NEW YORK INDEPENDENT SYSTEM OPERATOR

# NYISO Symposium

## The Future is Now:
## *Energy Efficiency, Demand Response and Advanced Metering*

*June 27, 2007*
*Desmond Hotel & Conference Center*
*Albany, NY*

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# The Future is Now

## *Energy Efficiency, Demand Response and Advanced Metering*

### A symposium sponsored by the New York Independent System Operator

***Desmond Hotel and Conference Center, Albany, NY***
***June 27, 2007***

*The New York Independent System Operator (NYISO) – www.nyiso.com – is a federally regulated, 501(c) 3 nonprofit corporation that began operations in 1999 to facilitate the restructuring of New York's electric industry. The NYISO operates the state's bulk electricity grid and administers the state's wholesale electricity markets. The NYISO's market volume was $8.6 billion in 2006.*

## Introductory Note

On June 27, 2007, the New York Independent System Operator (NYISO) sponsored a symposium entitled “The Future is Now: Energy Efficiency, Demand Response and Advanced Metering” at the Desmond Hotel and Conference Center in Albany, NY.

The day-long event was attended by over 200 participants and featured remarks from government and private sector leaders in the fields of energy efficiency, demand response and advanced metering.

Please note that speakers and panelists were not required to submit written remarks and presentations for the symposium. Only the remarks and presentations provided to the NYISO are included in this document

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# Opening Remarks - Mark S. Lynch

Welcome to the New York Independent System Operator (NYISO) symposium, "The Future is Now: Energy Efficiency, Demand Response and Advanced Metering."

The NYISO has responsibility for the safe and reliable operation of state's bulk electricity grid and the fair and open administration of New York's wholesale electricity markets. We play an integral role in assisting New York State to achieve its energy policy goals and we are pleased to host this event as part of that effort.

This symposium is intended to provide information that will assist policymakers and industry leaders to address the environmental, economic and energy goals of the Empire State.

Governor Eliot Spitzer has heightened attention to the importance of energy efficiency in New York State with his "15x15" Clean Energy Strategy. It includes a 15 percent reduction from forecasted levels of electricity use by the year 2015.

Consistent with the Governor's strategy, the New York State Public Service Commission (PSC) has initiated a proceeding to establish an Energy Efficiency Portfolio Standard that will "establish targets for energy efficiency, similar to the existing Renewable Portfolio Standard, and other programs, intended to reverse the pattern of increasing energy use in New York."

As New York State strives to make more efficient use of electricity, it is important to understand that the system of supplying electricity is based on the need to be ready and able to meet peak demand. Last year, New York State's average hourly demand for electricity was 18,523 megawatts (MW). On August 2, 2006, New York State reached a new record peak demand of 33,939 MW – 80% higher than the state's average.

The costs of being prepared to serve the peak – in terms of both economic and environmental impacts – are immense. To address these costs, more and more attention is being paid to the topics of today's symposium – energy efficiency, demand response and advanced metering.

Our agenda today is designed to begin with the broad, overarching topic of energy efficiency, move to demand response as a discrete element, and then focus specifically on the importance of advanced metering and other implementing technologies.

There are very real synergies among the topics of today's symposium. Demand response programs can help to identify non-essential or inefficient energy use that may be alleviated by energy efficiency measures.

Technologies used to enable demand response can likewise serve energy efficiency. Experience gained by participation in demand response can result in better overall awareness of consumption patterns and lead to adoption of energy efficiency measures.

Since the NYISO began operating in 1999, we have recognized the value of integrating demand response into our markets. We have worked with Market Participants, state and federal governments, and others to develop what many regard as the most advanced markets for demand resources in the U.S.

During peak demand periods, the NYISO's Demand Response Programs have proven to be a major contributor to maintaining grid reliability and to the stability of our markets.

Last summer's heat waves tested New York's bulk electric system and we met the challenge. Demand response provided voluntary load reductions on six occasions, five of them to address concerns in the New York City area. On August 2, 2006, when New York achieved a new record peak of 33,939 MW, the NYISO's Demand Response Programs supplied almost 1,000 MW of load reduction. Over the course of last summer, demand-side management efforts provided nearly 16,500 MW hours of load reduction – more than in any previous summer.

The NYISO's experience is a good illustration of the way demand response has grown in the electricity markets operated by ISOs and RTOs across North America. Demand response programs totaling more than 24,900 MW have been established by the 10 ISO/RTO markets in the U.S. and Canada. At the federal level, the Energy Policy Act of 2005 made demand response part of U.S. energy policy, which is being actively addressed by the Federal Energy Regulatory Commission (FERC). Many organizations that support energy efficiency and renewable power have recognized the value of open markets in fostering innovation.

In addition to the impetus for innovation made possible by competitive markets, the success of demand response programs in New York has been helped by the collaborative relationship between the NYISO and New York State government.

The PSC has been instrumental in the programs' success by encouraging utilities to offer retail demand side management programs consistent with the NYISO's wholesale program designs. The New York State Energy Research and Development Authority (NYSERDA) has offered innovative programs to assist participants with load reduction strategies, such as interval metering and emergency generator tune-up and emissions testing. The New York State Department of Environmental Conservation (DEC) has played a vital role in helping demand side programs to meet the environmental standards of New York.

We are pleased to have representatives of the PSC, NYSERDA, and DEC with us today and we are fortunate to have representatives of utilities, energy service companies, consumers, and manufacturers as speakers, panelists, and participants taking part in this timely symposium.

Energy efficiency is environmentally prudent, economically sensible, and increasingly vital to the Empire State's energy future.

On behalf of the New York Independent System Operator, I thank you for attending today and I hope that this event will assist all of us to learn more about the best ways to make New York State as energy efficient as it can possibly be.

# The Future is Now

## Energy Efficiency, Demand Response and Advanced Metering

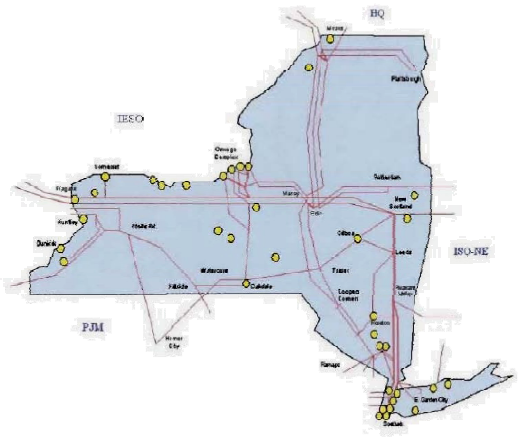
*A symposium sponsored by the*

**New York Independent System Operator**

*June 27, 2007*

*Albany, New York*

# New York ISO




**The New York Independent System Operator (NYISO) is responsible for:**

- *Safe and reliable operation of New York's bulk electricity grid*
- *Fair and open administration of the state's wholesale electricity markets*

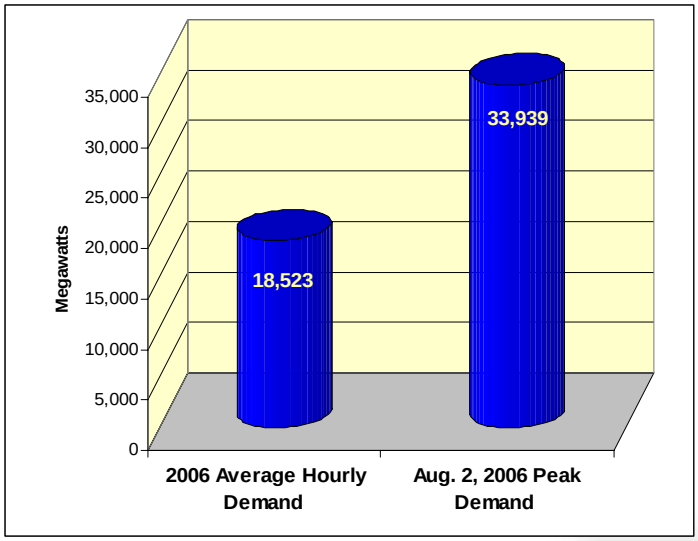
# Clean Energy Strategy

Governor Eliot Spitzer's "15x15" Clean Energy Strategy includes a 15% reduction in electricity use by 2015.

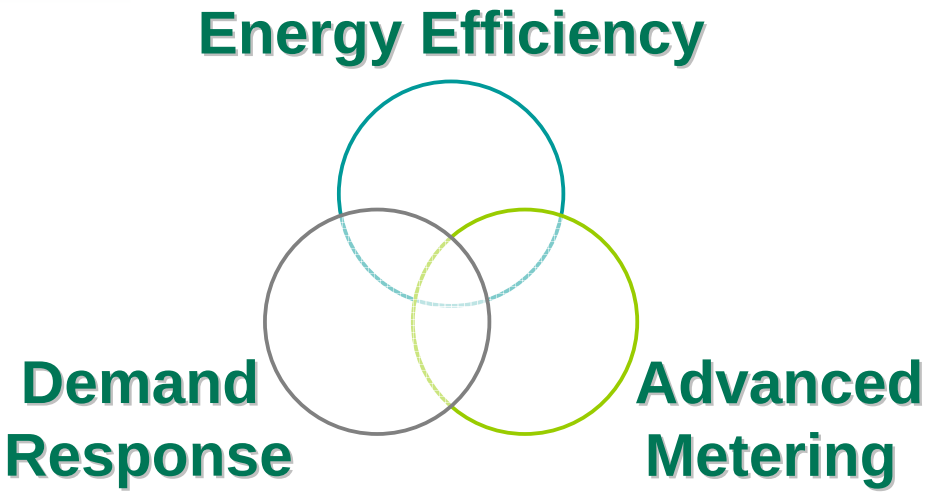



# New York's Electricity Demand

On August 2, 2006, New York State reached a new record peak demand of 33,939 MW -- 80% higher than the last year's average hourly demand.

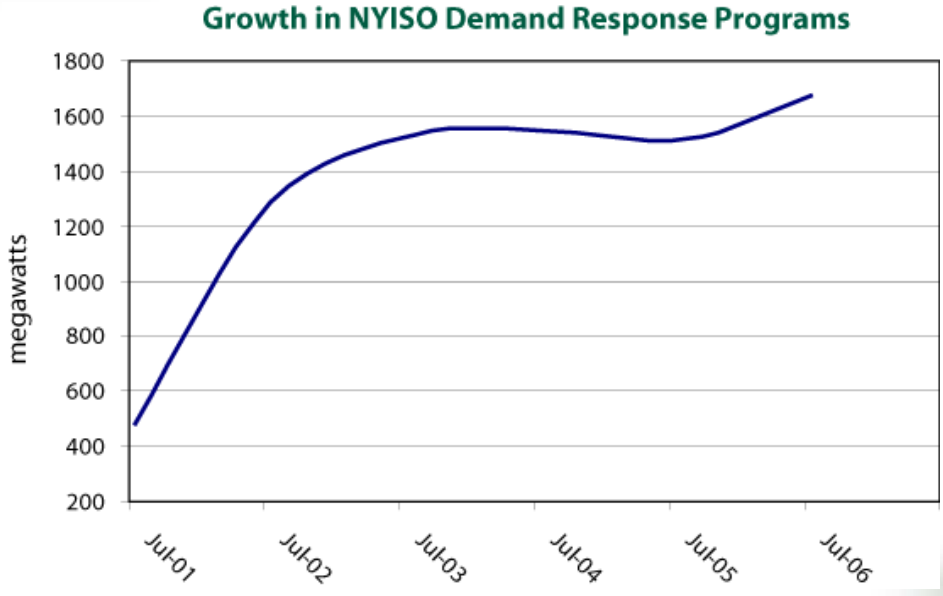


# Electric Synergies

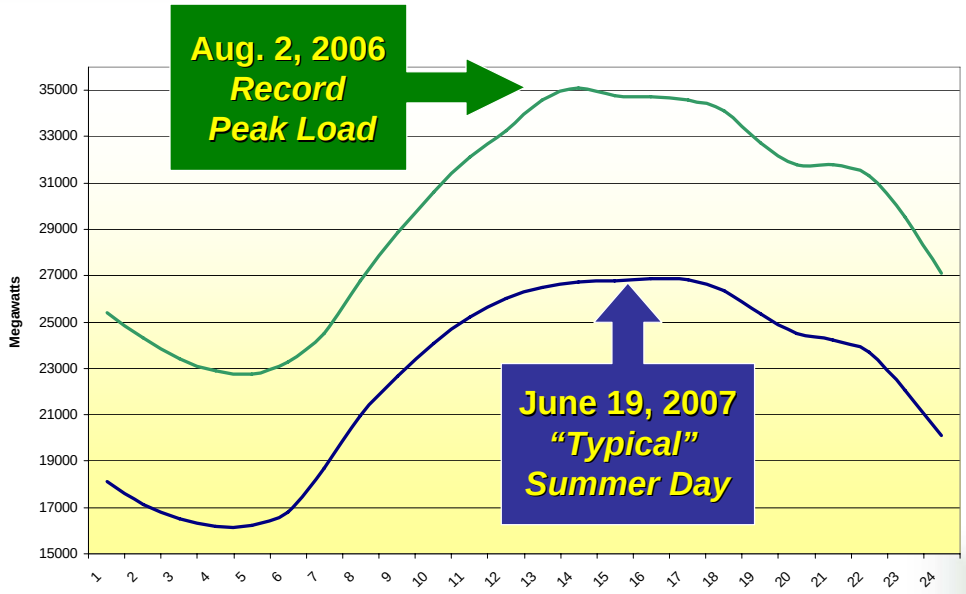





# NYISO Demand Response



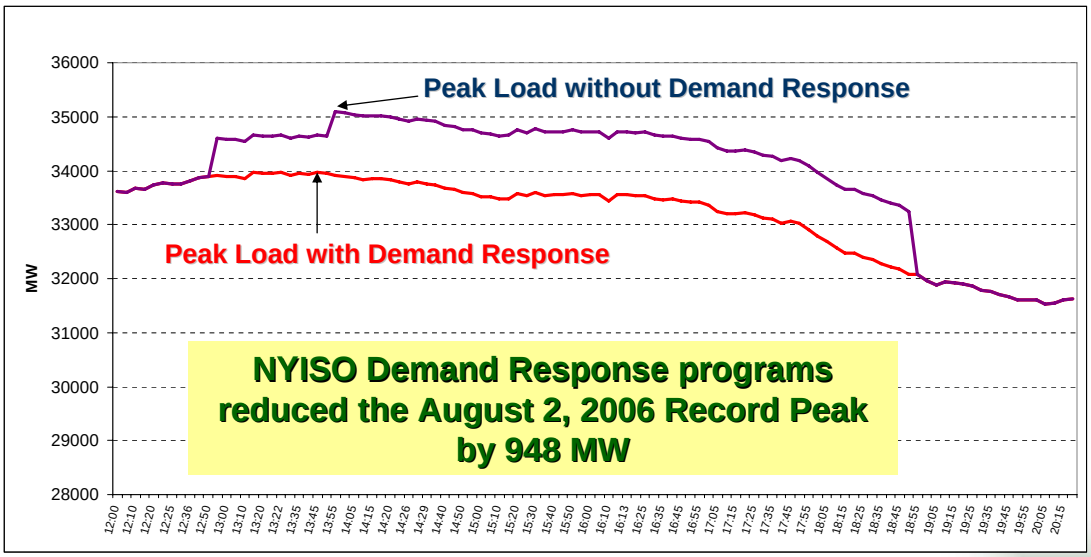
# New York's Electricity Profile






# Shaving the Peak

**New York State Record Peak - August 2, 2006**



# Demand Response & Electricity Markets

"Demand response is increasingly recognized as an essential ingredient to well functioning electricity markets. This growing consensus was formalized in the Energy Policy Act of 2005 (EPACT), which established demand response as an official policy of the U.S. government…"

-- Estimating Demand Response Market Potential among Large Commercial and Industrial Customers: A Scoping Study, Charles Goldman, Nicole Hopper and Ranjit Bharvirkar , Lawrence Berkeley National Laboratory; Bernie Neenan and Peter Cappers Utilipoint International, January 2007

"Together with energy efficiency, I believe that demand response is this country's untapped energy resource. Demand response, if properly implemented, can mitigate market volatility, eliminate price spikes, improve resource adequacy, alleviate congestion, and improve reliability."

-- FERC Commissioner Jon Wellinghoff, September 21, 2006

" Well-structured regional wholesale electricity markets operated independently allow far greater amounts of renewable energy and demand response resources to be integrated into the nation's electric grid."

-- Letter to FERC from the American Wind Energy Association and 21 other organizations supporting renewable power and energy efficiency, February 26, 2007

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# Working Together

The **Public Service Commission** -- Encouraging utilities to offer retail demand side management programs consistent with the NYISO's wholesale program designs.

The **New York State Energy Research and Development Authority** -- Innovative programs to assist participants with load reduction strategies such as interval metering and emergency generator tune-up and emissions testing.

The **Department of Environmental Conservation** – Assuring that demand side programs meet the environmental standards of the Empire State.

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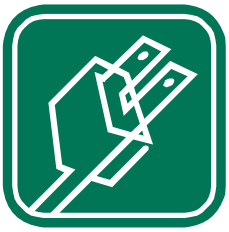
# Greening the Grid



Energy efficiency is environmentally prudent, economically sensible, and increasingly vital to the Empire State's energy future.

# Keynote Remarks - Commisioner Pete Grannis

***Commissioner Grannis provided the following talking points from his keynote remarks:***

**Greetings**

- Thank you very much -- good to be here – thanks for the invitation to address you today.
- Want to commend ISO for the important work it does "keeping the lights on" … ensuring reliability …
- Ensuring system reliability is more critical responsibility than ever before.
- Today is the kind of day that causes people to utter the phrase that strikes the most fear in the ISO: Hot enough for ya?
- The answer is yes.
- We had an air quality advisory out for the entire state on Tuesday, which continues today as well. I know that you all are concerned about pressure on the grid, but those with asthma and our seniors worry about their next breath.
- I'm sure you've noticed – but heat like today has become more and more common over the past few years.
- At least we can finally agree why. 2,000 leading scientists have spoken. The debate is over. Global warming is man-made – GHG emissions must be reduced to forestall catastrophic climate change.
- Each day -- new reports of glaciers melting, sea levels rising, polar ice caps shrinking.
- We see the effects in New York …
  - Since 1970, the Northeast United States has been warming at a rate of 0.5 degrees Fahrenheit per decade.
  - Winter temperatures have risen even faster, at a rate of 1.3° per decade from 1970 to 2000.
- Our climate will be that of North or South Carolina by the end of the century – and the ramifications will be dramatic:
  - Killer heat waves in NYC and across the state
  - Threats to our water supplies: drought and turbidity, both caused by storms, threaten the NYC watershed.
  - Rising sea levels/ more intense storm activity will raises likelihood of a perfect storm that floods the New York City infrastructure, including subways and sewage treatment plants.
- The fact is – climate change is the issue of our time. Need to take action now.



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10 Krey Boulevard | Rensselaer, NY 12144
www.nyiso.com

- How? EVERY WAY we can. On climate change, there is no silver bullet.
- As a state and nation we're late to the party – need to attack this issue on several tracks:
  - Controlling emissions …
  - Developing clean and renewable fuels …
  - Encouraging energy efficiencies/conservation, including green buildings
- Today, I want to talk about some of the ways we're addressing climate change – and how the ISO's efforts to ensure system reliability – including demand response and advanced metering – can work in concert with that agenda.

* * *

**Emissions Control**

- On emissions control, we're working on several tracks …
- Big Power Plants:
  - Fully committed to implementation of RGGI, particularly the 100% auction of allowances.
  - Auctioning allowances instead of the current practice of giving away the right to pollute for free means power companies will pay for their pollution – and we will return the value of those allowances to the public.
  - Specifically, we intend to return this value to the public in the form of energy efficiency improvements in the commercial, residential, and industrial sectors.
  - Other RGGI states have followed our lead – hope that ours will be a national model.
- Small Power Plants/ Distributed Generation
  - While you look at the small generators through their importance in ensuring reliability – we look at emissions.
  - NYISO's and NYSERDA's Demand Response Programs have reduced peak load across the state and strengthened reliability – that is a good thing.
  - But solving reliability issues in a way that contributes to climate change or harms air quality isn't an option. We need to aggressively move away from reliance on fossil fuel-fired sources of behind the meter generation.
  - This is something I've been concerned about for some time …
  - In the Assembly, I sponsored legislation to impose strict standards on diesel engines …

- And DEC is working on distributed generation regulations to ensure that behind-the-meter generators are made cleaner. These regulations were initially developed by the previous administration. We are taking a fresh look and hope to propose draft regulations later this summer.
- Toward this goal … we should look for ways to support clean distributed generation, such as solar, which is strongest during sunny days, and take a hard look at the institutional barriers that prevent businesses from siting PV on their rooftops. People should be able to sell excess power back to the grid – and I hope you will join me in this effort to expand net metering to include commercial installations.
- We need to partner to ensure that the behind the meter generation used to meet peak demand advances our clean air goals rather than hinders them – and to create a system that is not only reliable, but clean.

* * *

On emissions, we are not just looking at electricity … we are also working on other culprits as well …

- Transportation:
  - Have adopted and we are eager to enforce the California Low Emission Vehicle standards, which contain meaningful GHG reduction requirements.
  - California only state that can adopt its own emission standards that exceed feds. Other states can follow California's lead, but only if EPA grants a waiver from preemption under the Clean Air Act for the California standards.
  - Testified before Senate and EPA in Washington recently to urge EPA to grant Cal. waiver and allow states to lead the way on this – fill the vacuum left by EPA's lack of leadership.
  - Also looking ways to promote less carbon-intensive means of transportation, such as mass transit.
- Residential:
  - Home heating oils: New York is the largest user of home heating oil in the country. Looking at possibility of switching to lower sulfur oil, and blending biodiesel – could substantially reduce the CO2 generated through heating homes.

* * *

**Energy Efficiency/Conservation**

- Another track is Energy efficiency…
- Governor Spitzer's Energy Plan
  - Governor's Energy Conservation Plan –15 by 15— is key to this effort.

- Goal is reduce New York's electricity use by 15 percent from forecasted levels by the year 2015. This plan makes us the only state to commit to actually lowering electricity consumption below current levels.
- Would reduce annual carbon dioxide emissions by about 12.8 million tons – equivalent to removing 2.5 million cars from the road.
- Innovative, cutting edge plan – makes us the only state to commit to lowering electricity consumption below current levels.
- As part of the plan, many state agencies (including DEC) are working together to develop comprehensive green building strategy – DEC will be promulgating new regs. to implement the green buildings tax credit.
- We're also looking to support energy conservation when we settle enforcement cases – the recent Mirant (Lovett Plant) resolution provided $1 million for energy conservation.
- In addition, the State has completed promulgation of 18 product efficiency standards for energy consuming equipment in State-owned facilities, and initiated development of statewide energy standards for certain consumer electronic devices, incandescent reflector lamps, metal halide lamp fixtures and external power supplies.
- Most aggressive plan in the nation – I am committed to partnering with Governor on this – DEC will be an active participant in the PSC proceeding to implement this directive.
- The ISO should join us in this effort – look for ways to promote conservation and reduce demand to ensure the system's reliability.

- Advanced Metering
  - Advanced metering is another important way to foster energy efficiency.
  - Enhances public's energy awareness—helps consumers better manage energy usage and reduce overall consumption through dimming lights, reducing air conditioning etc.
  - Lowers electricity bills
  - Shifts more electricity usage to off-peak periods, reduces reliance on dirtier peaker units
  - In the future, it could be used to shift demand to periods when renewable sources are on line, in particular wind.
  - Advanced metering is a win-win -- lowers bills and fosters consumer awareness that leads to greater energy efficiencies.

* * *

**Clean Energy**

- Flipside of energy efficiency is making sure that the energy we use is clean. We're making good progress on this track:
- The Renewable Portfolio Standard (RPS) Program is pushing development of clean energy sources.
- We see the customer sited tier of the RPS as another policy tool to move us towards clean distributed generator technologies.
- ISO can play an important role in this area as well by moving renewable projects through the queue.
- I know your concerned about a predicable power plant permitting process The Governor proposed Article X power plant-siting bill that would expedite the siting of clean sources of energy – unfortunately, it did not pass –maybe a chance in special session – critical issue.
- And, as I said before when we're talking about the smaller plants, development of clean distributed generation technologies is key to keeping the lights on and keeping the air clean

**Conclusion**

- As I said, when it comes to addressing climate change, we're a bit late to the game – we need to do everything we can …
- To make headway, we need to work on different tracks … a multi-pronged approach ...
- This is a long-term priority for DEC— an enormous undertaking.
- Air quality issues like acid rain and urban smog are inextricably linked to our current electrical system. Millions of New Yorkers still live in areas not meeting health-based air quality standards.
- We cannot rely on technologies that will worsen the air quality and hasten climate change in the name of reliability. For our future, we can and must do better.
- Looking forward to working together with all of you to create a clean, efficient and reliable power system and a healthier state.
- Thank you.

# Energy Efficiency: The Environmental Imperative

**The Future Is Now: Energy Efficiency, Demand Response and Advanced Metering**
**NYISO Symposium**
**Albany, New York**
**June 27, 2007**

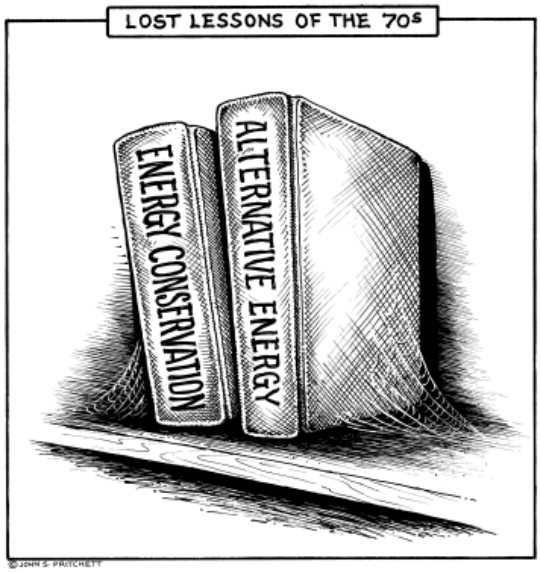
Pace Law School

Fred Zalcman

Executive Director

Pace Law School Energy Project

# Not your father's energy conservation

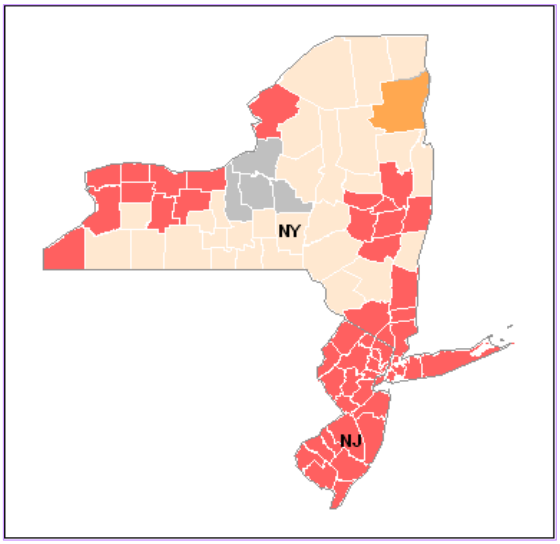


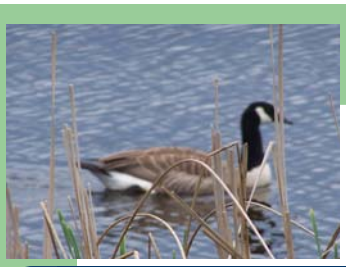
# Environmental Impacts of Power Generation

- The generation of electric power produces more pollution than any other single industry in the United States. The most recent data shows the U.S. electricity industry was responsible for:
  - 67% of sulfur dioxide emissions that contribute to *acid rain*
  - 25% of NOx emissions that contribute to *urban smog*
  - 40% of carbon emissions that contribute to *global climate change*
  - 33% of mercury emissions that pose *significant health risks*
- Among the other major environmental issues linked to electricity are *water impacts*, generation of *wastes*, and the disruption of *land uses*.

# Power Plant Pollution Impacts

- Particulate matter from power plants (soot) causes 1,200 premature deaths and 2,500 heart attacks a year in NY
- Many areas fail to meet health-based air quality standards
  - Red counties fail U.S. EPA standard for ozone



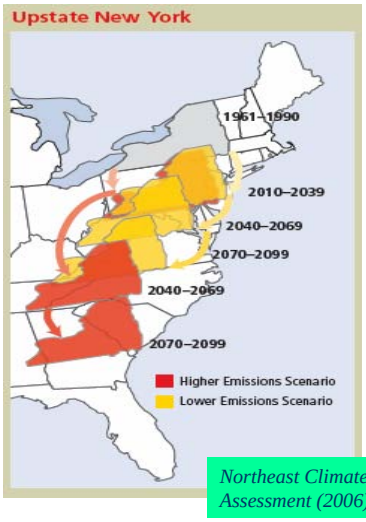


## Mercury Contamination from Power Plant Pollution

- NY Department of Health fish consumption advisories due to mercury contamination (06-07)
- Adirondack & Catskill waters
  - Women and children should eat no northern pike, pickerel, walleye, largemouth bass, smallmouth bass, or yellow perch longer than 10"
  - Women and children should eat no more than one meal a month of brook trout, brown trout, rainbow trout, bullhead, bluegill/sunfish, rock bass, crappie, or yellow perch less than 10"
- Advisories for 87 specific water bodies

## Impacts of Global Warming – Local Ecosystems

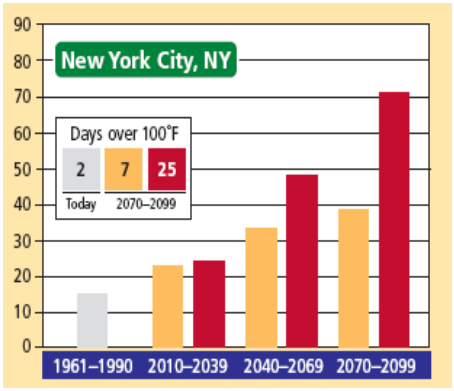
- Predicted Impacts in New York State
  - Up to 40% decrease in agricultural yield
  - Loss of sugar maples to oak-hickory forest
  - Loss of trout habitat
  - ~3 ft. sea level rise
    - Coast of Long Island, New York City and Hudson River to Albany
    - Coastal wetlands at risk due to inundation and erosion
  - Receding of the Great Lakes and Finger Lakes




*Northeast Climate Impacts Assessment (2006)*

# Impacts of Global Warming – Public Health and Infrastructure

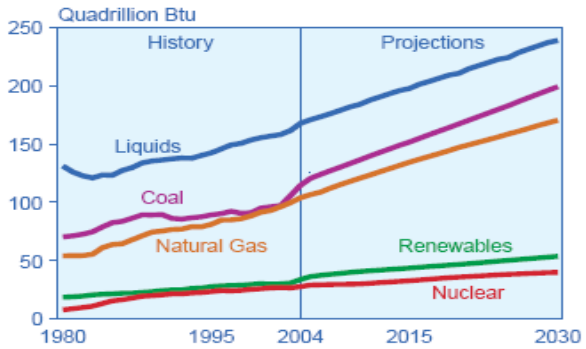
- Increase in the number of extreme heat days
  - Stress on vulnerable populations
- Risk of spread of vector-borne diseases
- Demands on energy supply to keep up with cooling load
- Increase in frequency/duration of drought
- Increase in insured losses
  - 5-10% increase in wind speed predicted to double annual damage costs
- Low-lying transportation infrastructure at increased risk of inundation
- Surprises???




*Northeast Climate Impacts Assessment (2006)*

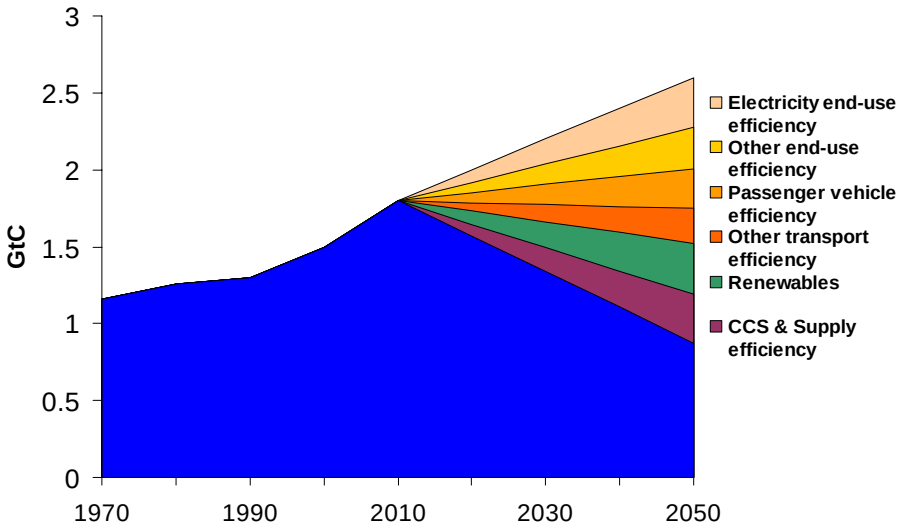
# In the face of rising global demand for energy…

**Figure 11. World Marketed Energy Use by Fuel Type, 1980-2030**




Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 2004* (May-July 2006), web site www.eia.doe.gov/iea. **Projections:** EIA, System for the Analysis of Global Energy Markets (2007).

# US CO2 Reduction Strategies



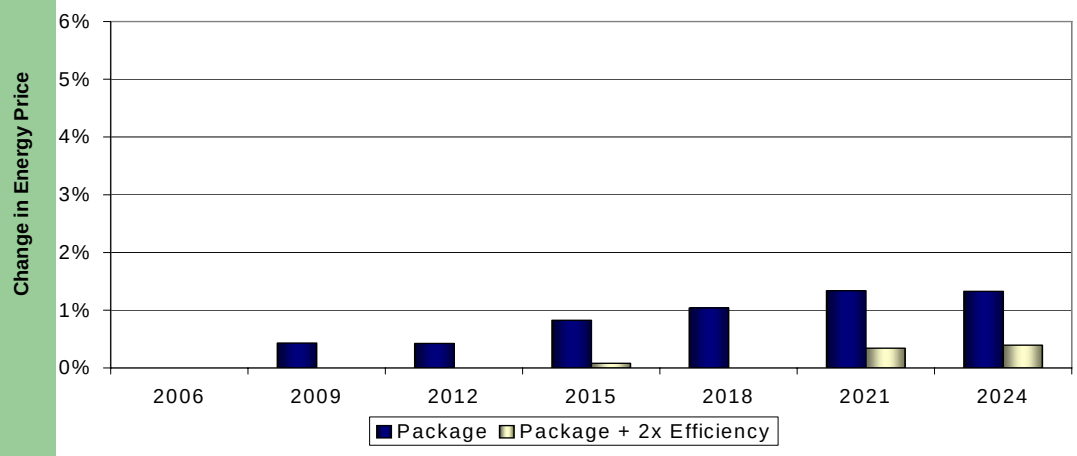

# A large and untapped resource…

- ACEEE Meta-study (2004)
  - Achievable potential = 24% electricity; 9% gas
- Inter-laboratory Working Group (2000)
  - 24% electricity savings achievable across U.S.
- NYSERDA (2003 & 2006)
  - NYS GHG reduction targets can be met by lowering electricity use by 11% (2012) and 14.1% (2022) at a cost of less than 3 cents/kWh; and yield $4.5-$9.1 **billion** in net economic benefits
  - 28% of forecast gas use economically displaceable by 2016

# Huge Savings Are Left on the Table...

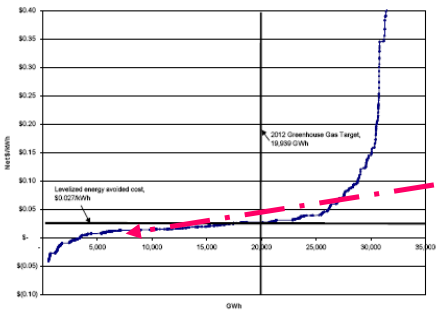
- Consumers/Businesses face barriers to choosing efficiency
  - Lack of information/trust in vendors
  - "First cost" factor/lack of access to capital
  - Limited product availability
  - Uncertainty about future occupancy
  - Split incentives
    - Landlord/tenant
    - Builder/owner
- "Iron ceiling" on public benefit funding

# Benefits of Efficiency – Meeting Regional GHG Targets at Least Cost



# The Efficiency Resource

Figure 1.10 Greenhouse Gas Target Supply Curve (2012, Low Avoided Costs)




| | Annual MWh | Lifetime net cost per kWh saved |
|---|---|---|
| **Residential** | | |
| Cooling | 789,035 | $ (0.2968) |
| Dishwasher | 158,840 | $ (0.0017) |
| Refrigerator | 209,235 | $ 0.0216 |
| Heat Pump | 92,678 | $ (0.0106) |
| Space Heating | 935,551 | $ 0.0171 |
| Domestic Hot Water | 167,649 | $ 0.0086 |
| Lighting | 3,100,239 | $ 0.0092 |
| Miscellaneous | 566,205 | $ 0.0028 |
| Pool/Hot Tub Pump | - | NA |
| TV/VCR/DVD | 228,685 | $ 0.0059 |
| Clotheswasher | 569,786 | $ (0.0331) |
| **TOTAL** | 6,817,904 | $ (0.0286) |
| **Commercial** | | |
| Indoor Lighting | 6,227,948 | $ 0.0170 |
| Outdoor Lighting | 173,918 | $ 0.0133 |
| Cooling | 1,692,562 | $ (0.0097) |
| Ventilation | 1,715,563 | $ 0.0147 |
| Water Heating | 378,942 | $ 0.0080 |
| Refrigeration | 990,031 | $ 0.0147 |
| Space Heating | 111,886 | $ (0.0031) |
| Office Equipment | 560,559 | $ 0.0008 |
| Miscellaneous | 293,195 | $ 0.0251 |
| Whole Building | 700,899 | $ 0.0148 |
| **TOTAL** | 12,845,503 | $ 0.0121 |

- NYSERDA (2003)
  - NYS GHG reduction targets can be met by lowering electricity use by 11% (2012) and 14.1% (2022) at a cost of less than 3 cents/kWh; and yield $4.5-$9.1 **billion** in net economic benefits

# "15 by 15"

*"Here in New York, we face three seemingly intractable challenges: rising energy bills, rising global temperatures, and a rising tide of young people leaving New York for opportunity elsewhere – each of which can be addressed by a long-term clean energy strategy."*

*Gov. Eliot Spitzer*

*April 19, 2007*

# Not all DER is created equal...

- Efficiency versus load management
  - EE can reduce load significantly and over many hours of the daily load shape and for many days of the year
    - Very different implications depending upon whether goal is kW, kWh and/or $CO_2$ reduction
  - EE does not need to be re-enrolled
  - EE reduces load over the life of the efficiency measure
  - EE does not reduce the level of service or amenity
  - EE resource is always “on”
  - EE captures lost opportunities and avoids addition of inefficient load
- Efficiency versus distributed generation
  - Also dramatically different environmental results depending on what gets dispatched (e.g., diesel BUG versus CHP) and when

# Panel Discussion:
## Realizing the Promise of Energy Efficiency

Moderator —
Tina Palmero, NYS Department of Public Service

Presentation provided by:

*Micro-CHP,* Dr. Eric Guyer, Climate Energy

Other Panelists included:

Dan Zaweski, LIPA

Paul Belnick, NYPA

Ruth Horton, NYSERDA

# Micro-CHP is here in US !

POWERED by HONDA

An economic and practical new tool for:

- Superior Residential Efficiency
- Primary Energy Conservation
- Grid Capacity Support
- Large Carbon Footprint Reduction

Climate Energy freewatt Combined Heat and Power for the Home

# Micro-CHP: Exactly what is it?

DEFINITION: Grid-connected, professionally-installed home space and water heating appliances operating on natural gas that

1) generate significant electric power as a byproduct of normal operation ( ~ 5,000 kWh/year)

+

2) provide self-powering, emergency backup power, and grid support capability

# What Can Micro-CHP do?

**80% of the energy and environmental benefit of residential solar electric power at 20% of the cost**

**Neutralize Residential Peak Demand from Grid**

**Produce significant amounts of on-site electric power at total costs comparable to residential utility rates**

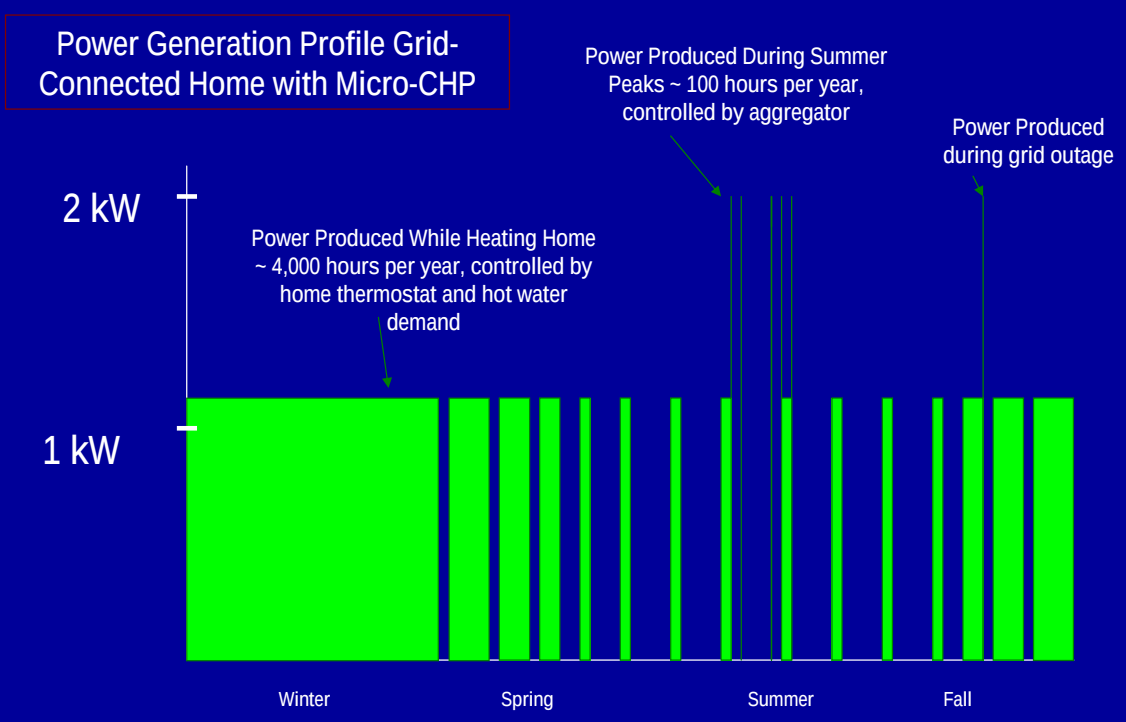
**Provide back-up power during grid outages**

**Widely deployable: Over 25 million candidate home sites**

**Siting challenges: None**

Climate Energy freewatt Combined Heat and Power for the Home

## Power Generation Profile Grid-Connected Home with Micro-CHP



# Micro-CHP: Why now?

**World-class manufacturers of energy appliances see and understand the opportunity and market gap for a high-performance, plug-and-play product, and can produce it an affordable price**

**Underlying power technology is proven in over 50,000 homes in Japan**: ultra-endurance, ultra-quiet small internal combustion engine technology married with catalytic emissions, control, sold-state power inverter electronics and digital communications technology meets all the challenges.

**Investment in product has been made**: No need to wait any longer.

Climate Energy freewatt Combined Heat and Power for the Home

# What will help fulfill the promise of Micro-CHP?

- Net metering: Keep it simple and low cost to interconnect and measure
- Capacity Aggregation: Allow thousands of homes to combine to provide dispatchable Megawatts.
- Incentive parity with “renewable” energy
- Education

Climate Energy freewatt

Combined Heat and Power for the Home

Popular Mechanics

2006 Breakthrough Product Award

POWERED by HONDA


Climate Energy freewatt

Eric Guyer
Climate Energy, LLC
93 West St., Medfield, MA 02052
www.Climate-Energy.com, 508-359-4500

# Panel Discussion:
## The Power of Demand Response

Moderator —
David Lawrence, NYISO

Presentations provided by:

*Market-based Opportunities for Demand Response,* Robert Pike, NYISO

*Demand Response Next Steps,* Tim Roughan, National Grid

*Energy Curtailment Specialists,* Marie Pieniazek, ECS

*Multiple Intervenors*, Robert M. Loughney, Esq., Couch White, LLC

*Demand Response in New York,* Aaron Breidenbaugh, EnerNoc

*DR, DG and Storage*, Ruben S. Brown, The E Cubed Company

# Market Based Opportunities for Demand Response

## The Future is Now:

**Energy Efficiency,**
**Demand Response and Advanced Metering**

Robert Pike
NYISO
Demand Response Product Manager
June 27, 2007

# Demand Response Programs

- Two Reliability Programs – Controlled by NYISO
  - *Emergency Demand Response Program*
  - *ICAP Special Case Resources Program*
- One Economic Program – Controlled by Customer
  - *Day-Ahead Demand Response Program*

# Current Marketplace Situation

- In the current constructs of the NYISO Marketplace, the benefit seen from reliability based demand response is significant. Unfortunately, the program is not invoked frequently.
  - *Provides a significant and important role used in very specific circumstances.*
  - *Demand response is a vital component in peak load management. Last summer they combined to provide 1000 MW of peak load relief in response to our instructions, avoiding operational problems and potential reliability deficiencies.*



# Opportunities

- How do we develop demand response to be part of the everyday market?
- Supply and demand curves require a level of price elasticity. How much is needed?
  - *Load duration curves show:*
    - Final (peak) 4000 MW of load occurs for just 1% of the time.
    - 2000 MW of that load only occurs for 22 hours.
    - An opportunity for demand response to further their role in daily peak load management.
  - *Price duration curves show:*
    - Highest 1% of the hours contribute 5% to the annual real-time cost of energy.
    - Critical price events exists outside of peak load periods.
    - Opportunities for demand response exist every day of the year.

# Market Evolution

- New market constructs are now being developed to allow participation by demand response resources in the Ancillary Services markets.
  - *What remaining segments of demand response remain untapped?*
  - *What volume and what services can be provided?*



# Standards Development

- Market designs may have evolved differently in the various regions of the country, but they all deal with similar concerns when looking to incorporate demand response.
  - *How is reliability maintained? How is the response measured? How do we communicate with demand response?*
- Standards development will allow the markets to build upon the successes of each other. Standards development will allow service providers to more quickly and efficiently enter markets and grow participation.
- Standards creation efforts occurring at NAESB (North American Energy Standards Board) and at ISO/RTO Council (IRC)

# Enablers

- Energy Efficiency, Demand Response and Advanced Metering Initiatives are not three distinct opportunities.
  - *Together they compound to offer new and expanded opportunities for managing the electricity consumption in New York State.*

# Demand Response Next Steps

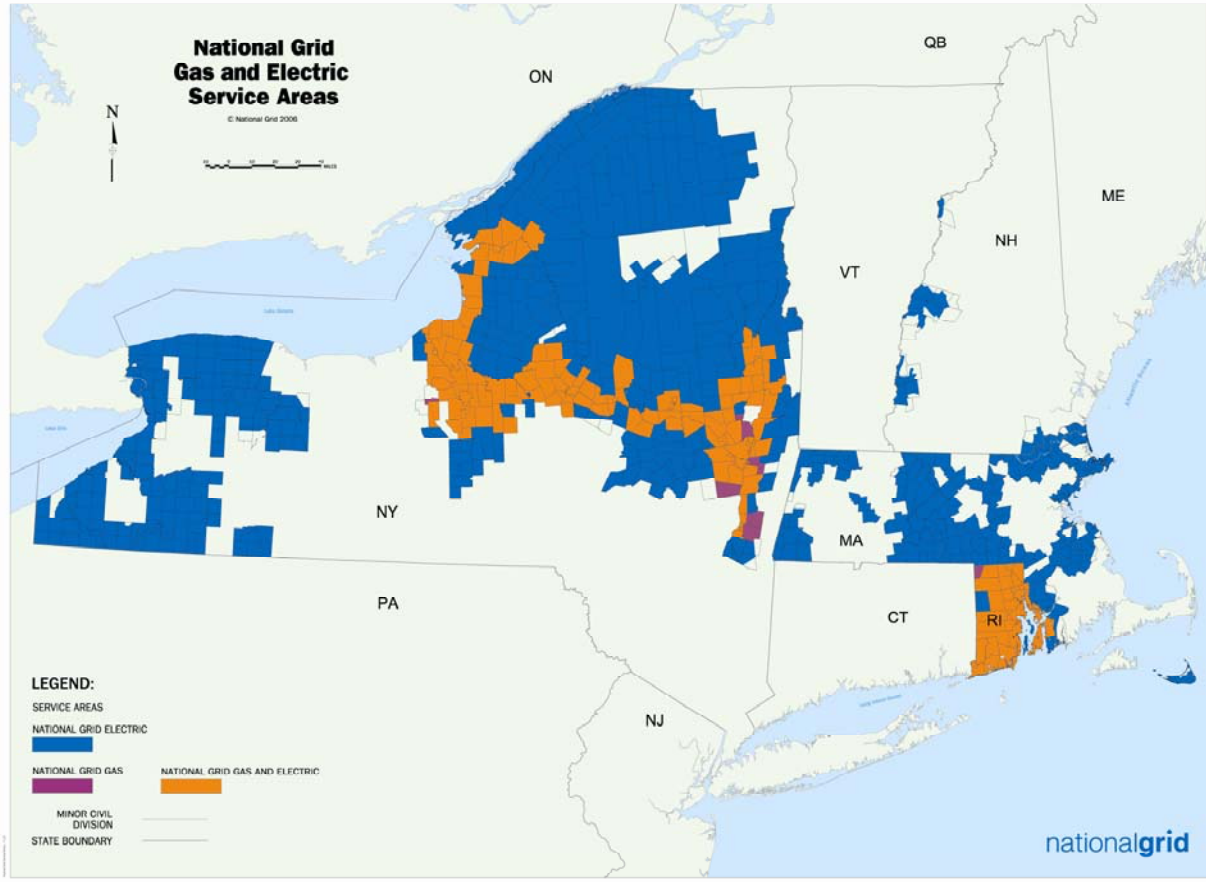
Tim Roughan
Director of Distributed Resources
NYISO Symposium
June 27, 2007
timothy.roughan@us.ngrid.com

nationalgrid

## National Grid's US business at a glance

- 3.4 million electricity customers in NE and NY
- 569,000 gas customers in NY and 245,000 in Rhode Island
- 898 towns and approximately 29,400 square miles of service territory
- Approximately 8,900 employees
- $8.2 billion in revenues, fiscal year 2006
- New York Stock Exchange symbol – NGG.N
- Pending merger with Keyspan

nationalgrid




# Demand Response Objective

- **Any energy conservation measure paid for by SBC finds should be required to have some ability to also reduce peak load beyond their average reduction**
  - Use of enhanced control technologies that provide additional reduction based on price or frequency
    - Daylight dimming for lighting
    - Chiller systems
    - Energy Management Systems required to have one or two levels of load shed
      - 5% for a transparent load shed where no one notices the event based on marginal high prices
      - 15% for an emergency event, or if price signal is high enough
  - Requires substantial customer education and assistance
    - Help customers understand how energy is used in their facility

# Demand Response Objective

- **Goal should be to provide demand response without using backup generation except during emergency conditions**
  - Use of demand response audits
  - What comprises a customer's peak load?
  - What are the internal costs to manage this peak load, as compared to available credits
  - How can this process be automated?
    - Integrate into energy conservation project
  - If a manual process – develop specific load shed plan with internal backup
  - Provide real-time information
    - Customer needs feedback on effectiveness of load shed
      - If internal users are not happy, can scale back
      - If internal users don't notice can increase load shed



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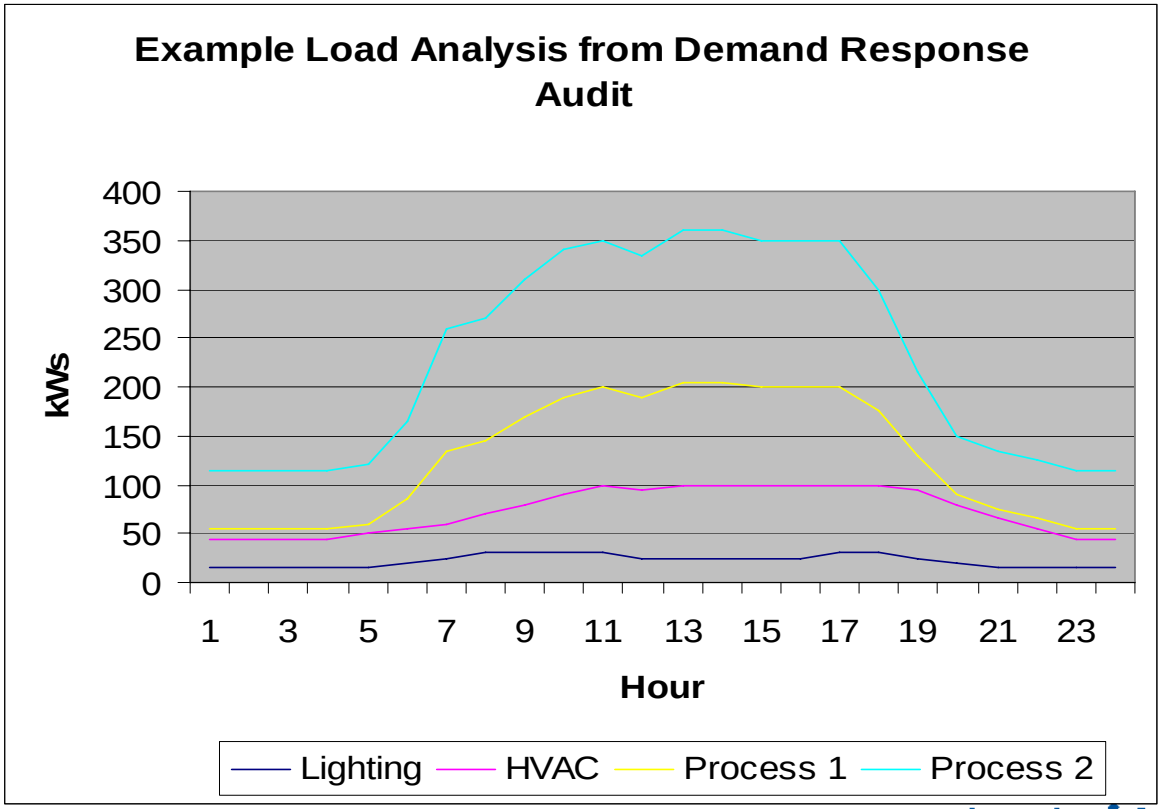


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# Conclusion

- Integration with existing conservation programs a must
- Automation is key for sustained ability
- As customer become comfortable with minor levels of load shed, they can become permanent for energy savings year-round
- Minor reductions in peak loads from many customers will be more sustainable than a few customers doing all the work

nationalgrid

# *Energy Curtailment Specialists*

**Marie Pieniazek**
**Vice President**
**Strategic Operations**

## Background

- **Full service demand response provider**
- **ECS was founded in 2001 — partly in response to crisis in California**
- **Currently 60+ employees**
- **Fast rate of growth: ~ 50% annually**

# Presence

- New York
- California Market:
- New England market:
- Mid West

# Add / Maintain Current Levels of Participation

- Protection from short-term anomalous market results

*Temporary surplus in capacity*

↓

*Lower capacity costs*

↓

*Less demand response*

↓

*Less investment in DSM technologies*

- Long term forecasts show capacity <u>shortage</u>
  - Lack of DR & DSM investment will have big impact

## Add / Maintain Current Levels of Participation

- When generating capacity is no longer adequate demand response resources previously set aside will not be motivated to return.
- Even with adequate generation, transmission and distribution issues still arise.
- Need DR for sufficient long term protection
- Takes time to build a reliable portfolio

## Importance of DR Providers

- Treat DR as primary service
- Understand barriers/ concerns of all industry types
- Managing risk of portfolio
- Proven source of DR
- Considered “objective” – not connected with utility

## Impact of Private Aggregators

- **NYISO has enabled programs / companies to flourish.**
- **Demand Response is now a thriving industry employing thousands.**
- **DR specific focus with aggregators has produced significant resources that are consistent and reliable.**

## More Complex…

- **Engineering / Demand Response Audits**
- **Reduction Action Plans**
- **Demand Response Performance Analysis**
  - *Performance measurement*
  - *Analysis of performance*
  - *Readiness for next event*

## Summary of Key Participation Enablers

- Clear Event Triggers
- Certainty of kW level
- Reduction Action Plan (RAP)
- Active Interface with Aggregator
- Concept of Demand Response


On Behalf of *Energy Curtailment Specialists*

**Thank You**

# Energy Efficiency, Demand Response and Advance Metering Symposium June 27, 2007

**Presented by:**
**Robert M. Loughney, Esq.**
**Couch White, LLP**
**Albany, NY 12201**
**(518) 426-4600**

## Multiple Intervenors – An Overview

- Formed in 1972
- Fifty Members including some of largest industrial, commercial and institutional energy users in the State
- Multiple Intervenors was instrumental in the development and implementation of Demand Response programs at the NYISO
  - Multiple Intervenors continues to work with the NYISO and other market participants to improve and expand the DR programs

# NYISO DR Programs – A Success Story

- NYISO DR Programs provide critical resources that benefit all New York consumers
  - SCR and EDRP provide compensation to DRs that can reduce or eliminate usage on short notice
  - DADRP allows DRs to compete with generators in the day-ahead energy market; DADRP participation is lagging
- Ancillary Services markets will be open to DRs very soon



# Why Do Customers Participate In DR Programs?

- Payments from DR programs help to offset the increased cost of electricity to participating customers
  - Deregulated markets have resulted in higher bills
  - Payments to participating end users are intended to provide fair compensation to incent customers to curtail
- By increasing competition, participation in DR programs helps to reduce the cost of electricity to all consumers
- Participation in DR programs is a critical contributor to statewide reliability, which is very important to Multiple Intervenors members

# Benefits of Demand Response (DR) Programs

The benefits of demand response programs include:

- Lower wholesale prices for all consumers due to the impact on locational marginal pricing (LMP) peaks
- Less required investment in high cost peaking generation facilities and enhanced grid reliability
- Reduced carbon emissions
- Enhanced energy cost management capability of end users



# Key Elements to Grow DR Participation

For a DR program to be effective it must contain key elements that will benefit the participant and supplier to generate the intended benefits

Those elements include:

- Fair and equitable financial compensation
- Fair and equitable access to program benefits
- Flexible and non discriminatory program rules
  - Should recognize differences between loads and generators

# Fair and Equitable Financial Compensation

- Quality of demand response service should be recognized in the compensation. For example, end users can provide an ancillary service product that is superior to traditional generators
- Penalties must be equitably assessed and designed
- Program costs should be allocated on a cost causative basis not on a postage stamp methodology



# Fair and Equitable Access to Program Benefits

- DRs should have equal access to programs as generators enjoy. This is particularly important with respect to ancillary service market opportunities
- Reasonable & nondiscriminatory performance capability tests. Key is to have DR resources demonstrate capability in the most cost effective manner to promote and maximize participation
- For reliability programs and ancillary services DRs should be required to meet applicable performance standards

# Flexible and Non Discriminatory Program Rules

- Establish clearly defined rules that define frequency, magnitude, and duration of curtailment and compensation so that an end user can decide between consuming or curtailing electricity
- Load aggregation must be allowed to encompass all potential DR providers
- Power supplied via bilateral contracts must be eligible for demand response programs
- Participation should not result in additional regulatory burden so to discourage participation

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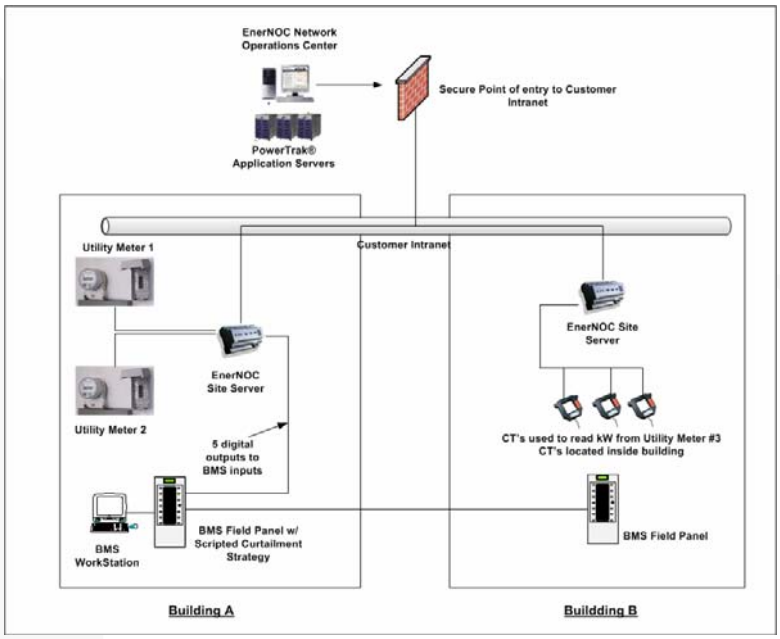
get more from energy

# Demand Response in New York

- Recommendations for The Next Phase

***The Future is Now: Energy Efficiency, Demand Response and Advanced Metering***
***June 27, 2007 (Originally presented December, 2006)***

## Sample Customer Implementation
## *(Demand Response and Energy Management)*




- Directly connected to customer BMS
- 2.1 MWs fully automated for DR
- Monitoring BMS schedules, set points, and outside air intake
  - 780,000 kWh annual energy efficiency opportunities identified
  - $125,000 annual energy cost savings





ENERNOC

get more

# Energy Network Operations Center

**EnerNOC's award-winning, state-of-the-art Network Operations Center is staffed 24/7/365 to ensure successful event performance for each of our customers. Our advanced technology is unparalleled in the industry!**



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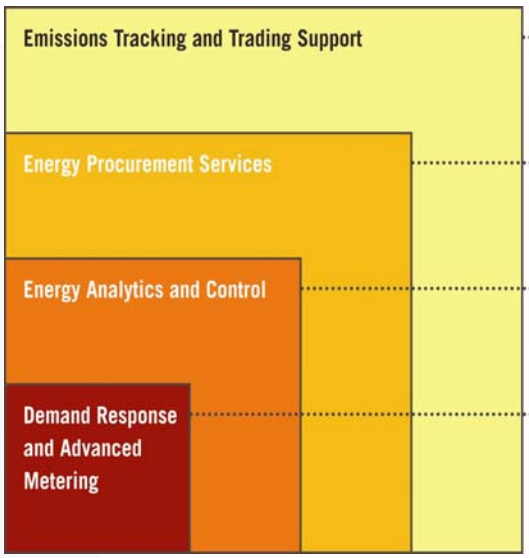
# EnerNOC: Total Energy Management (aka Energy Efficiency)




- EnerNOC supports customers' efforts to reduce and trade their emissions of carbon dioxide and other greenhouse gases.
- EnerNOC achieves further customer savings by helping customers secure competitive commodity supply contracts from electricity suppliers.
- EnerNOC's energy management services distill data into actionable strategies that reduce energy costs at customers' facilities.
- EnerNOC offers a turnkey solution that simplifies participation in demand response and enables customers to measure and manage energy consumption with advanced metering.



ENERNOC

## Background

**NYISO has robust demand response resources at its disposal that have proven their value over the past five years. Heavy program utilization in 2006 has revealed areas to enhance the programs.**

- **Phase I – Create the Tool**
  - 2001: NYISO introduces EDRP and DADRP
- **Phase II – Use the Tool**
  - 2002-2005 – NYISO and third-party providers grow the programs, learn lessons
  - 2006: Heavy program usage and strong performance
    - 5 event days – most ever
    - 34 event hours – most ever
    - 23 GWh curtailed (NYISO estimate) – most ever
- **Phase III – Refine the Tool**
  - 2006 – Fine-tune, sharpen performance measurements
  - 2007 – Open ancillary service markets to DR
  - 2008 – implement IBCS, refine aggregation options, synchronize SCR and EDRP baselines, allow targeted program activations



ENERNOC

## And target DR Resources more accurately

- 414 MW of EDRP and SCR resources were activated on July 19, 2006, however NYISO reports that only 13 MW — 3% — was located in the LIC network where the load relief was needed
- NYISO and ConEd agree that these resources were activated solely in response to ConEd's request to relieve pressure on the LIC network
- Zone J LSEs and their customers could pay as much as $2 million for $65k worth of reductions (i.e., a sledgehammer was used, where a scalpel was needed)
- We can do far better; demand response can be targeted much more precisely than that

**Recommendation #4:**

**Transmission owners or the NYISO, at a TO's request, should have the ability to activate resources in specific sub-zones, counties, or towns; this will be greatly facilitated by Recommendation #1**

DONE!





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## Automate and accelerate performance reporting,

- 2006 Events Resulted in Data Overload
  - Huge volume of capacity and energy event data
  - Last-minute/late submissions
    = Late Settlements
    = Unhappy Customers
    = Reduced Enrollment?

**Recommendation #1:**

**Replace the current manual data submission process with an automated, internet-based system that interfaces with Phase II of the ICAP Automation system**



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## Allow RIPs to better manage their own portfolios,

- Asset by asset performance varied significantly in summer 2006
- The current derating formula is calculated on an asset by asset basis and is capped at 100% within and across events, as a result, some resources will be derated for summer 2007 *regardless of overall performance by the RIP's portfolio in 2006*
- Thus, a RIP's revenue stream for a portfolio of assets will decrease in 2008 *regardless of overall portfolio performance*
- This result is contrary to the intent of aggregation, which is to incentivize RIP's to create a portfolio of assets with stable performance
  - Analogous to NYISO derating a power plant on a turbine by turbine basis rather than on total output

**Recommendation #2: Remove hourly performance caps and apply a portfolio-wide Performance Factor for each RIPs' existing assets**





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## Align capacity value with real-time performance,

- Detailed performance data is not yet available, BUT…
- We believe that data will reveal significant “free riding”
  - Telltale signs for a given resource/customer
    - load generally below CMD
    - load often above CBL
    - high Performance Factors for 2007
    - low energy payments in 2006
- We believe that the APMD approach is inherently flawed:
  - It pays some RIPs despite no response to ISO program activations
  - It underpays others for providing real value
  - It has no relevance to operational needs
  - It is inconsistent with standard industry practice

**Recommendation #3:**

**Use the EDRP CBL approach to determine ICAP/UCAP Translation Factors and eliminate APMD from the SCR program altogether**

# DR, DG and Storage

Comments To **NYISO Symposium**
**The Future Is Now**: Energy Efficiency, Demand Response and Advanced Metering
June 27, 2007

Ruben S. Brown, M.A.L.D.
The E Cubed Company, LLC



# DR, DG and Storage - Outline

- **INTRODUCTION AND BACKGROUND**
- **Who are we and what do we do? (Slide 3)**
- **What have we done lately? (April-June 2007) (Slide 4)**
- **What have we done lately? (Jan-March 2007) (Slide 5)**
- **What have we done lately? (2005-2006 - CT) (Slide 6)**
- **What have we done lately? (2004-2006 - NY) (Slide 7)**
- **FOCUS OF ORAL REMARKS**
- **What's next? (2007-2008 - NY) (Slide 8)**
- **What are New Demand Resource Opportunities for NY? (2007-2008 - NY) (Slides 9 & 10)**
- **Sample New Demand Resource Opportunities for NY (2007-2008 - NY) (Slide 11)**
- **Array of Benefits for A Sample Measure (Storage) (Slides 12)**
- **Contact Information (Slide 13)**

## Who are we and what do we do?

- E3 LLC (1989)
  - Providers of Strategic Services at the Exponential Interface of Energy, Environment and Economics.
- Joint Supporters (1990)
  - Voluntary Association of users, providers, and mobilizers of demand resources, including EE, DR, DG, CHP (including micro-CHP) active in policy settings on occasion. Facilitated by E3 LLC.





## What have we done lately? (April-June 2007)

- June 18, 2007 NYPSC approves Rider U
  - adopting modifications proposed by Joint Supporters creating Network Based Demand Response Program for Con Edison (effect July 1, 2007) - stems from Long Island City 2006 event
- April - June: Residential micro-CHP Opportunities
  - Multiple Jurisdictions Move to Facilitate micro--CHP
- April 2007 Clients Climate Energy, LLC and ECR International (Utica, NY) go Commercial in North America
  - E3 LLC aids market opening for residential micro-CHP system combining ECR furnace and ultra-durable, ultra-quiet, ultra-clean Honda generator.

# What have we done lately? (Jan-March 2007)

- Targeted Demand Response Program [pending FERC approval]
  - Negotiated sub-zone voluntary targeted demand response program for Zone J (NYISO) (Feb - March)
- Forward Capacity Market (FCM) for ISO-NE [FERC approved]
  - Negotiated final revisions of design and approval (Feb) by ISO-NE committees,
  - FCM includes DG, EE, aggregation of resources ok from the smallest size, meter on generator ok for M&V, seasonal resources can participate.
- Analysis of Connecticut DG and EG Monetary Grant Programs and capacity bid programs for Grid Capacity Relief
  - Analysis prepared for Rhode Island DG Work Group Report to Legislature. (Jan 2007) - Report on line at MD PSC.
- http://webapp.psc.state.md.us/Intranet/CaseNum/NewIndex3_VOpenFile.cfm?filepath=%5C%5CColdfusion%5CEWorkingGroups%5CDRDG%5CDistributed%20Generation%5CRhode%20Island%20DG%20Study%202-1-07.doc.





# What have we done lately? (2005-2006 - CT)

- Negotiated Design of CT Energy Independence Act of 2005 programs, including CHP Portfolio Standard, EE, DG and EG Monetary Grant Programs and capacity bid programs for Grid Capacity Relief (Sept 2005-June 2006)
  - By June 2007 343 MW awards sought in 156 applications to DPUC
  - 223 MW awarded to level of $90 M. All participate in ISO-NE capacity market as demand resources.
  - In first six months, as per E Cubed analysis, DG awards averaging $470/kW leveraged an average total investment of $2300/kW. EG awards averaging $230/kW leveraged total investments of $650/kW.
  - E Cubed clients won three of first twenty awards.
  - CHP Portfolio Standard targets 6% of load by EE and DG by 2010. (revised in recent legislation).

# What have we done lately? (2004-2006 - NY)

- Negotiated Con Edison Base Rate Case (for 2005-2008) on key measures benefiting distributed resources
  - $1 B plus transmission and distribution infrastructure improvements (among other purposes) to advance the potential utilization of distributed resources, including DG, EE, and DR. (DG friendly web-site at Con Edison).
  - Fault Current Study and Accelerated Breaker Replacement Program (from 19 in 1999 to over 100 in 2006 out of 600 in 58 networks.)
  - Negotiated goal of meeting load growth of 650 MW by demand resources, including SBC programs, and 300 MW of Demand Resource Programs in the territory.
- Negotiated Design of 300 MW Demand Resource Programs in Con Edison Territory ($250 M allowed)
  - System Wide Program 150 MW NYSERDA (EE/DR/DG)- Targeted Program 150 MW Con Edison (EE/DG) - incentives to utility for all kW achieved by either.
- NYSERDA Study with Distributed Utility Associates on Electricity Storage Opportunities in NYS, especially NYC. (pub May 2007)





# What's next? (2007-2008 - NY)

- **Negotiate Energy Efficiency Portfolio Standard (EEPS) Proceeding (15% improvement by 2015)** - DG, DR, Storage are second order priorities. What about greater recognition for CHP Savings and Peak Shaving Benefits? Interface of DR with EE & DG? Role of residential micro-CHP?
- **Negotiate/litigate New Con Edison Base Rate Case begun May 2007 (for 2008-2011 period - decision by March 2008 - negotiations over next five months)**
  - How does Proposal comport with NYISO Planning? Role of load resources? Further transmission and distribution infrastructure improvements (post Long Island City blackout) - How can DG/DR/EE contribute?
  - Advanced Metering Proposed for 2.5 million accounts. Interface with NYISO programs? How can AMI interface with DR?
  - Mandatory Hourly Pricing for additional 2000 accounts (above 500 kW)
  - 500 MW demand resource proposal for EE & DG. What about DR?
  - How does 15% EEPS objective (circa 1600 MW by 2015) compare with Con Ed proposal for 500 MW by 2016?
  - How does proposed Demand side program interface with NYSERDA responsibilities? Carry over from 2005-2008 rate plan? Going forward?
- **Negotiate other initiatives in regulatory and RTO situations.**

# What are New Demand Resource Opportunities for NY? (2007-2008 - NY) (1)

- **Promote the aggregation of benefits.**
  - Generators aggregate multiple benefit streams -
  - So should demand resources be able to aggregate benefit streams.
  - Composite aggregation should be facilitated for capacity, ancillary services and other benefit streams.
  - See NYSERDA Storage Study identifying optional benefit streams for storage systems - would apply to other resources.
- **Promote Ancillary Services involving Demand Resources**
  - Wide array of DR resources, including controls and communication.
  - Specifically DG and storage, e.g. commercial and industrial scale DG/CHP, residential micro-CHP and plug-in hybrid vehicles.
- **Allow Clean DG to perform in the economic markets as other DR resources can.**
- **Create Alternate Energy Sector at the NYISO, encompassing Demand Response, DG, EE and other Demand Resources with voting rights, manuals, etc.**





# What are New Demand Resource Opportunities for NY? (2007-2008 - NY) (2)

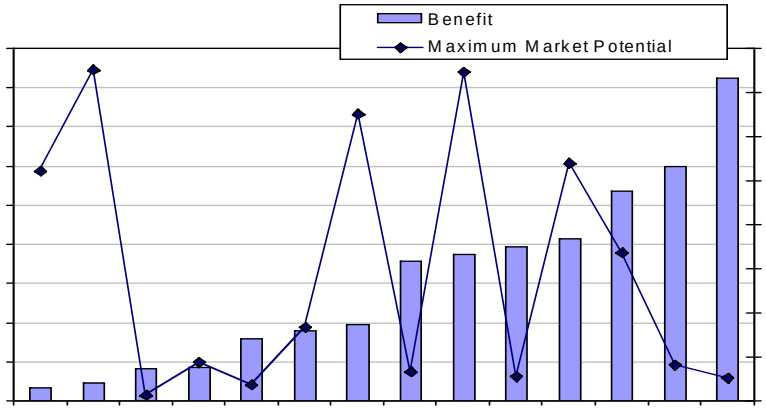
- **Promote CHP Portfolio Standard And Aggressive Awards Program**
  - Adopt a CHP Portfolio Stdd approach similar to CT as revised by 2007 Law
  - Move to aggressive CT model for Monetary Awards for CHP and EG with differential for SE New York. Open the door for projects of all qualified applicants -- not competitive elimination. Program is much more aggressive than NY.
  - Adopt CHP Savings Policy similar to Senator. Schumer's Senate Amend 1797 (June 19, 2007) deals with combined savings for gas & electricity sides, not either/or.
- **Promote Electricity Storage As Demand and Grid Resource**
  - Promote consideration of NYSERDA Report 8723 by DUA and The E Cubed Company, LLC, **Guide to Estimating Benefits and Market Potential for Electricity Storage in New York (With Emphasis on New York City)**
  - Promote utilization of storage as resource to integrate intermittent demand resources and wind and solar facilities.

# Sample New Demand Resource Opportunities for NY? (2007-2008 - NY)

- **Promote mass market aggregation of residential and other EE/DG/DR/storage/renewable capabilities for capacity, energy, ancillary and other benefits** -
- **Example of residential micro-CHP**
  - Assume 100-150,000 natural gas furnaces or boilers are replaced each year in New York.
  - If 20% were replaced with high efficiency micro-CHP systems (80% or better) then by 2015 approximately 160-240,000 residences can improve their household energy efficiency measurably.
  - Summer-time Peak grid needs could be moderated by 270-430 MW**.**
  - Ancillary services can be obtained within 30 seconds of notification at any level of aggregation within all zones of NYISO, each zone, each sub-zone, network, or even feeder.
- **Example of plug-in hybrid vehicles**
  - NYISO and NYS should take lead in collaborating with Smart Grid Study called for in Senate Amendment 1797 to the Energy Bill passed on June 21.
- **Example of Storage Facilitating Wind and Solar Installation**







**Ruben S. Brown, NYISO Symposium June 27, 2007**
**Table ES.2. Estimated Market Potential and Benefits for Applications -**

| # | Application | Benefit | Description | Cost Element(s) or Price Signal(s) |
|---|---|---|---|---|
| 1 | Electric Energy Buy Low – Sell High | Revenue - VOC - (Purchase ÷ Efficiency) | 1. Avoided market-based cost for purchases or 2. "Profit" from selling. | LBMP DAM |
| 2 | Electric Supply Capacity | Installed Capacity (ICAP) | Avoid charges/receive payment for "supply" installed capacity (ICAP). | NYISO ICAP Strip Auction |
| 3 | Reduce Transmission Capacity Requirements | Reduced Transmission Service Charges (TSCs)[2] | Avoid payment of charges incurred for access to the transmission system. | NYISO Transmission Service Charge (TSCs) |
| 4 | Reduce Transmission Congestion | Reduced Transmission Congestion Costs[2] | Reduce congestion on transmission system(s) -- to reduce congestion-related cost -- by serving peak load with storage. | LBMP DAM (Congestion Component) |
| 5 | Transmission and Distribution Upgrade Deferral | Avoided Annual Revenue Requirement for T&D Upgrade | Defer need for relatively expensive T&D upgrades by serving peak load downstream from hot spots. | Annual revenue requirement for upgrade. |
| 6 | Operating Reserve | Operating Reserve, Value | "Back-up" for Emergencies (loss of one or two large resources) | DAM Prices (LBMP and reserve capacity) |
| 7 | Regulation and Frequency Response (Regulation) | Regulation Service, Value | Maintain grid stability, frequency; attenuate small, frequent load fluctuations. | DAM Prices |
| 8 | Transmission Support | Enhanced Transmission Performance | Short duration support for transmission stability and improved throughput. | n/a |
| 9 | Electric Service Reliability | Reduced Outage Related Cost | Financial losses avoided due to improved PQ. | Value-of-Service as proxy |
| 10 | Electric Service PQ | Reduced PQ-related Cost | Financial losses avoided due to improved PQ. | Value-of-Service as proxy |
| 11 | Electric Service Bill Reduction: Demand Charges | Reduced Electric Service Bill[2] | Reduced electricity bill. | Tariff: PSC No. 9, Service Class 9, Rate I |
| 12 | Electric Service Bill Reduction: Time-of-use Energy Prices | Reduced Electric Service Bill[2] | Reduced electricity bill. | Tariff: PSC No. 9, Service Class 9, Rates II & III + Market Supply Charges |
| 13 | Renewable Electricity Production Time-shift | Enhanced Wind *Energy* Value | Increased benefit from wind energy if low value wind energy is sold when value is high. | DAM LBMP and "firmed capacity" (ICAP) Credit. |
| 14 | Renewables Capacity Firming | Enhanced Photovoltaics *Capacity* Value | Increase benefit from PV using low value grid energy to firm-up PV capacity on peak. Firming: from .5 to.95 effective capacity (Summer). | DAM LBMP and "firmed capacity" (ICAP) Credit. |

Notes
1. Key Definitions: LBMP = Location Based Marginal Price (for energy). ICAP = Installed Capacity (electric supply). DAM = Day-ahead Market. VOC = non-energy-related variable operating cost (e.g., battery replacement).
2. A cost avoided by one entity may reduce revenue needed by another entity to cover fixed and/or embedded costs.

– Joseph Sayer, Project Manager (NYSERDA), Jim Eyer (Distributed Utility Associates) and Ruben S. Brown (The E Cubed Company, LLC), **Guide to Estimating Benefits and Market Potential for Electricity Storage in New York (With Emphasis on New York City)** NYSERDA Report 8723, May 2007.

**Ruben S. Brown, NYISO Symposium June 27, 2007**
**Table ES.2. Estimated Market Potential and Benefits for Applications -**

| # | Application | Maximum Market Potential MW, 10 Years* | Notes | Unit Benefit, $/kW, over 10 Years** | Total Benefit $ Million, over 10 Years** |
|---|---|---|---|---|---|
| 1 | Electric Energy Buy Low – Sell High | 3,265 | 25% of Peak load[1] and of load growth[2] -- storage cannot compete with intermediate, baseload gen. | 394 | 1,288 |
| 2 | Electric Supply Capacity | 3,739 | ICAP required in 2006 -- 2,306 MW -- plus all load growth for next nine years. (Does not include reserve capacity or capacity provided via bilateral contracts.) | 753 | 2,815 |
| 3 | Reduce Transmission Capacity Requirements | 3,759 | Portion of in-city peak demand not served by in-city generation (20%) plus peak load growth. (Does not include reserves or capacity via bilateral contracts.) | 93 | 350 |
| 4 | Reduce Transmission Congestion | 2,612 | Portion of NYC peak demand not served by in-city generation (20%) plus growth[2] thereof. (Does not include reserves or capacity via bilateral contracts.) | 72 | 187 |
| 5 | Transmission and Distribution Upgrade Deferral | 411 | All T&D Upgrades: 1/30 of peak load each year (assume 30 year life); average 411 MW/year. Assume that storage can defer 10% of that amount, plus growth. | 1,200[3] | 494 |
| 6 | Operating Reserve | 445 | Premise: generation is at least 2/3 of reserves. Storage: 1/3 of operating reserves (1/3 of 1,200 MW = 396 MW) plus growth[2] of that portion (49 MW). | 258 | 115 |
| 7 | Regulation and Frequency Response (Regulation) | 281 | Current market size for regulation (statewide) plus growth.[2] | 789 | 351 |
| 8 | Transmission Support | 70 | 1/4 of existing market size for regulation (statewide) plus growth of that share. | 169 | 47 |
| 9 | Electric Service Reliability | 842 | 1/4 of SC9 (tariff/customer class) load plus growth[2] of that load. | 359 | 25 |
| 10 | Electric Service PQ | 337 | 10% of SC9 (tariff/customer class) load plus growth[2] of that load. | 717 | 604 |
| 11 | Electric Service Bill Reduction: Demand Charges | 1,685 | 1/2 of SC9 (tariff/customer class) load plus growth[2] of that load. | 1,076 | 362 |
| 12 | Electric Service Bill Reduction: Time-of-use Energy Prices | 270 | 8% of SC9 (tariff/customer class) load plus growth[2] of that load, for "peak clipping." | 1,649 | 2,779 |
| 13 | Renewable Electricity Production Time-shift | 2,700 | 2,700 MW in Western upstate New York (per G.E./NYSERDA study). | 832 | 2,246 |
| 14 | Renewables Capacity Firming | 188 | 1% of peak load (116 MW) and 5% of all load growth (72 MW). | 323 | 61 |

* MW of cumulative market potential over ten years.

** $ present worth, over ten years, 2.5% inflation, 10% discount rate, mid year convention.

1 Peak Load in 2006 = 11,627 MW.

2 Peak load growth rate = 1.30%/year

3 Transportable storage could provide the same single year benefit at several locations.

Key premise: existing resources/equipment -- especially if it has useful life -- will not be replaced with storage.

# Further Information

- The E Cubed Company, LLC is available to assist you evaluate market entry and operations.

Contact Ruben S. Brown, or Arthur W. Pearson
The E Cubed Company, LLC
1700 York Avenue, Suite B-2
New York, NY 10128
212.987.1095
Rsbrown@ecubedllc.com
Apearson@ecubedllc.com

# Panel Discussion:
## Advanced Metering and other Implementing Technologies

Moderator —

Garry Brown, NYISO

Presentations provided by:

*Advanced Metering: Benefits for Customers and the Environment,* James Laurito and Gary Fauth, NYSEG/RGE

*Trilliant Networks,* Jeff Havranek, Trilliant Networks

Other Panelists included:

Tom Barone, NYSERDA

Don Von Dollen, EPRI

# Advanced Metering

## >> Benefits for Customers and the Environment

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## Regulatory Drivers

- Energy Policy Act of 2005 directed states to consider fuel diversity, fossil fuel generation efficiency, advanced metering and demand response.
- Advanced metering supported by the National Association of Regulatory Utility Commissioners.
- New York State PSC order (August 1, 2006) "…removes regulatory barriers to utility investments in advanced metering … to enable the State to take full advantage of new advanced metering systems to manage energy distribution and consumption more effectively."
- Utilities ordered to develop plans for deployment of advanced metering systems, including automated meter reading. (NYSEG and RG&E filings made in February and May 2007.)

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## NYSEG/RG&E Filing

- Responding with enthusiasm.
- Proposed deployment for all 1.3 million NYSEG and RG&E electricity and natural gas meters.
- Design of the deployment will be a practical leveraging of proven technologies.
- Assisted by consultants that have demonstrated success in deploying advanced metering systems on time and on budget.



## Customer and Societal Benefits

- All bills based on actual energy use – no more bills based on estimated use.
- Eliminates need for visits to turn on or turn off electricity service.
- Should enhance our efficiency in responding to service interruptions.
- Will include tampering alarms that will warn of potential irregularities and theft of service.
- By empowering customers to move energy use away from peak times and also reduce their overall energy use, we can reduce the amount of electricity that needs to be generated and the related environmental impacts.

# AMI Overview - Introduction

- Presentation objective is to describe the basics of AMI and its potential impact on customers
- Presenter has extensive North American and international experience in AMI
  - Gary Fauth is an economist specializing in AMI financial analysis and AMI deployment management. He has been active in project planning and implementation at PPL, PG&E, Southern Companies, PHI, Idaho Power, PSE&G, Progress Energy, and other companies.
- Presenter focuses on three questions and encourage your questions
  - How does AMI technology work?
  - Where is AMI being deployed?
  - How does AMI create customer value?

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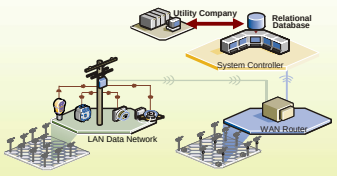
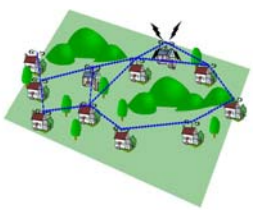
# AMI is a standard that has evolved though 20 years of meter reading automation.

- Mobile AMR (ca. 1986)
  - People using short range radios to collect data
  - Primarily done for:
    - Monthly billing related benefits including eliminating estimated bills
- Network AMR (ca. 1993)
  - Primarily 1-way "always on" communication network
  - Primarily done for:
    - Monthly billing related benefits including eliminating estimated bills
    - Enhanced service quality through power outage management
- AMI (ca. 2004)
  - 2-way communication and data management software
  - Primarily done for:
    - Monthly billing related benefits including eliminating estimated bills
    - Enhanced service quality through power restoration, voltage control etc.
    - Enhanced customer control of energy bills (Demand response and energy conservation enablement)
    - New energy conservation and "green" benefits
    - Enhanced service through change of party provisioning
    - Support for emerging Smart Grid concepts
      - The integration and automation of distribution monitoring and control capabilities



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## There are three commercially available AMI technologies for full-scale systems and they are often used in hybrid combinations.

- AMI system basic building blocks
  - Meters are grouped to communicate within a Local Area Network (LAN)
  - Multiple LANs cover a utility's service area
  - LAN's connect to a WAN to connect with utility information systems
- The three major LAN options are:
  - Star radio network
  - Mesh radio network
  - Power line carrier
- Wide Area Networks (WAN) link LANs to the utility
  - LAN needs impact WAN cost
- AMI implementation options
  - Focus on minimizing the number of LAN and WAN technologies
  - Hybrids of one primary and one secondary LAN and WAN are common, based on service area characteristics

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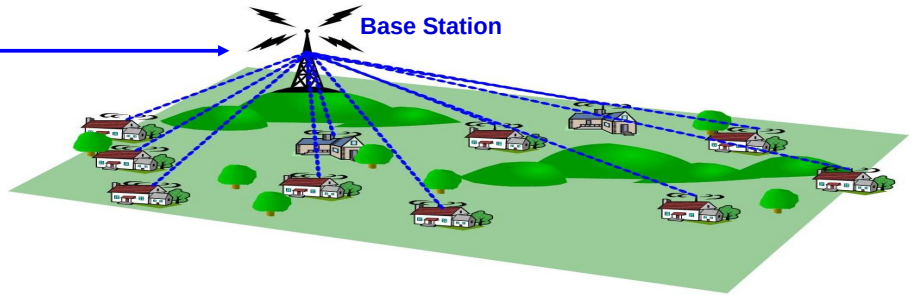
## AMI star radio networks communicate up to 5 miles between meters and a base station.

**Examples of Base Station Equipment**




- AMI star networks support "Point to Multi Point" operation
- Meters use high power radios to achieve their range
- Base station antenna elevation must be high to achieve the range
- Require overlapping base station coverage to ensure high reliability
- Can be affected by hilly terrain and dense building areas
- Supplier examples*: Hexagram, Sensus

***Supplier examples are illustrative only.**

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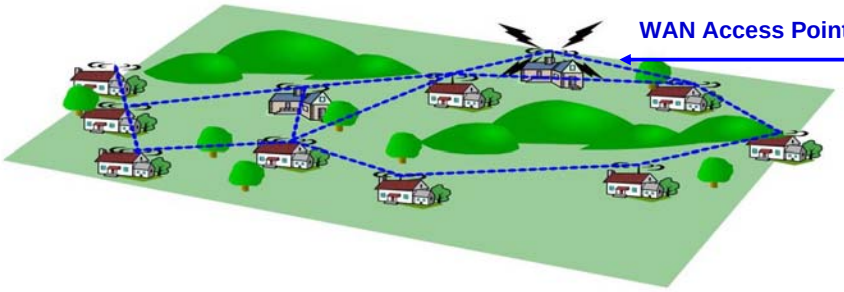
# AMI mesh radio LANs use multiple hops to send messages up to 5 miles.




**Examples of WAN Access Points**

- Meters form the LAN
- Meters use low power radios
- Meters forward messages to WAN Access Points
- LAN uses existing poles for WAN Access Point sites
- LANs are self configuring
- Supplier examples*: Cellnet, EKA, Elster, Hunt, Itron, Silver Spring Networks, Trilliant

***Supplier examples are illustrative only.**

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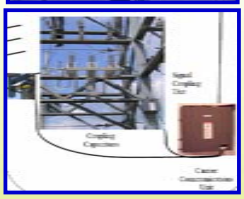
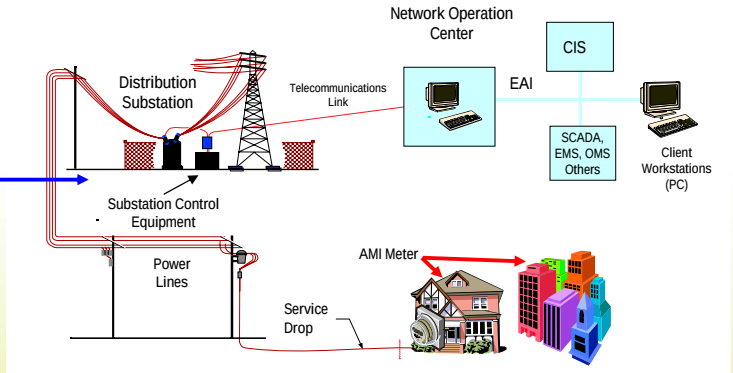
# AMI power line carrier (PLC) networks use existing power lines to send data.



**Substation Communication Units**




- Communication is between substations and meters
- Some systems require message repeaters on the line
- Some systems do not communicate during a power outage
- Systems communicate with anything connected to the grid
- Supplier examples:
  - Narrowband PLC - Cannon, DCSI, Hunt
  - Broadband PLC – Amperion, BPL Global, Corinex, Current

**Supplier examples are illustrative only.**

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Emerging Demand Response products are increasingly popular optional add-ons with customers wanting to control energy bills and life style.

Energy Information Display

Programmable Communicating Thermostat

Direct Load Control

Pre-Payment

Mass Market and Commercial Energy Management (Low End): Solutions cost from $150 to $400 installed but prices are coming down.

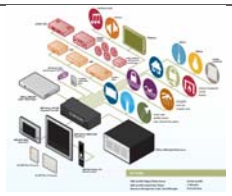
AMI Energy Management System

Stand Alone EMS


Stand Alone Home Manager

Mass Market and Commercial Energy Management (High End): Solutions cost from $500 to $10,000 but few are connected to AMI now.

Lifestyle Management System



Home Automation & Control:
High end solutions ranging from $20,000 to $100,000 to support entertainment, security, Internet, energy and other uses.

**Examples of products from AMX, Cannon, Comverge, Samsung, L+G, Cannon and DCSI**

## AMI is gaining wide acceptance among state and federal regulators across North America.

| Utility | Electric Meters (millions) | Status |
|---|---|---|
| PPL (Eastern Pennsylvania) | 1.4 | Complete |
| PG&E (Northern California) | 5.1 | Deployment has begun |
| SCE (Los Angeles) | 4.5 | Preparing for full-scale deployment |
| SDG&E (San Diego) | 1.3 | Preparing for full-scale deployment |
| TXU (Dallas) | 2.8 | Deployment has begun |
| Centerpoint (Houston) | 1.9 | Deployment has begun |
| Florida Power & Light | 4.0 | First 100,000 meters are being deployed |
| Ontario, Canada | 4.0 | Regulators have mandated AMI, and deployment has begun |
| Southern Companies | 4.1 | RFP results being evaluated |
| BG&E (Baltimore) | 1.1 | Working on RFP |
| Detroit Edison | 2.2 | Working on RFP |
| Portland General | 0.7 | Detailed planning underway |
| PHI ( DC) | 2.0 | Final RFP planning underway |
| | | |
| All Utilities | 35.1 | |

EPAct of 2005 and NARUC have endorsed AMI as a necessary platform for demand response

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# How do AMI Systems Create Customer Value?

- **Operational Savings Examples**
  - Bill processing efficiencies, and elimination of estimated bills
  - Call center efficiencies
  - Meter reading cost savings
  - Off cycle read efficiencies
  - More efficient power restoration after a storm
- **Customer Benefit Examples**
  - More accurate bills (elimination of estimated bills)
  - More responsive call centers
  - Less intrusive meter reading process
  - More timely off-cycle reads
  - Increased billing equity from reduced theft of service and more accurate meters
- **Demand Response Enablement**
  - Interval data drives demand response incentives
  - Two-way communications drive demand response automation
  - Participants in demand response programs will save on the energy component of their bill
  - Over time all customer bills will be lowered as a result of lower purchased power costs and capacity
- **Energy Conservation Enablement**
  - Internet display of data increases awareness
  - Optional in-home displays show real time usage

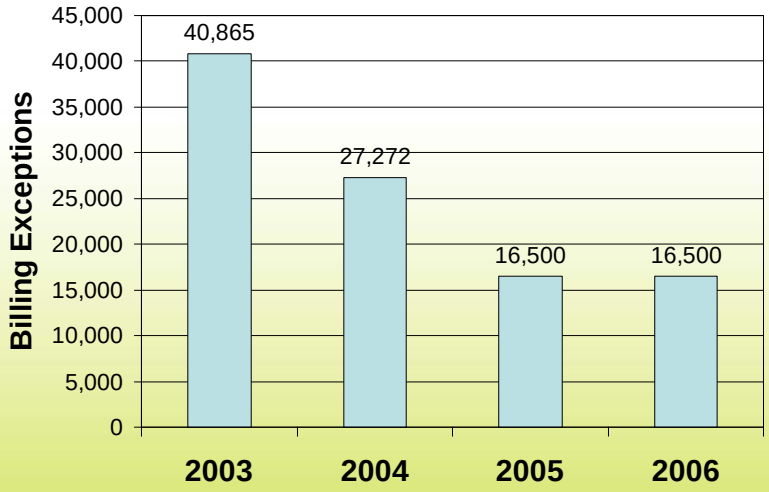
NYSEG RGE 13

# AMI Impact Examples

- Billing Exceptions
- Customer Complaints
- Revenue Recovery
- Outage Restoration
- Customer Information
- Demand Response

NYSEG RGE 14

# PPL Experience with Reduced Billing Exceptions that Generate Additional Back-Office Costs




Note: Billing exceptions represent bills that require manual processing before they can be sent out.

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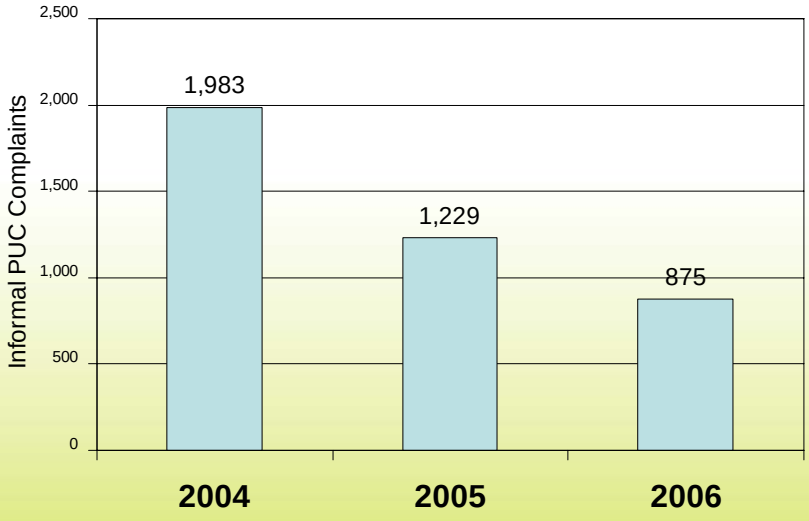
# PPL Experience with PUC Complaints




Note: Complaints tracked are "informal" complaints, which are all those PUC complaints that do not escalate to formal proceedings.

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# PPL Revenue Diversion Experience

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# PPL AMI Consumption Data

| Date | Day | Beginning Read | Ending Read | Daily Consumption |
|---|---|---|---|---|
| 01/02/05 | Sun | 23,487 | 23,487 | 0 |
| 01/03/05 | Mon | 23,487 | 23,487 | 0 |
| 01/04/05 | Tues | 23,519 | 23,487 | 32 |
| 01/05/05 | Wed | 23,560 | 23,519 | 41 |
| 01/06/05 | Thurs | 23,600 | 23,560 | 40 |
| 01/07/05 | Fri | 23,632 | 23,600 | 32 |
| 01/10/05 | Mon | 23,658 | 23,632 | 26 |
| 01/11/05 | Tues | 23,690 | 23,658 | 32 |
| 01/12/05 | Wed | 23,733 | 23,690 | 43 |
| 01/13/05 | Thurs | 23,764 | 23,733 | 31 |
| 01/14/05 | Fri | 23,799 | 23,764 | 35 |
| 01/15/05 | Sat | 23,828 | 23,799 | 29 |
| 01/16/05 | Sun | 23,828 | 23,828 | 0 |
| 01/17/05 | Mon | 23,828 | 23,828 | 0 |
| 01/18/05 | Tues | 23,884 | 23,828 | 56 |
| 01/19/05 | Wed | 23,932 | 23,884 | 48 |
| 01/20/05 | Thurs | 24,013 | 23,932 | 81 |
| 01/21/05 | Fri | 24,113 | 24,013 | 100 |
| 01/22/05 | Sat | 24,216 | 24,113 | 103 |
| 01/23/05 | Sun | 24,313 | 24,216 | 97 |
| 01/24/05 | Mon | 24,390 | 24,313 | 77 |
| 01/25/05 | Tues | 24,477 | 24,390 | 87 |
| 01/26/05 | Wed | 24,565 | 24,477 | 88 |
| 01/27/05 | Thurs | 24,639 | 24,565 | 74 |
| 01/28/05 | Fri | 24,720 | 24,639 | 81 |
| 01/29/05 | Sat | 24,808 | 24,720 | 88 |
| 01/30/05 | Sun | 24,849 | 24,808 | 41 |
| 01/31/05 | Mon | 24,849 | 24,849 | 0 |
| 02/01/05 | Tues | 24,894 | 24,849 | 45 |
| 02/02/05 | Wed | 24,945 | 24,894 | 51 |
| 02/03/05 | Thurs | 24,983 | 24,945 | 38 |
| 02/04/05 | Fri | 25,012 | 24,983 | 29 |
| 02/05/05 | Sat | 25,012 | 25,012 | 0 |
| 02/06/05 | Sun | 25,012 | 25,012 | 0 |
| 02/07/05 | Mon | 25,012 | 25,012 | 0 |
| 02/08/05 | Tues | 25,039 | 25,012 | 27 |
| 02/09/05 | Wed | 25,064 | 25,039 | 25 |
| 02/10/05 | Thurs | 25,087 | 25,064 | 23 |
| 02/11/05 | Fri | 25,114 | 25,087 | 27 |
| 02/12/05 | Sat | 25,114 | 25,114 | 0 |
| 02/13/05 | Sun | 25,114 | 25,114 | 0 |
| 02/14/05 | Mon | 25,114 | 25,114 | 0 |

Yellow highlights indicate days with 0 consumption

## PPL Experience with Meter Tampering at Residence

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## Outage Management with AMI

- AMI allows confirmation of outages at the customer level.
- Traditional OMS is still needed to manage incoming calls, collect AMI information, graphically map data, generate work orders, and provide management reports.
- Restoration is more efficient and costs during a storm are reduced.

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# PPL Experience during Hurricane Isabel

- 502,516 customers lost power in 2003 as a result of Hurricane Isabel
- Without AMI, PPL would have had to check individual customers because of extensive damage to individual service drops.
- With AMI, PPL "pinged" individual customer meters with its AMI system to verify service restoration, and to clear crews to move to other areas to continue service restoration.
- Restoration effort ended 6 hours earlier as a result of "pinging" effort

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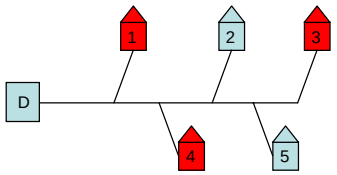
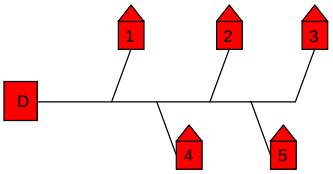
# Outage Management (OMS) with AMI

Customers 1, 3, and 4 call in outages.



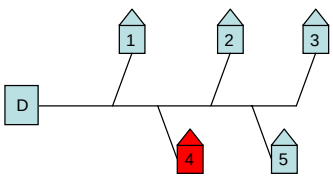

A

OMS assumes Device D caused outage. AMI confirms customers 1-5 are out.



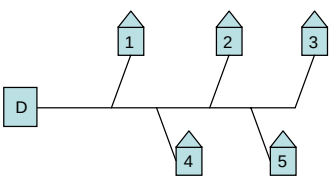

B

Crew fixes problem at Device D. AMI indicates customer 4 still out. Crews stay onsite and fix customer 4.




C

Customers notified issues are fixed. No call backs or rework required.



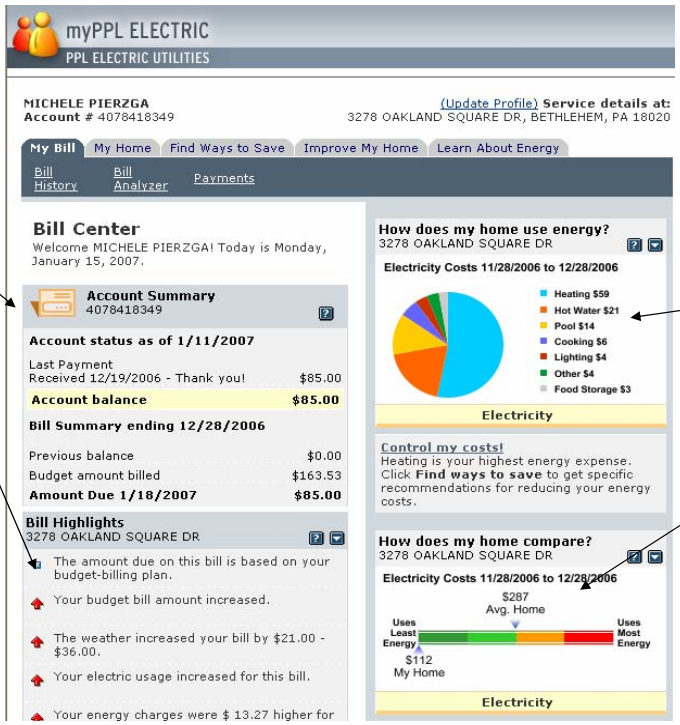

D

# PPL Customer Interface: Knowledge Can Change Energy Consumption Behavior

**How much do I owe?**

**How do I view and pay my bill?**

**Why is my bill different than before?**




**How does my home/facility use energy?**

**How can I control my costs?**

**How does my home compare?**

# PPL Customer Interface

**When do I use energy? Am I on the right rate?**


**How does my bill compare to last year?**

**Are there programs that would benefit me?**

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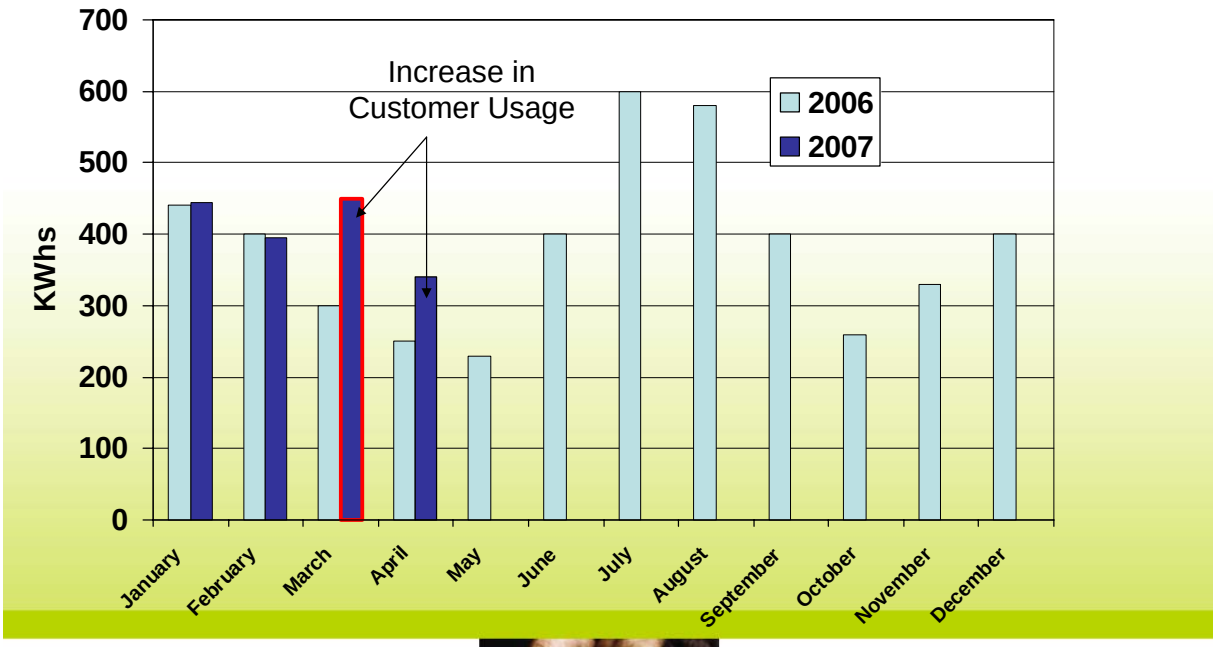
## Change in Monthly Energy Usage to be Explored

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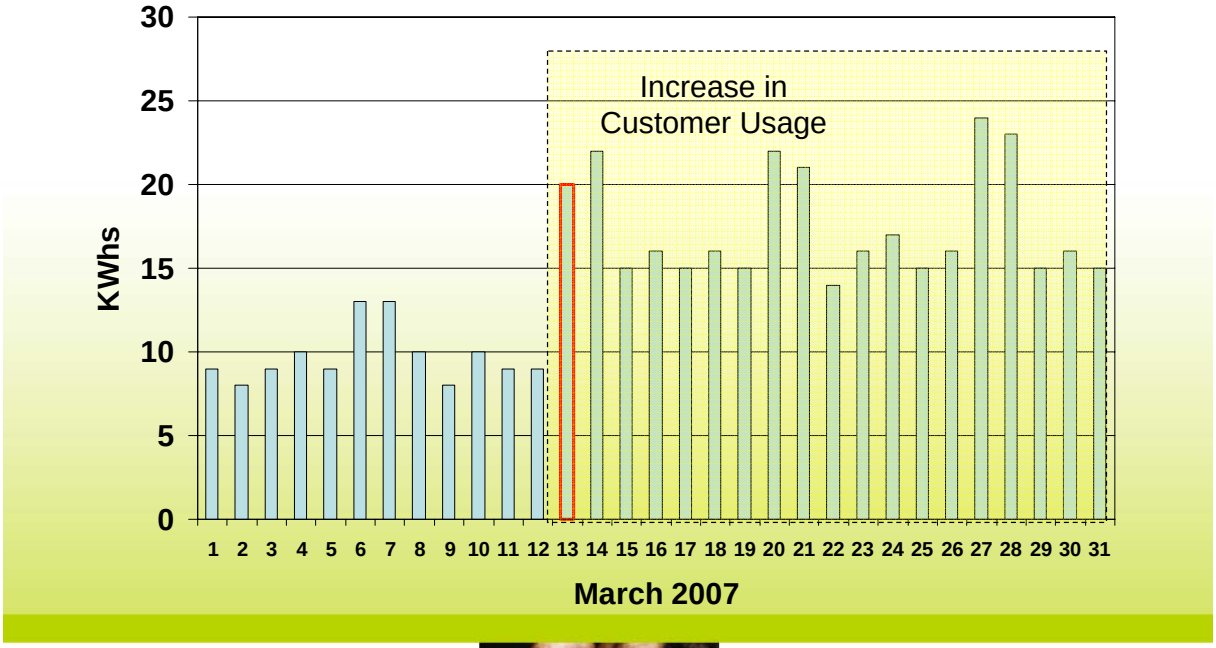
## Exploring Daily Usage Highlights Change on March 13th

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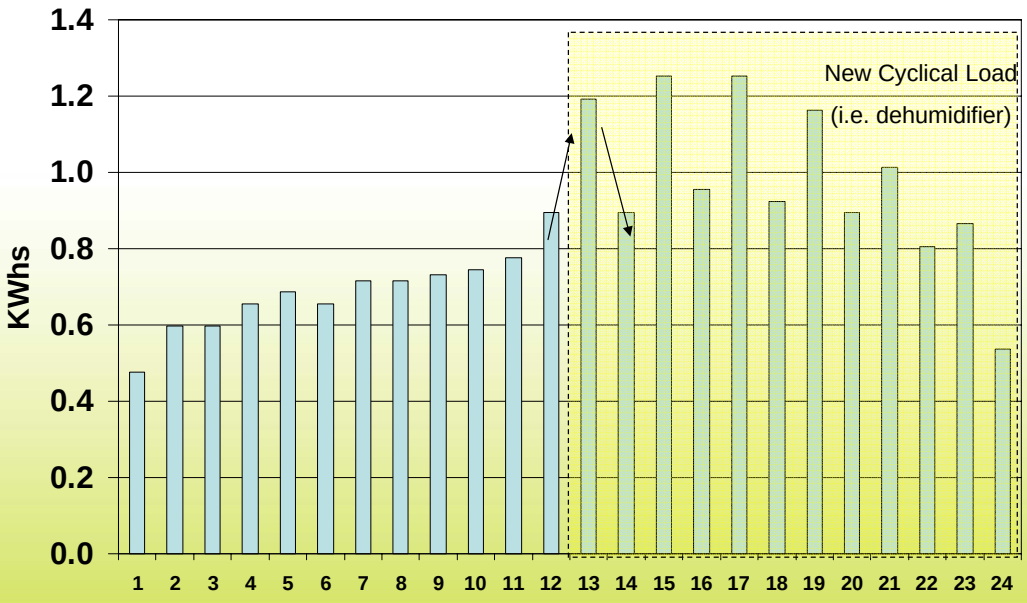
## Exploring Hourly Usage Highlights New Cyclical Load



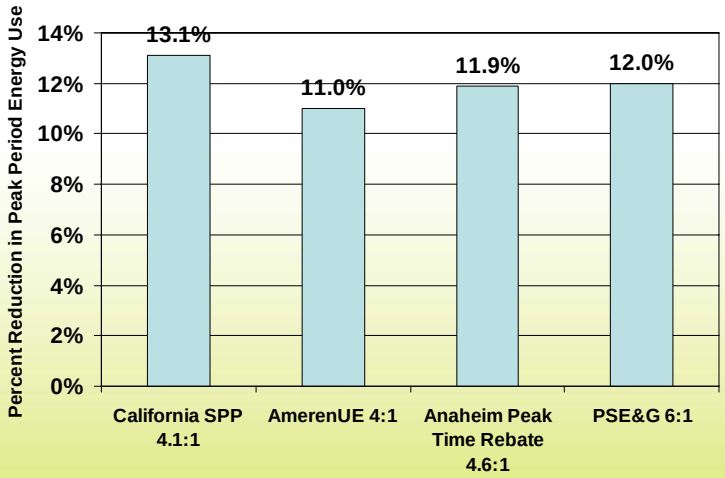



## Demand Response at PG&E

- Anticipated voluntary participation rate of 15%
- Program potentially operates up to 15 times per year between 2 pm and 7 pm during June-September
- When program operates, customers who volunteered pay 60 cents per kwh more than base rate during the critical peak hours on impacted days; customers pay 3 cents less than base rate during all other times
- First year bill protection
- Projected 455 avoided megawatts of capacity that will benefit all customers

Source: PG&E Demand Response Benefit Analysis

# Residential Customers Can and Do React to Demand Response Financial Incentives

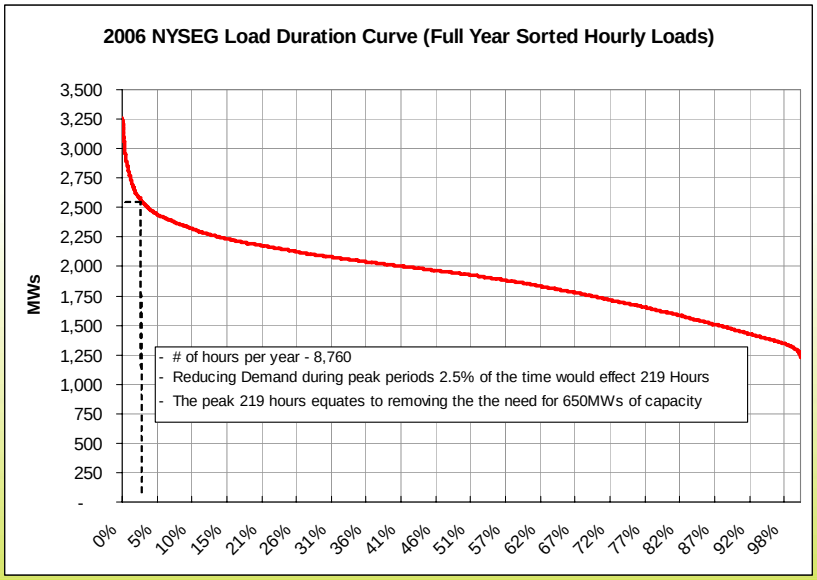



Bars indicate participant percentage reductions in peak period energy use observed in critical peak pricing experiments. Basically, participants were able to cut their peak period use by slightly over 10% in response to price signals that increased price or paid incentives that were 4 times the base kwh charge. ( Source: Stephen George, conference presentation)

NYSEG RGE



# Load Duration Curve Example

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## AMI Conclusions

- There are a range of AMI technology choices and providers available to utilities today
- AMI offers a range of practical benefits, including operational improvements, customer satisfaction improvements, and fairer cost distribution. AMI also provides the foundation for emerging demand response and energy conservation initiatives.
- With the support of their regulators, utilities around the country are deploying AMI to achieve these benefits for customers.



## NYSEG/RG&E AMI Filings – Overview

- February 1, 2007 filing in response to NYSPSC's Order directing utilities to file plans and proposals for approval of integrating advanced metering systems
  - Summary of existing NYSEG and RG&E system
  - High level deployment plan
  - Preliminary estimates of capital costs, operational costs/benefits
  - Delivery surcharge mechanism to recover costs
- May 4, 2007 filing to update information presented in February 1, 2007 filing
  - Request for approval of electric and gas tariffs to implement a formula rate mechanism for the recovery of AMI costs, effective January 1, 2008
  - Projected customer bill impacts are minimal
  - Revised estimates of capital costs, operational costs/benefits
  - Expanded description of potential customer service benefits
  - Deployment plan and key milestone activities

## Tariff Filing – Request for Approval

- Formula rate surcharge mechanism for the recovery of AMI investment and operating costs net of benefits, effective January 1, 2008
- Recovery through monthly minimum/customer charges on all metered customer bills
- Surcharge determined annually in accordance with formula in the tariff
  - Per meter surcharge based on forecasted annual revenue requirement needed to recover AMI costs, net of identifiable savings
  - Reconciliation of actual costs and savings, with any over/undercollection included in surcharge for subsequent year
  - AMI Surcharge Statement sets forth monthly AMI surcharge amounts by service classification; filed annually with PSC

NYSEG RGE 33

## Current Projections of Monthly Bill Impacts ($ per month)

| Utility | Bill Type | 2008 | 2009 | 2010 | 2011 | 2012 | 20-year Average |
|---|---|---|---|---|---|---|---|
| NYSEG | Res. Elec. – 600 kWh | $0.54 | $0.85 | $0.91 | $0.83 | $0.74 | $0.31 |
| NYSEG | Res. Gas – 30 therms | $0.57 | $0.97 | $1.12 | $1.06 | $0.98 | $0.65 |
| RG&E | Res. Elec. – 600 kWh | $0.53 | $0.86 | $0.95 | $0.87 | $0.78 | $0.34 |
| RG&E | Res. Gas – 30 therms | $0.51 | $0.89 | $1.02 | $0.95 | $0.87 | $0.52 |

The AMI system associated with these small monthly bill increases has three kinds of positive impacts:

- Promotes Improved Customer Satisfaction from Basic Services
- Provides Information and Platform to Promote Energy Conservation
- Provides Platform for Demand Response Programs
- Bottom Line: Customers need only save approximately 50¢ per month to pay for investment

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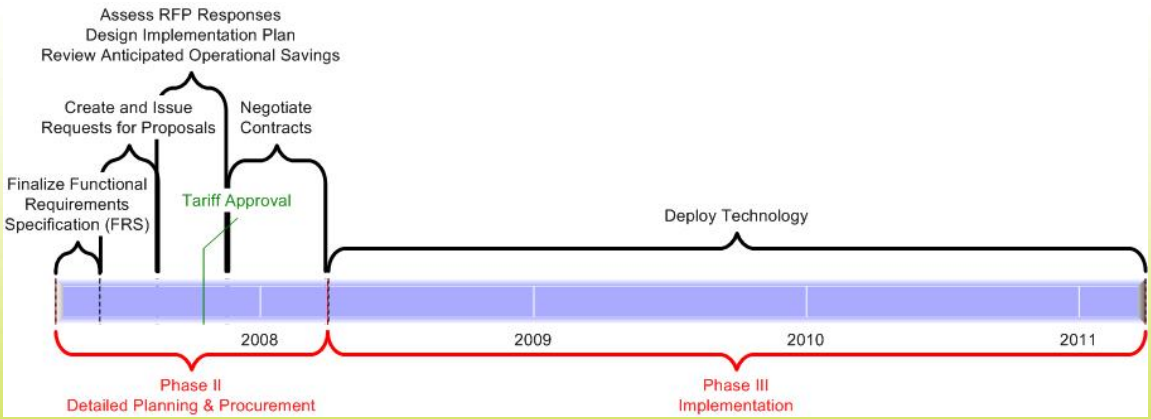
# Deployment Plan

- Phase I: Preliminary planning & cost/benefit analysis [Complete]
- Phase II: Detailed planning & procurement
- Phase III: Implementation






# Next Steps

- RG&E and NYSEG are proceeding with the planning needed to identify the particular AMI solutions that will work best in New York
  - Functional Requirements Specifications
  - Create and Issue Requests for Proposal (RFP)
  - Assess RFP Responses
  - Design Implementation Plan
  - Review Anticipated Operational Savings
- PSC Review and Approval of Tariffs

# Presenter Bio

- Gary Fauth has a PhD in economics from Harvard University, where he was also an Associate Professor for 10 years, teaching statistics and economics a the Kennedy School of Government. He has spent his consulting career working for organizations in regulated markets, including transportation, telecommunications, and gas and electric distribution. For electric utilities, he has helped systems in Washington D.C., Northern California, Georgia, Idaho, Texas, Pennsylvania, Melbourne, Australia, and Hong Kong understand the benefits and costs of meter reading automation, and has been part of implementation teams in California and Pennsylvania to deploy new technology throughout the service area.

- Contact Information: gary.fauth@att.net

NYSEG RGE

# The Future is Now: Energy Efficiency, Demand Response and Advanced Metering

## *NYISO Symposium*

*Advanced Metering and other Implementing Technologies*

*Jeff Havranek*
Trilliant Networks
*June 27, 2007*

Trilliant NETWORKS

## About Trilliant Networks, Inc.

- Provider of wireless network solutions for AMI, demand response and grid management applications
- 20+ years experience and more than 1.5 million AMI meters under contract
- Over 100 utility customers including Baltimore Gas & Electric, Duke Energy, Hydro One, Hydro Quebec, Milton Hydro, Northeast Utilities, OneOK, Public Service Electric & Gas, National Grid, NYPA and San Diego Gas & Electric
- Drawing on experience from CellNet, Itron, MetraTek, Comverge, Invensys, Honeywell, Sun Microsystems, Microsoft,
- Privately held company with key operations in:
  - Redwood City (San Francisco), California (headquarters)
  - Granby (Montreal), Quebec
  - Concord (Toronto), Ontario

Trilliant NETWORKS

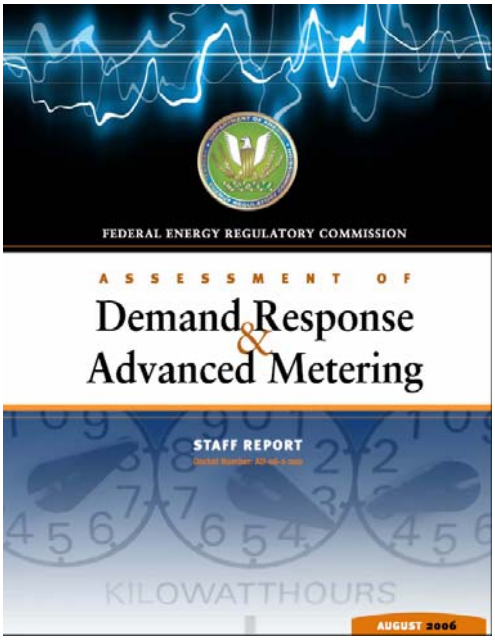
# Evolution of Metering Communications Technology

- 1970s - AMR (Automated Meter Reader) – hand-held tools that automated the reading of meter data by the meter reader walking on foot
- 1980s - AMR (Automated Meter Reading) – tools to enable reading of meter by driving trucks through neighborhood
- 1990s - AMR (Automatic Meter Reading) – fixed RF wireless or power line carrier based, 1-way communications to read meter data
- 2000s - AMI (Advanced Metering Infrastructure) – Mesh based RF wireless, 2-way communications – adds ability to control functions at premise in addition to simply reading meter

*AMI provides a technology platform that supports new programs and services beyond billing such as Demand Response (load management), remote connect/disconnect, power distribution grid monitoring, etc.*




# FERC Report – August 2006




AMI - Definition

"The communication H/W & S/W and associated system and data management S/W that creates a network between advanced meters and utility business systems and which allows collection and distribution of information to customers, retail providers and the utility."

# Meter-Centric Services Supported by a two-way AMI Network

- Meter Reads providing hourly (or more frequent) **interval consumption data**
- **On-demand Reads** (save time and money on truck rolls for final reads, initial reads and improves customer service)
- **Load Survey** for every account (save time and money on having to place 1000s of load survey meters in various locations every year)
- **Load Research** for every account (saves time and money when load data is needed for distribution or loading studies)
- Deliver **Customer Energy Consumption Data** (improves customers understanding and awareness of energy usage)
- Allows for **Pre-Paid Metering** (let's you offer different services to current customer base)
- **Remote Service Disconnect/Reconnect** (save time and money on truck rolls and increase employee's safety)
- Meets **EPACT and Smart Metering Requirements** (PUC/PSC satisfaction and benefits)
- Better **Outage Management and Event Reporting** (saves on truck rolls to wrong locations and increases Customer Satisfaction)
- **Better Service** Large Commercial Accounts (can give advance notification of events or trouble)

***…and Provides Foundation for Demand Management Programs***




# Examples of Meters that may be Connected to an AMI Network

**Can integrate AMI communications** | **External**

Residential


**GE I-210**


**L&G Focus**


**Itron Centron**


**American Gas**


**Gas**


**Multi-Utility**

Commercial


**GE KV series**


**Itron Sentinel**


**Landis & Gyr S4**


**Electric/Gas/RTU RS232/485**

# Non-Meter AMI Applications

- **Critical Peak Price Tiered Load Control** – time of day schedules with critical peak price tier signaling in thermostats, remote appliance controllers, residential or commercial applications
- **Direct Load Control** – cycling signals sent on demand to thermostats, remote appliance controllers, residential or commercial applications
- **Virtual Peaking Control** – system monitors available load to shed and sheds a desired amount of demand from your grid or from a premises
- **Premises Based Load Control** – ability to monitor and control a single premises based on their not to exceed demand level.
- **In Premise Displays** – ability to message customers, display usage data, current price tier and more. Can be via the thermostat or a separate PDA.
- **Smart Grid Control and Monitoring** – to include Capacitor Banks, Voltage Regulations, Sectionalizer, Fault Indicators and more.




# In-Premise Devices
## Support Demand Management Programs



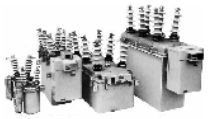
**Programmable Communicating Thermostat (PCT)**
- HVAC set points
- Messaging

**Remote Appliance Controller (RAC)**
- Electric water heaters
- Pool pumps

**In-Home Display**
- Messaging
- Consumption Data

# AMI network can enable Smart Grid Automation

- Capacitor Bank Control and Monitoring
- Voltage Regulator Control and Monitoring
- Recloser Monitoring



Switches

Sectionalizer

Recloser

Voltage Regulator

Capacitor Bank

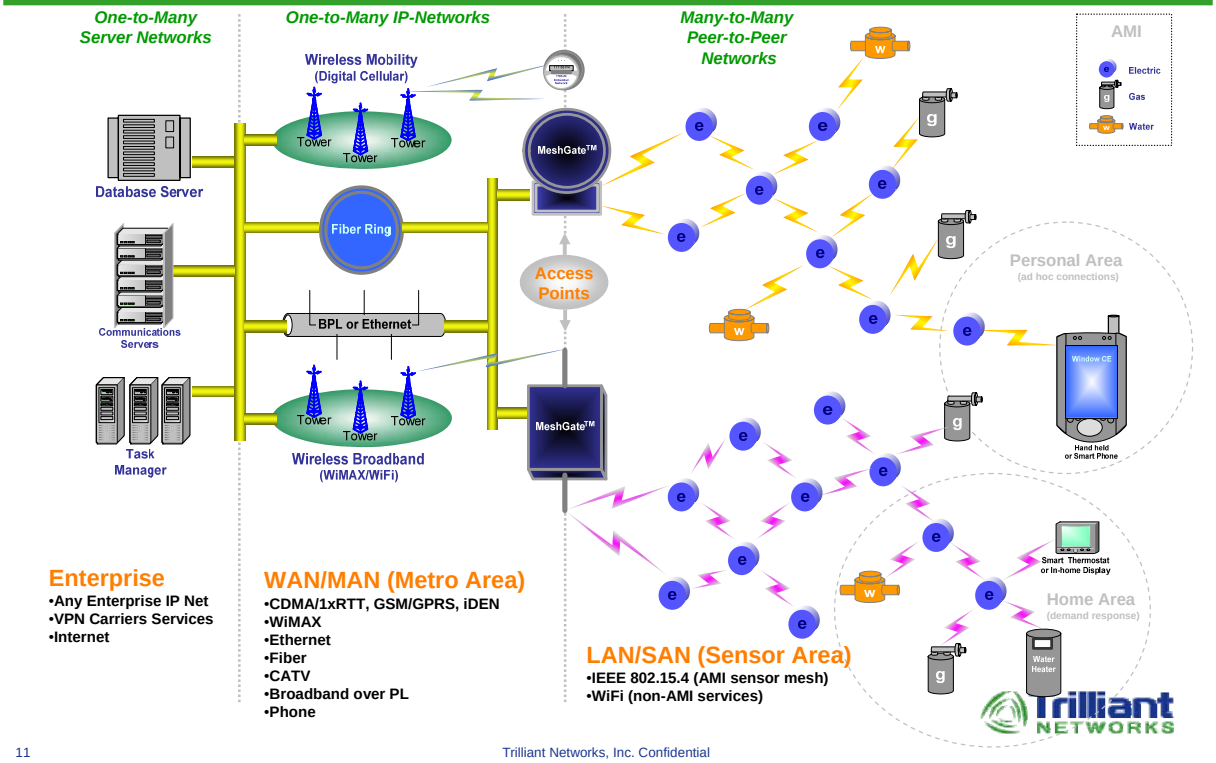




# Critical Technology Considerations

- Adopt standards where available:
  - Metering communications – ANSI
  - Wireless technologies - IEEE 802.15.4
  - Web standards – SOAP, IP based communications
- Protect choice of meters
- WAN communications options: WiMax, BPL, CDMA, GPRS, Ethernet,
- Ensure proven scalability - >1 million devices on network
- Future upgradeability – communication module firmware upgrades over the network
- Data rate at 2.4GHz is 6.25 times faster than at 900MHz
- Capacity for long term expansion
- Key network decision
  - 900MHz versus 2.4GHz
  - analogous to “dial-up” Internet versus broadband

# Modern AMI Network Architecture








# How Does This Network Benefit You?

- **Full Two-way Demand Side Management and Load Control**
  - Direct Load Control (can cycle or turn off load when peaks occur or to avoid spot purchases of power)
  - Critical Peak Price Tier Control (gives customers choice to participate in load control or pay a higher price to use energy during critical times)
  - Nega-watt Based Control (tell the system to remove XX MW and it happens in minutes)
  - Premises Based Control (can control load at a premise when it achieves a preset threshold)
  - Customer Based Control (give the customer the ability to control their own energy loads and costs by using a PDA or from a Website)
  - Two-way network permits instant notification that the event happened, that MW were removed and load shed from the targeted customers

- **Smart Grid Control and Monitoring** –
  - Control System Power Factor or Loading
  - Manage System Voltage at the Regulators down line
  - Remotely Control Sectionalizers, Reclosures and Switches down line
  - Monitor Fault Indicators down line for faster Responses to Issues.

***All from ONE SYSTEM using Open Standards and Trilliant Networks***

Trilliant NETWORKS


# Thank You!

**Jeff Havranek**

**Trilliant Networks, Inc.**

**1100 Island Drive**

**Redwood City, CA 94065**

**jeff.havranek@trilliantnetworks.com**

**Tel: 650.204.5057**

**Mobile: 818.519.8042**

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# NYISO SYMPOSIUM

## THE FUTURE IS NOW: ENERGY EFFICIENCY, DEMAND RESPONSE AND ADVANCED METERING

*June 27, 2007*
*Desmond Hotel and Conference Center*
*Albany, NY*

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**Agenda**

| | |
|---|---|
| 8:00 – 9:00am | Check-In and Continental Breakfast |
| 9:00 – 9:20am | **Welcome and Introduction:** Overview of Symposium<br>• Mark Lynch, NYISO President & CEO |
| 9:20 – 9:40am | **The Environmental Imperative**<br>• Fred Zalcman, Pace University |
| 9:40 – 10:00am | **NYS Energy Efficiency Portfolio Standard**<br>• Jim Gallagher, NYS Department of Public Service |
| 10:00 – 10:10am | **Break** |
| 10:10 – 11:30am | **Realizing the Promise Of Energy Efficiency -** How can energy efficiency measures serve to alleviate the pressures of increasing demand on electric capacity and resource constraints, while helping to meet environmental policy goals.<br><br>Moderator: Tina Palmero, NYS Department of Public Service<br>• LIPA - Dan Zaweski<br>• NYPA – Paul Belnick<br>• NYSERDA – Ruth Horton<br>• Climate Energy – Dr. Eric Guyer |
| 11:30 – 1:00pm | **Lunch** (Buffet Style) |
| 12:00 – 12:30pm | **Keynote Address**: Commissioner Alexander Pete Grannis,<br>NYS Department of Environmental Conservation |

1:00 - 2:15pm **The Power of Demand Response**

Demand response programs have been a valuable asset in sustaining reliability during peak demand in New York State. How do we balance the addition of new capacity and the desire to increase participation, or at least sustain the current level of participation in Demand response programs? How do we expand participation to smaller resources?

Moderator: David Lawrence, NYISO

- NYISO – Rob Pike
- National Grid – Tim Roughan
- ECS – Marie Pieniazek
- Multiple Interveno**r**s - Bob Loughney
- EnerNOC – Aaron Breidenbaugh
- The E-Cubed Co. - Ruben Brown

2:15 – 2:30pm **Break**

2:30 – 3:45pm **Advanced Metering and Other Implementing Technologies**

How can technological innovation help the market to efficiently allocate limited electricity supplies, simultaneously signaling conservation, innovation and consumer price elasticity? How can it help achieve our energy efficiency and demand response goals?

Moderator: Garry Brown, NYISO

- NYSEG – Jim Laurito
- Consultant to NYSEG – Gary Fauth
- NYSERDA – Tom Barone
- Trilliant Networks, Inc. – Jeffrey Havranek
- EPRI – Don Von Dollen

3:45 – 4:00pm **Concluding Remarks**

# Biographies

### Tom Barone, New York State Energy Research and Development Authority

Tom Barone is the Program Manager of Implementation Services within the Energy Efficiency Services Division at the New York State Energy Research and Development Authority (NYSERDA) in Albany.

He is responsible for NYSERDA's energy efficiency and demand-response activities in the commercial and industrial existing building sectors. The two most active programs are the Peak Load Reduction Program, and the Commercial/Industrial Performance Program. These programs are currently budgeted at over $71 million per year in financial incentives from NYSERDA, and are responsible for enabling nearly 600 MW of load reduction.

Tom has been with NYSERDA for 12 years and previously worked for the New York State Energy Office and in the private sector. Tom is a licensed professional engineer in NYS and has Bachelor's and Master's degrees in Civil Engineering from Rensselaer Polytechnic Institute in Troy, NY.

email: trb@nyserda.org

### Paul Belnick, New York Power Authority

Paul began his utility career in 1986 at the Long Island Lighting Company (LILCO) as Division Manager of Load Research. In addition to traditional load and class studies this group was also responsible for planning and evaluating LILCO's demand side management programs.

In 1992, Paul joined the New York Power Authority, and began implementing lighting and motors programs in State owned facilities across the State. The target market for this program was expanded to schools and county and local governments through the 1990's. Today, these programs are offered to all publicly operated facilities statewide and in 2006 $120M in projects were implemented. In addition, measures were added to the programs to include all energy saving measures, both electric and no-electric.

In 2003, Paul was promoted to Director of Energy Services Programs and is currently responsible for all energy services programs offered by the New York Power Authority.

Paul has a Bachelor's of Science degree in Industrial Engineering from SUNY Buffalo and an MBA from Indiana University.

email: paul.belnick@nypa.gov

### Aaron Breidenbaugh, EnerNOC

As Manager of Regulatory Affairs and Public Policy for the NorthEast (New England and New York regions), Aaron will attend all relevant ISO-NE and NYISO committee meetings related to Demand Response. He represents EnerNOC before the region's public utility commissions,

as well as the Federal Energy Regulatory Commission. Finally, Aaron is responsible for coordinating EnerNOC's interaction with state and federal legislative bodies throughout the Northeast.

Aaron's entire career has been involved in the process of electric industry restructuring, starting with the independent power industry, moving to the creation of the region's Independent System Operators, development of wholesale power markets, and, most recently, advocacy for the active participation of end-users in those markets through demand response programs at the ISO and utility levels.

Prior to joining EnerNOC, Aaron was the Program Coordinator for the New York Independent System Operator, in charge of the day-to-day operation of the NYISO's award-winning Demand Response programs. Prior to that, Aaron was the Executive Director of the Price Responsive Load Coalition, the only trade association representing demand response interests in the Northeast. In that position, Aaron was intimately involved in the development of the demand response programs in New York and New England. Previous to that, he was a strong advocate for electric industry restructuring at Automated Power Exchange, Inc. as they attempted to establish a private power pool/market in the Northeast. Finally, the first ten years of his career was spent at the Independent Power Producers of New York, Inc., and the state's IPP trade association where he culminated as the association's Deputy Director and Director of Regulatory Affairs.

Aaron holds a Master's degree in Science and Technology Studies, with a specialization in Energy Policy from Rensselaer Polytechnic Institute, as well as Bachelor's degree in Nuclear Engineering, also from RPI.

email: abreidenbaugh@enernoc.com

### Garry Brown, New York Independent System Operator

Garry Brown serves the New York Independent System Operator (NYISO) as Vice President, External Affairs, where he is responsible for interaction with local, state and federal governments, as well as internal and external communications.

He joined the NYISO in July 2003 as Vice President Strategic Development. In that position, he was responsible for the strategic, business and electric system planning functions at the NYISO, which operates the states high voltage transmission system and administers the annual $11 billion wholesale electricity market.

Mr. Brown has been directly involved in the electric industry for more than 27 years. Prior to the NYISO, he was Manager of Governmental and Market Relations at Sithe Energies, a large independent power producer. Previous to that, Mr. Brown spent 17 years with the New York State Energy Office and was actively involved in the initial stages of introducing competition into the electricity industry.

He has served as Chairman of the NYISO's Management and Business Issues committees. Mr. Brown was a member of the Board of Directors for the Independent Power Producers of New York and for Independent Energy Producers of New Jersey.

Mr. Brown has a Masters of Public Administration from the Rockefeller School of Public Affairs at SUNY Albany and a Bachelor of Arts degree from the State University of New York College at Plattsburgh.

email: gbrown@nyiso.com

### Ruben Brown, The E Cubed Company, LLC

Ruben S. Brown, M.A.L.D., founded The E Cubed Company, LLC in 1989. The Company provides strategic energy services to clients. In 2005 the New York Chapter of the Association of Energy Engineers named him "Energy Services Professional of the Year." Mr. Brown has worked in the policy arena dealing with energy efficiency, environmental and energy applied to alternative energy since 1970. He has worked at the National Research Council, directed studies for a Presidential Commission (Materials Policy), directed research staffs at two universities (MIT and Polytechnic University), directed the Council on the Environment of New York City and evaluated more than 250 combined heated and power and generation project developments for clients and his own account. Clients range from end-users to equipment, service and fuel providers and then to developers. Clients are often assembled in a voluntary association for interventions and public statements. It is called the Joint Supporters. It has appeared from Washington, D.C. to Ohio to Maine on occasion since 1989. Climate Energy, LLC is a client.

Mr. Brown has written a number of business plans involving demand resources, DG and energy efficiency: some implemented successfully and others not so successfully. He has published numerous papers and testimonial remarks, including presentations at the FERC's first technical conference on Demand Resources in 2001.

In New York, he negotiated the NYISO design (also served on Board of Directors Selection Committee), the utility restructuring cases, the system benefits charge cases, the stand-by rate cases and other generic and utility specific cases. He negotiated the design of the 300 MW DG/CHP/EE programs in the Con Edison base rate case for 2005-2008. He recently co-authored a report on the potential role of electricity storage in New York State being published shortly by NYSERDA.

More recently: (1) he negotiated the role of Distributed Generation & Combined Heat and Power in the design of the new capacity markets at ISO-New England, (2) in the 2005 Energy Independence Act Implementation of DG Monetary Awards in Connecticut, (3) prepared an evaluation of the CT Monetary Awards programs for the 2006-7 DG working Group in the Governors Office in Rhode Island (leading to a Least Cost Purchasing Scenario) and (4) in administrative and legislative reforms involving DG/CHP in Massachusetts (2002-2007).

Mr. Brown was one of ten invited witnesses at the first US Senate Oversight Hearings (in 1986) regarding the implementation of the Public Utility Regulatory Policy Act of 1978 (PURPA) which opened the door for interconnection and markets across the United States. He has negotiated interconnection issues in 11 jurisdictions.

email: rsbrown@ecubedllc.com

### Gary Fauth, Consultant to New York State Electric & Gas Corporation

Gary Fauth has a Ph.D. in economics from Harvard University, where he was also an Associate Professor for ten years, teaching statistics and economics at the Kennedy School of Government.

He has spent his consulting career working for organizations in regulated markets, including transportation, telecommunications, and gas and electric distribution. For electric utilities, he has helped systems in Washington, D.C., Northern California, Georgia, Idaho, Pennsylvania, Melbourne, Australia and Hong Kong understand the benefits and costs of meter reading automation, and has been part of implementation teams in California and Pennsylvania to deploy new technology throughout the service area.

email: gary.fauth@att.net

### James Gallagher, New York State Department of Public Service

James T. Gallagher is Director of the Office of Electricity and Environment (OEE) for the New York Public Service Commission. This Office of 75 professional engineers and energy analysts has responsibility for the oversight of New York's investor owned electric system operations and pricing, including: the siting and reliability of the State's generation, transmission, and power distribution systems; the design of appropriate rates and tariffs; and the development of ratepayer-funded energy efficiency, renewable energy, and environmental programs.

Before joining the Department of Public Service, Mr. Gallagher held senior energy policy positions at Northeast Utilities, The Pennsylvania Governor's Energy Council, and during the late 1970's, the Tennessee Valley Authority (TVA), where he was their first Manager of Renewable Energy Programs.

He received a B.S. in Economics from Lehigh University and an M.S. in Energy Management and Policy from the University of Pennsylvania.

email: kathleen_bloomingdale@dps.state.ny.us

### Commissioner Alexander B. Pete Grannis, New York State Department of Environmental Conservation

Pete Grannis was nominated by Governor Eliot Spitzer to serve as Commissioner of the Department of Environmental Conservation (DEC) and began his tenure in April 2007. His appointment marks a return to the Department for Mr. Grannis, who began his career in public service at DEC in the early 1970's as a Compliance Counsel.

Mr. Grannis served as a member of the Assembly representing the Upper East Side of Manhattan and Roosevelt Island for more than 30 years. While in the Assembly, Mr. Grannis championed a wide range of environmental issues as a long-time member of its Environmental Conservation Committee, and played a key role in enacting laws addressing acid rain, clean air and water, fluorocarbons and recycling. He fought for the passage of the State Environmental Quality Review Act (SEQRA), the original Bottle Bill and the clean-up and revitalization of brownfields. Last year, legislation he sponsored was signed into law requiring heavy duty trucks utilized by state contractors to use the best available technology and low-sulfur diesel, making such equipment virtually emission free.

Early in his career, Mr. Grannis chaired the Assembly's first Subcommittee on Toxic Wastes, sponsored legislation ensuring a worker's right to know about hazardous materials in the workplace, and worked to regulate the transport, storage and disposal of toxic wastes. Mr. Grannis's other environmental interests include preserving open spaces, reducing packaging waste, and preserving the beauty and irreplaceable resources of the Adirondacks. He has also advocated for funding for the complete and timely clean-up of Superfund sites. Mr. Grannis authored the state's rapid transit noise code and has been in the forefront of the fight to force the MTA to convert its polluting bus fleet to clean fuels.

Mr. Grannis is a three-time winner of the Legislator of the Year award from the Environmental Planning Lobby and was accorded similar honors by the Audubon Society, the Environmental Action Coalition and Environmental Advocates.

A nationally recognized leader in the fight to curb the health hazards posed by smoking, Mr. Grannis authored New York's historic Clean Indoor Air Act and strengthening amendments to protect all working men and women from exposure to deadly secondhand smoke. His Adolescent Tobacco Use Preven-

tion Act stands as one of the strongest laws in the nation to limit teenagers' access to tobacco. He also wrote the first state law to require tobacco companies to produce a fire-safe cigarette. The first law in the country to address directly how cigarettes are manufactured, this life saving measure banned the sale in New York of any brand not meeting the fire safety standard.

Mr. Grannis's work has been hailed by the American Cancer Society, the American Heart Association, and the New York State Association of County Health Officials He received the American Lung Association's prestigious Hall of Fame Award in 1996 and the New York State Public Health Association's Herman M. Biggs Memorial Award in 2004.

Mr. Grannis's efforts on behalf of consumers were recognized by the Consumer Federation of America, which presented him with its prestigious Philip Hart Public Service Award-the first state legislator to receive this award-joining a list of distinguished past recipients including Senators Paul Wellstone, Ted Kennedy and former House Speaker Tip O'Neill.

As Chair of the Assembly Insurance Committee from 1992 to 2007, Mr. Grannis championed legislation on behalf of consumers, including New York's precedent-setting Community Rating/Open Enrollment law which revolutionized the way small group and individual health insurance policies are sold in the state. In 2006, Mr. Grannis negotiated a new law requiring hospitals receiving funding under the state's $850 million Indigent Care Program to provide discounted care to uninsured patients and rein in the abusive billing and collection practices that have come under fire across the country.

Mr. Grannis led the fight to strengthen the state Insurance Department's authority to oversee auto insurance premium rates to stop auto insurers from ripping off New Yorkers and developed important measures to ensure the availability of homeowners' insurance in coastal areas.

Prior to his appointment to the Insurance Committee, Mr. Grannis served as Chair of the Assembly Housing Committee for ten years, where he was the leading legislative voice on behalf of tenants' rights and protections. He crafted many of the state's affordable housing programs for homeless, low-, moderate- and middle-income New Yorkers.

Long recognized for his tireless work to reform and improve the operation of government and politics by good government groups including the League of Women Voters, Common Cause and the New York State Public Interest Group, Mr. Grannis sponsored and supported sweeping reforms to bring transparency and efficiency to the state budget process and to state government. Among the many areas he worked on were overhauling the state's ethics laws and limiting the "revolving door" from legislative member or staff to lobbyist-reforms which were included in the first law signed by Governor Spitzer. Mr. Grannis also sponsored legislation to strengthen the state's lax campaign finance laws by providing public financing of elections and banning unlimited "soft money" contributions to political parties' housekeeping accounts.

An avid outdoorsman and fly fisherman, Mr. Grannis lives with his family on the Upper East Side of Manhattan. He was born in Chicago, Illinois, grew up in Michigan, and is a graduate of the Loomis School, Rutgers University and the University of Virginia Law School. Prior to entering the Assembly, Mr. Grannis practiced law in New York City.

email: dpaeweb@gw.dec.state.ny.us

**Dr. Eric Guyer, Climate Energy, LLC**

Dr. Guyer has spent his entire career in the development of energy technology and systems. Beginning with an advanced degree from MIT in Nuclear Engineering, he soon found an interest in smaller scale energy systems of all types, particularly building energy systems.

With the founding of Yankee Scientific in 1988, he has led the development of important new products for the HVAC industry. In the year 2000, Dr. Guyer brought together the international industry team that now comprises Climate Energy and he serves as the chief executive officer for Climate Energy.

Now he spends his time working to make micro-CHP a significant and practical energy alternative for North America.

email: eguyer@yankeescientific.com

**Jeffrey Havranek, Trilliant Networks, Inc.**

Director at Trilliant Networks has over 12 years of proven leadership with metering technology-based AMR/AMI companies in the electric and gas utility industry. Jeff worked with ESPs, and IOUs while at the original CellNet during which 11 million meters under fixed network were deployed. After the CellNet glory years, he went on to a successful career in metering hardware and software in the Electric Business Unit of Itron. Throughout his sales management career he has been responsible for managing and sales at numerous investor-owned utilities, and large municipalities in the Western U.S. and Canada. He has also been a conference speaker and course instructor at various meter schools and industry conferences. Additionally, he has served on the planning committee of the Western Energy Institute. His education includes an MBA from the American Graduate School of International Management – Thunderbird; and a degree in American Studies from Brigham Young University. Jeff and his family, reside in Southern California where he surfs regularly in front of the San Onofre Nuclear Generating Station.

email: jeff.havranek@trilliantnetworks.com

### Ruth Horton, New York State Energy Research and Development Authority

Ms. Horton is a Program Manager with over 26 years experience managing energy-efficiency and transportation programs for New York State.

She currently manages a $25 million portfolio of market development initiatives for the commercial/industrial sector as part of the New York Energy Smart Program. These include energy efficiency efforts related to quality lighting installations, motor systems, HVAC, and electronics.

Ms. Horton also oversees the New York Energy Smart Loan Fund which provides low-cost financing for efficiency projects, as well as NYSERDA's alternative-fuel vehicle deployment activities.

email: rmh@nyserda.org

### James P. Laurito, New York State Electric & Gas Corporation and Rochester Gas & Electric Corporation

James P. Laurito is President and CEO of New York State Electric & Gas Corporation (NYSEG) and Rochester Gas & Electric Corporation (RG&E).

From October 2000 until he was elected to his current positions in April 2003, Mr. Laurito was President and Chief Operating Officer of The Southern Connecticut Gas Company in Bridgeport and Connecticut Natural Gas Corporation in Hartford.

From 1997 until October 2000, Mr. Laurito was Vice President –business development and then President of The Energy Network, Inc. (TEN), a non-utility subsidiary of Energy East.

NYSEG, RG&E, Southern Connecticut Gas and Connecticut Natural Gas are all subsidiaries of Energy East Corporation [NYSE:EAS] headquartered in Albany, New York, and Portland, Maine.

Prior to joining TEN, Mr. Laurito was President and CEO of Consumers Applied Technologies, Inc., a subsidiary of Consumers Water Company. He has also served as President of Cochrane Environmental Systems, Inc., King of Prussia, Pennsylvania, and Vice President and General Manager, U.S. Filter Corporation, Rockford, Illinois.

Mr. Laurito is a trustee of the Northeast Region, Boys and Girls Clubs of America. He serves on the boards of the Federal Reserve Bank (Buffalo Branch), Edison Electric Institute (EEI), Metropolitan Development Association (MDA), Center for Governmental Research (CGR) and Rochester Business Alliance (RBA).

Mr. Laurito is a graduate of West Virginia University with a Bachelor of Science degree in civil engineering, and has completed executive programs in financial and manufacturing management at Columbia University.

Jim, his wife VaNita and their son, Tyler, live in Rochester, New York.

email: roberta_holahan@rge.com

### David Lawrence, New York Independent System Operator

In his position as Manager of Auxiliary Market Products, Mr. Lawrence is responsible for working with stakeholders and staff of the New York Independent System Operator to design, implement and enhance the company's Installed Capacity (ICAP) and Demand Response products.

Mr. Lawrence came to the NYISO in April 2000. He has also contributed to NYISO's environmental initiatives, serving as a resource panel member on the Regional Greenhouse Gas Initiative and working with stakeholders on windpower issues.

Prior to joining the NYISO, Mr. Lawrence spent 24 years at Power Technologies, Inc., where he was Director of the Instrumentation and Energy Management Department. He has served as chairman of the Schenectady Chapter of the IEEE Power Engineering Society and the IEEE Schenectady Section.

Mr. Lawrence received a Bachelor of Science degree in Engineering and a Master's degree in Electric Power Engineering from Rensselaer Polytechnic Institute in Troy, NY.

email: dlawrence@nyiso.com

### Robert Loughney, Couch White, LLP

Robert M. Loughney is a magna cum laude graduate of the University of Scranton (1977) and a cum laude graduate of Temple University School of Law.

For the past 25 years Mr. Loughney has concentrated on energy law matters and regularly appears before the State of New York Public Service Commission and the Federal Energy Regulatory Commission. He also has represented dozens of clients throughout the nation in contract negotiations involving energy and environmental matters, including many of the nation's largest industrial and commercial energy users.

Mr. Loughney regularly assists client in analyzing their energy supply options, including the evaluation and implementation of self-generation and gas bypass alternatives. He is well-versed with respect to deregulated energy markets and has represented electricity and natural gas buying groups in procuring physical and financial price hedging instruments and renewable energy products. Mr. Loughney also represents the City of New York on various issues, including the City's purchase of electricity, natural gas and steam supply and delivery services.

email: rloughney@couchwhite.com

### Mark Lynch, New York Independent System Operator

Mark S. Lynch is the President and Chief Executive Officer of the NYISO. He came to the NYISO from Mirant Corporation where he served as President of Mirant New York and also Mirant New England. He was responsible for electric system planning, operations, engineering, construction, maintenance and power marketing.

Mr. Lynch held various leadership positions with the Mirant Corporation. He was named Vice President of Mirant Corporation, Chairman of DWR CYMRU from 2000 -2001. He managed all aspects of the Welsh water utility, located in the United Kingdom, serving over 1.1 million customers.

From 1999-2000, he was Vice President, Power Generation and Delivery of Mississippi Power Company. Mr. Lynch was responsible for power plant and transmission system operations for this division of Southern Company.

From 1996-1999, Mr. Lynch held the position of Vice President of Southern Energy, President and Chief Executive Officer of ELDENOR.

From 1992 to 1996, he held domestic and international Project Director positions with Southern Energy.

Mr. Lynch is a graduate of Villanova University with a Bachelor's degree in Electrical Engineering.

email: mlynch@nyiso.com

### Christina Palmero, New York State Department of Public Service

Christina Palmero has been on staff with the New York State Department of Public Service since 1988.

She currently manages a staff with policy, administrative and compliance oversight responsibilities for a number of the Department's clean energy initiatives and programs including NYSERDA's Energy Smart Programs funded through the system benefit charge.

She is an active member of the Regional Greenhouse Gas Initiative (RGGI) Staff Working Group responsible for designing a cap and trade program for CO2 emissions from electric generation facilities and she also serves as the staff co-chair for the National Association of Regulated Utility Commissioners Energy Resources and Environment Committee.

email: christina.palermo@dps.state.ny.us

### Marie Pieniazek, Energy Curtailment Specialists

Ms. Pieniazek is responsible for representing Energy Curtailment Specialists' interest at the California ISO, New York ISO, NYSERDA, the New York and California Public Utility Commissions, the Federal Energy Regulatory Commission as well as representing our legislative interests in Albany and Sacramento.

Ms. Pieniazek previously worked at the New York Independent System Operator where she was responsible for facilitation of New York's $750,000,000 Installed Capacity market. Prior to joining the New York Independent System Operator, Ms. Pieniazek was employed by Selkirk Cogen Partners, a 345-megawatt cogeneration facility that provides power to New York's wholesale market.

Ms. Pieniazek holds a Bachelor's of Science degree in Business, Management, and Economics, with a concentration in Accounting, from State University of New York, Empire State College and expects to receive her MBA from the College of St. Rose in August 2007.

email: mpieniazek@ecsny.com

### Robert Pike, New York Independent System Operator

Robert Pike has worked for the New York Independent System Operator and its predecessor the New York Power Pool, for almost 15 years.

In the time he has held a variety of positions in Planning, Operations, Market Operations, Market Design, Information Technology and most recently Product Management.

Robert is currently responsible for overseeing the products managing the Operations and Reliability of the System Grid and the creation and implementation of Demand Response Programs.

He has a Bachelor's of Science degree and Master of Science degree in Electrical Engineering from Clarkson University and a MBA from Union College.

email: rpike@nyiso.com

### Tim Roughan, National Grid

Tim Roughan is the Director of Distributed Resources for National Grid's distribution companies which serve 3.4 million customers in New England and New York.

His prior positions include Business Services Vice President for the Western district for MECO and the Manager of Power Quality Services. He has been with the company or it's predecessors for 25 years.

The Distributed Resources group is responsible for coordinating customer-side distributed resources to actively manage loads on the local distribution system through targeted load response programs, and manages all aspects of the ISO-NE Load Response programs for the company's customers.

In addition, the group manages the DG interconnection process to the Company's New England distribution system. The group also provides power quality engineering services to customers.

email: timothy.roughan@us.ngrid.com

### Don Von Dollen, Electric Power Research Institute (EPRI)

Don Von Dollen is the Program Manager for the Electric Power Research Institute (EPRI) Communications and Data Integration Group and the leads the IntelliGrid Program. The IntelliGrid Program is focused on accelerating the transformation of the power delivery infrastructure into the intelligent grid needed to support our future society through a unique collaboration of public and private stakeholders.

IntelliGrid has conducted substantial R&D on the topic of Smart Grids and works closely with utilities and suppliers to implement the results of the work. Results are available at www.EPRI-IntelliGrid.com.

Don joined EPRI in 1991 and has held positions as Applications Manager for Power Delivery and Markets, Program Manager for Underground Transmission and Project Manager. Don has managed EPRI's superconductivity research program including wire and cable development, and research projects relating to transmission cable systems.

Before joining EPRI, he was a Research Engineer with the Pacific Gas & Electric Company.

email: dvondoll@epri.com

### Fred Zalcman, Pace University

Fred Zalcman is the Executive Director of the Pace Energy Project, one of New York's leading sustainable energy research and advocacy organizations. He has been lead counsel for environmental coalitions in regulatory proceedings in New York, New Jersey and Pennsylvania, promoting electric industry market structures and regulatory policies supportive of energy efficiency, renewable energy and clean distributed generation technologies.

Mr. Zalcman is part of a team of attorneys advising environmental stakeholders on legal issues related to the design and implementation of the Northeast Regional Greenhouse Gas Initiative (RGGI), the Nation's first program to regulate emissions of global warming pollutants from the power sector.

He currently serves on the Westchester County Global Warming Task Force, advising on carbon-reducing energy strategies available at the local and county level. Since 2003, Mr. Zalcman has also co-directed the Northeast Combined Heat and Power Application Center with a mission of accelerating the market penetration of energy efficient and superior CHP in a seven state New York-New England region.

Additionally, Mr. Zalcman currently serves on the New York System Benefits Charge Advisory Group, a blue-ribbon committee providing guidance and counsel to the New York State Energy Research and Development Authority on implementation of the $175 million annual New York Energy Smart™ Program.

He teaches energy law at Pace Law School and has significant experience in energy and environmental matters, both as an attorney and as a policy analyst. Prior to joining Pace in 1994, he was head of the Strategic Planning Section of the Illinois Department of Energy and Natural Resources where he was chiefly responsible for the development of statewide policies and programs for electric and gas integrated resource planning (IRP), energy conservation, renewable energy development, competitive resource bidding and power plant siting and certification.

email: fzalcman@law.pace.edu

### Dan Zaweski, Long Island Power Authority (LIPA)

Dan Zaweski is currently the Assistant Vice President of Energy Efficiency and Distributed Generation for the Long Island Power Authority. In this role Mr. Zaweski maintains primary responsibility for LIPA's Clean Energy Initiative - a ten year, $355 Million Initiative consisting of a mix of energy efficiency programs and the promotion of clean and renewable generation technologies.

Mr. Zaweski holds a BA and MBA with concentrations in Management.

Prior to joining LIPA in September 1999, Mr. Zaweski spent the previous decade with the Empire State Electric Energy Research Corporation - the former R&D arm of the New York State electric utilities, leaving there as the Director of Administration.

In addition to his duties at LIPA, Mr. Zaweski also serves as the Secretary/Treasurer of the Adirondack Lakes Survey Corporation in Raybrook, NY, is a member of the Board and serves as Treasurer of the Northeast Energy Efficiency Partnerships, Inc., is a member of the Board of the Consortium for Energy Efficiency, and is a member of the U.S. Department of Energy's State Energy Advisory Board.

email: dzaweski@lipower.org

The New York Independent System Operator (NYISO) is a not-for-profit corporation that is responsible for operating the state's bulk electricity grid, providing non-discriminatory access to transmission services and administering wholesale markets for electricity and transmission products.

The NYISO is governed by an independent Board of Directors and by committees comprised of its customers and other stakeholders.

It began operations in December 1999 as the successor to the New York Power Pool.

In its role as grid operator and market administrator, the NYISO has become a repository for information about the bulk electricity grid in the state and the northeast region. Drawing on this data, the NYISO can offer insights into trends that have an impact on important features of the electric system. Consequently, the NYISO strives to serve as an objective, authoritative source of information on such issues.

The NYISO's sponsorship of the symposium, "The Future is Now: Energy Efficiency, Demand Response and Advanced Metering," is part of its effort to provide policymakers and industry leaders with the information needed to make knowledgeable decisions about the future of New York State's electricity system.

If you have questions about the proceedings of the symposium or other issues relating to the NYISO, please contact NYISO External Affairs.


***Garry Brown, Vice President of External Affairs***
***gbrown@nyiso.com***
***518-356-7524***

***Elaine Robinson, Director of Regulatory Affairs***
***erobinson@nyiso.com***
***518-356-6178***

***John Cordi, Manager of Government Affairs and Media Relations***
***jcordi@nyiso.com***
***518-356-6044***

***Gary Paslow, Manager of Communications***
***gpaslow@nyiso.com***
***518-356-7326***

***Ray Stalter, Manager of Committee Support***
***rstalter@nyiso.com***
***518-356-6077***

NEW YORK INDEPENDENT SYSTEM OPERATOR

*10 Krey Blvd.*
*Rensselaer, NY 12144*

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