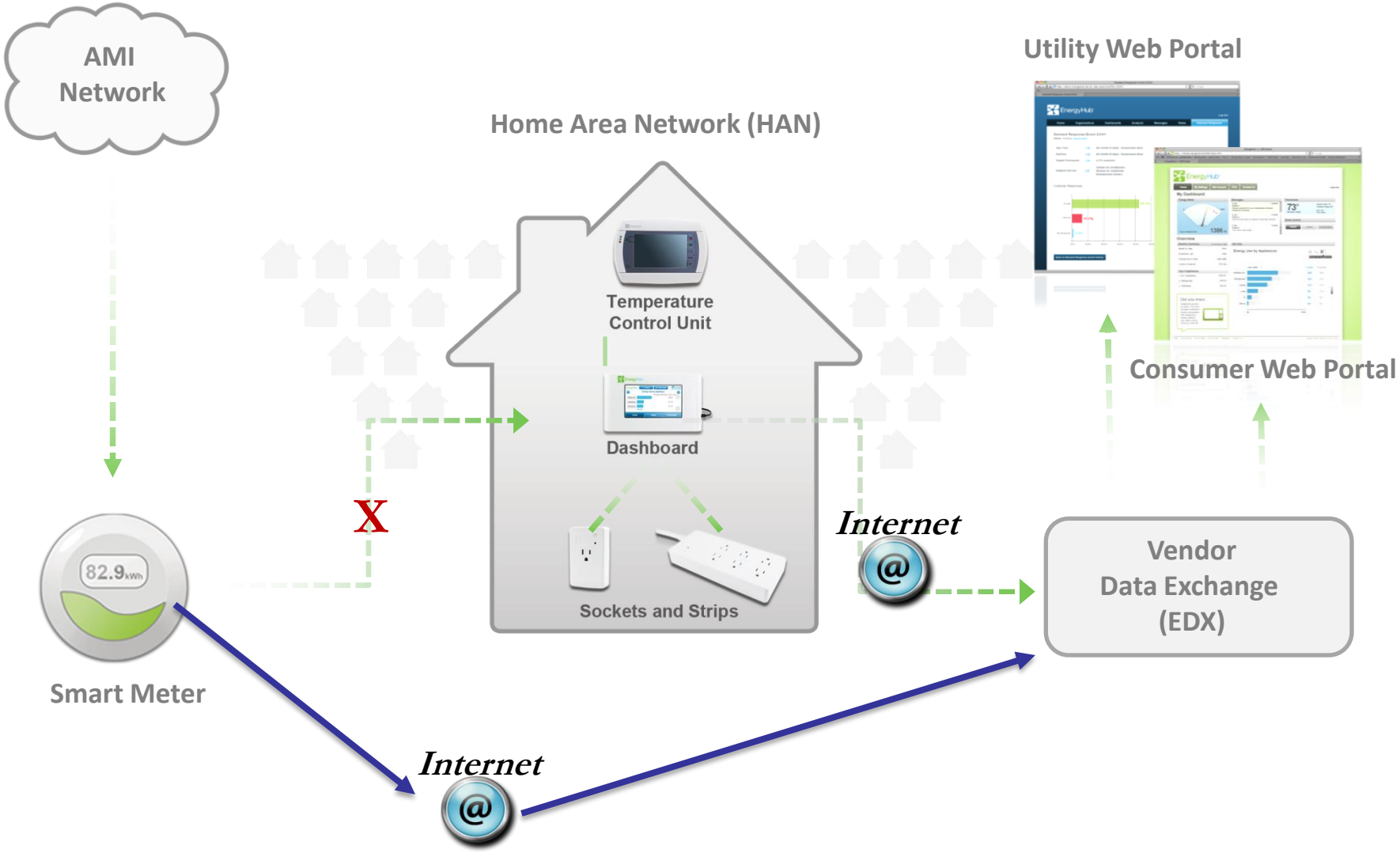
Long Island City Residential Home Area Network Demonstration

- **Target area chosen as a result of the 2006 Long Island City Blackout, where minimal to no information was available to Con Edison regarding customers without electric service**
  - *Customer demand response might have avoided or at least reduced the severity of the outage*
- **Opportunity to install state of the art smart meters and in home digital information systems**
- **Opportunity to evaluate customer response to improved price and usage information**

Three Participating Vendors of Home Area Network Technologies (GE Smart Meter installed in every home to enable technologies)

SILVERSPRING NETWORKS	Customer web portal + smart plugs	100 homes
EnergyHub™	Dedicated In Home Display + smart plugs	150 homes
CISCO	Multi-purpose In Home Display	50 homes

Pilot Setup



Demand Response Set Up

Utility controlled demand response
- **Three to four plug loads automatically turn off**

Utility and customer control
- **Customer Option to pre-program up to nine plug loads**

No control through devices
- **Notification only**

Impact by Event

- Customers were provided rebates for two hour energy reductions on six peak days (ranging from $1.50 kWh to flat $5.00). $25 thank you gift for project participation.
- Four out of the five events showed statistically significant load reductions
- The load reduction varied from an average reduction of 0.36 kW to 1.06 kW
- The event with the greatest reduction (1.06kW) was held on Saturday, July 24, which had one of the higher daily average temperatures of the five events (91 degrees F).

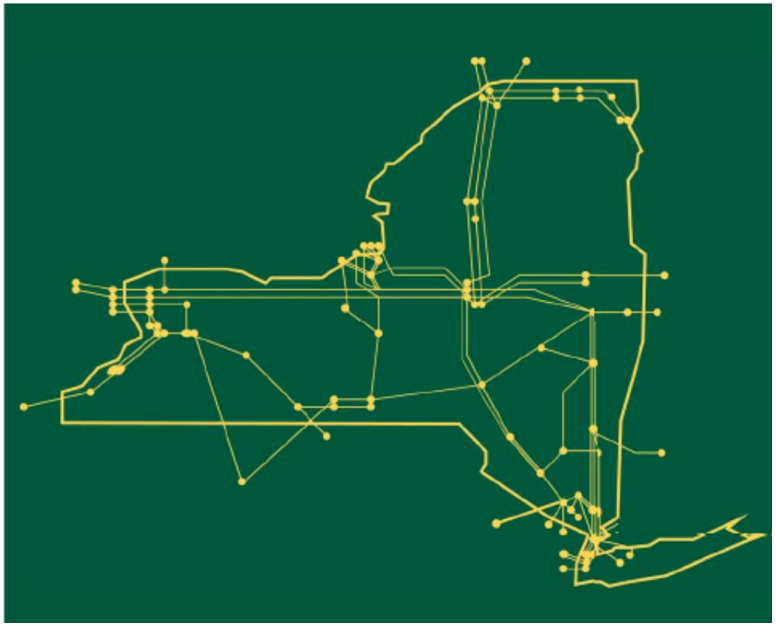
Technology Acceptance

- **General acceptance of technology, which participants found "informative".**
  - *Some technical problems. Technology still wasn't mature.*
  - *In house displays and controls expensive ($500 and up), and vendors moving to web portal approach to reduce costs.*
- **No clear customer preference among the 3 different vendors**
  - *Demand reductions similar across vendors*
- **Limited end uses to control in residential applications – Con Ed moving to targeted end use demand control**

Other Con Edison Pilots the NYISO will be Closely Following

- **CoolNYC Room Air Conditioner pilot with ThinkEco**
  - *500 units under direct load control (Tendril)*
  - *Millions of room ACs in NYC*
- **Residential Smart Appliance Pilot**
- **Home Area Network integration with AMR meters in Westchester (In home displays coupled with pre-existing drive by meters)**
- **Large scale "behavior pilot" (e.g.OPower) – system-wide program under consideration**

The New York Independent System Operator (NYISO) is a not-for-profit corporation responsible for operating the state's bulk electricity grid, administering New York's competitive wholesale electricity markets, conducting comprehensive long-term planning for the state's electric power system, and advancing the technological infrastructure of the electric system serving the Empire State.



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