NYU Langone Medical Center

NYU Langone Medical Center

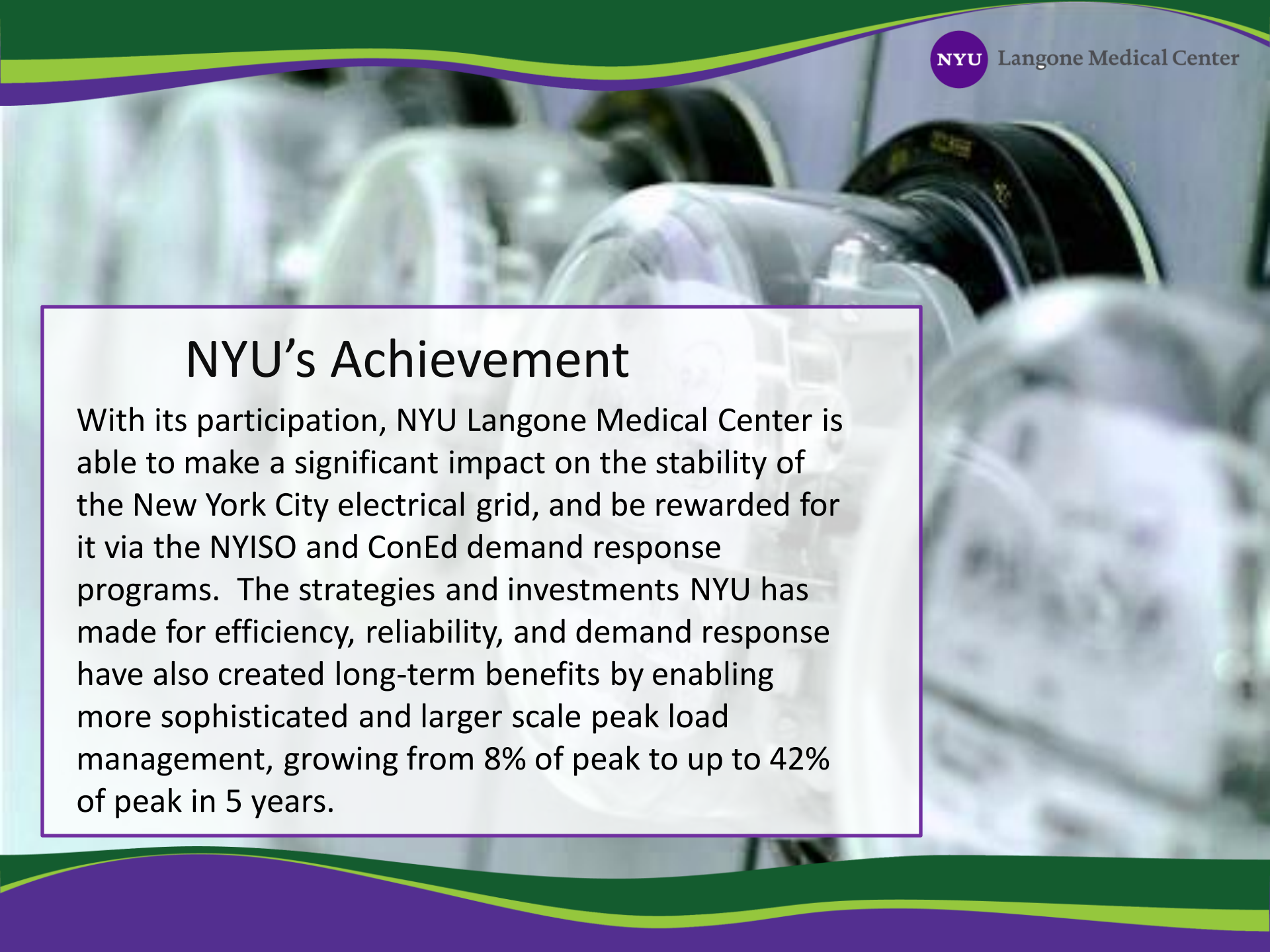
Case Study on Innovation of Demand Response

PLMA
Demand Response Leadership
Since 1999

NYU Langone DR Case Study – Building a Smart Microgrid

- Diversified forms of demand response – emergency generation, fuel-switching, curtailment
- Maximized rebates available to enable technology improvements to increase DR functionality
- Increasingly sophisticated DR protocol design / implementation despite more stringent management constraints in implementing DR
- Reinvesting DR revenues into upgrades has led to dramatic increases in DR revenues and additional revenues to financing projects
- Next phase – integrating DR capabilities for on-going peak load management and commodity cost-management – Combined Heat and Power Plant and Primary Electric

NYU Langone Medical Center is one of the nation's premier centers of excellence in health care, scientific research, and medical education. Committed to both energy efficiency and sustainability, NYU Langone Medical Center selected Constellation Energy, a strategic dynamic energy management firm, to help support the institution’s energy conservation initiatives, starting with demand response.



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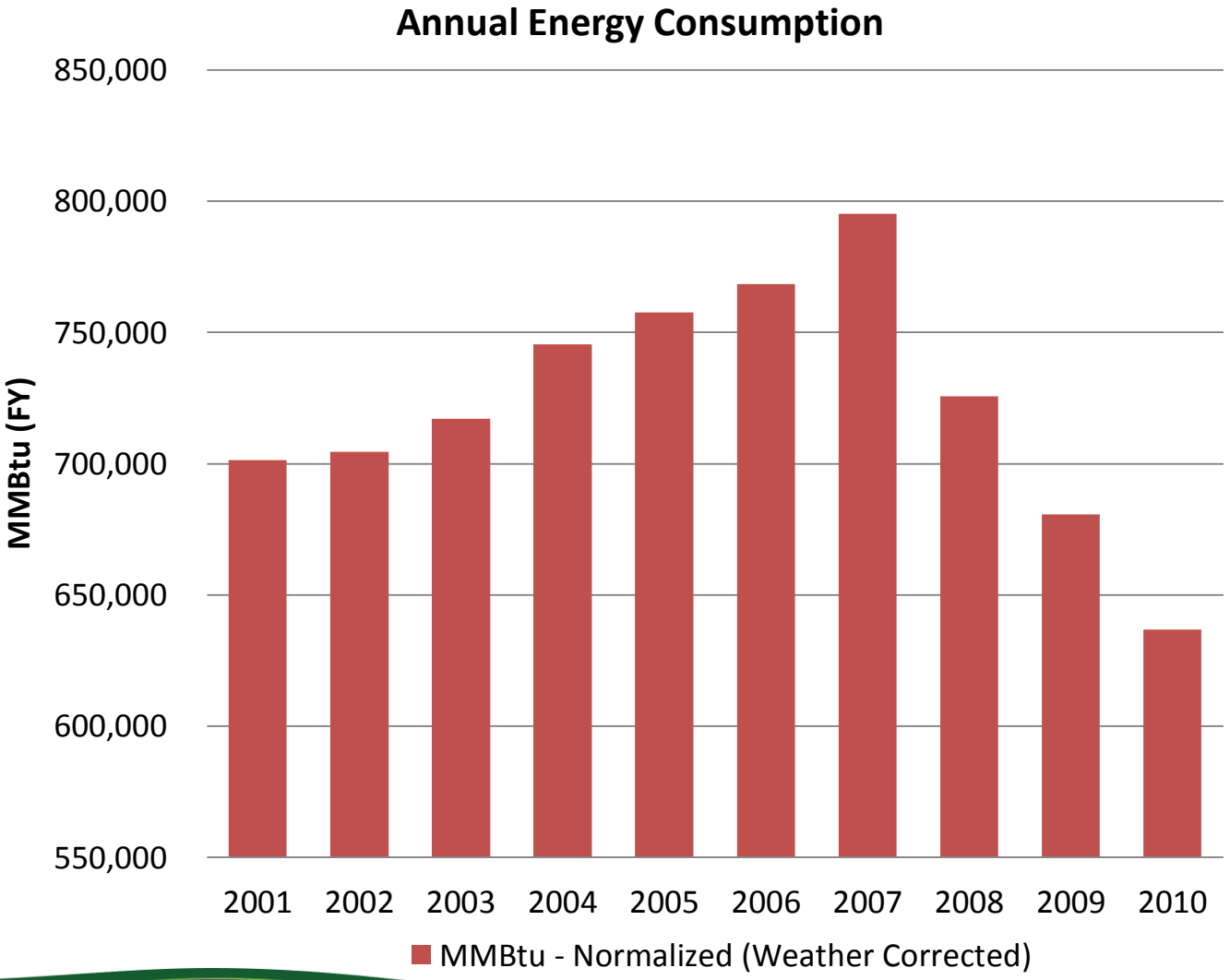
NYU's Achievement

With its participation, NYU Langone Medical Center is able to make a significant impact on the stability of the New York City electrical grid, and be rewarded for it via the NYISO and ConEd demand response programs. The strategies and investments NYU has made for efficiency, reliability, and demand response have also created long-term benefits by enabling more sophisticated and larger scale peak load management, growing from 8% of peak to up to 42% of peak in 5 years.

Energy Management: Accomplishments – Conservation



- $3.5 million savings in 2010
- Cumulative $7.7 million savings (Compared to 2007 Consumption)

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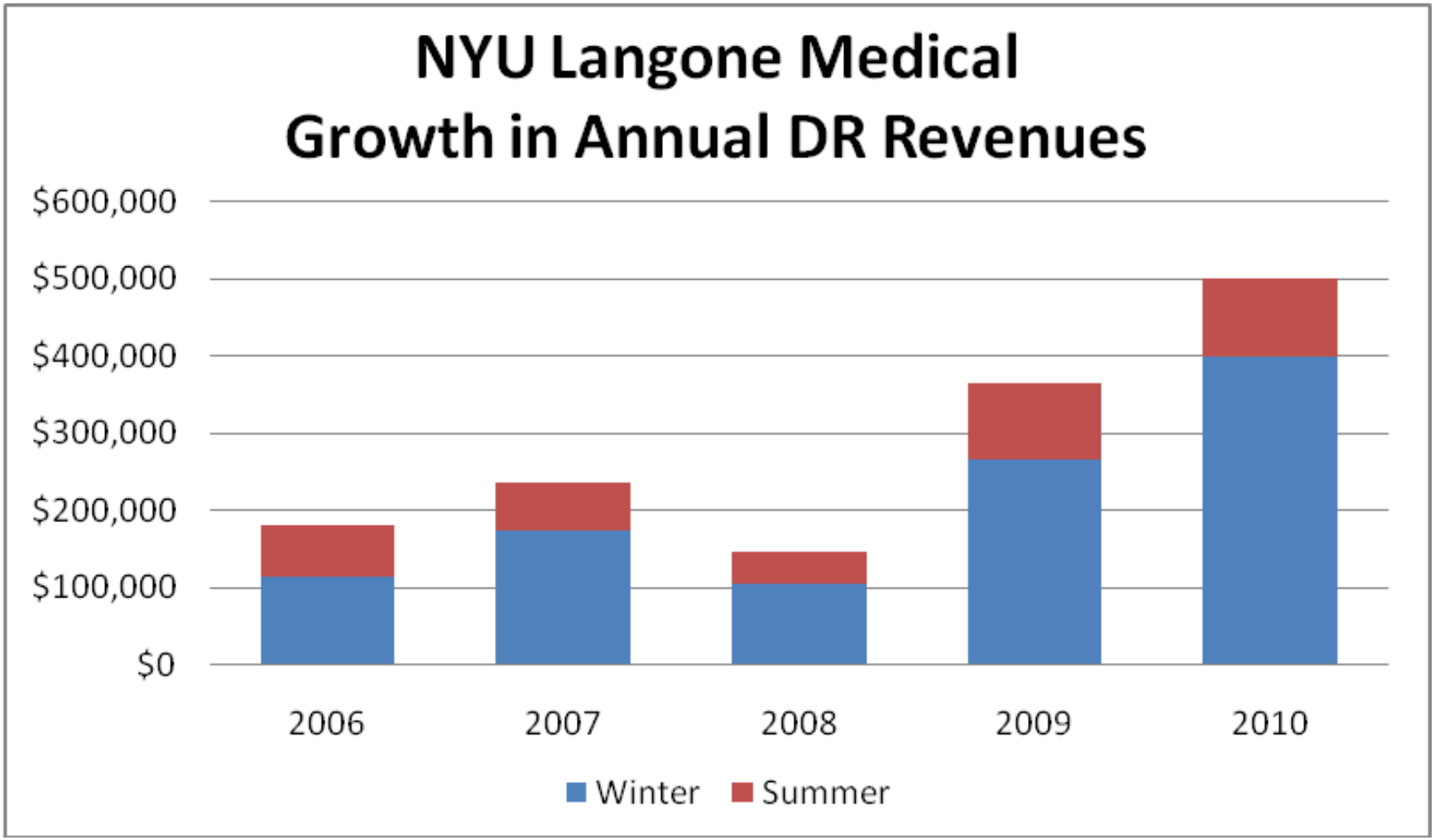
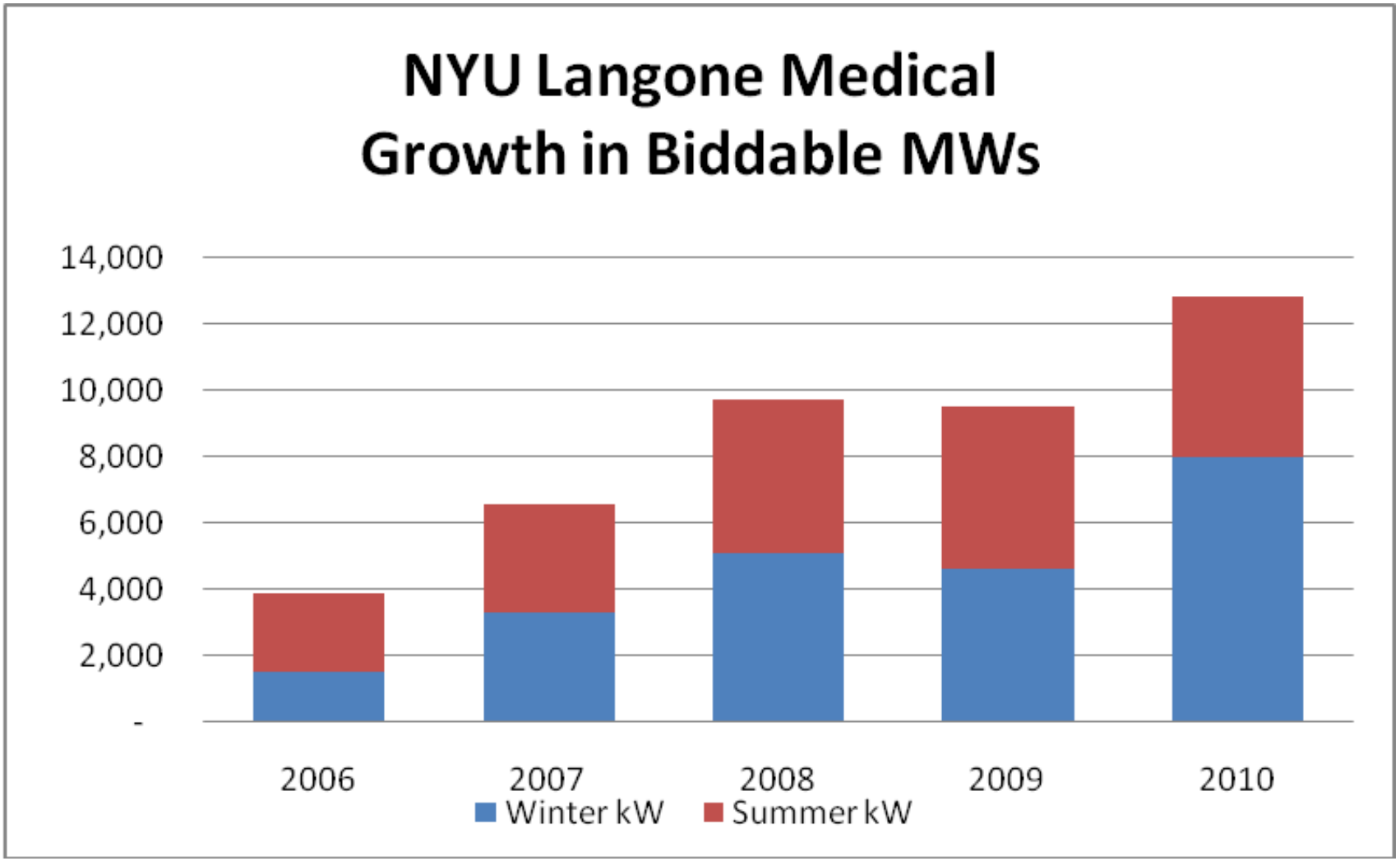

NYU Langone Medical
Growth in Annual DR Revenues
$600,000
$500,000
$400,000
$300,000
$200,000
$100,000
$0
2006
2007
2008
2009
2010
Winter
Summer


NYU Langone Medical
Growth in Biddable MWs
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-
2006
2007
2008
2009
2010
Winter kW
Summer kW

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Executive Energy Report - Financial Summary

Financial Summary (Superblock Only)

	Budget	Actual	Variance	Prior Year Actual	Variance Analysis: Unit Cost	Weather Impact	Conservation Impact	Other Impacts
Current Month:	$2,674,050	$2,377,818	$296,232	$2,363,570	$278,926	($88,519)	$105,825	$0
Fiscal Year to Date:	$12,135,056	$12,034,665	$100,391	$11,891,565	($5,305)	($332,090)	$437,786	$0
Projected Year End:	$24,332,000	$23,349,318	$982,683	$23,315,604	$876,987	($332,090)	$437,786	$0

Projected Variance Factors for FY11:

Unit Cost Impacts:

Electric

$873,734 Favorable Fixed Unit Cost from Suez

$62,830 Favorable Fixed Unit Cost from Adj for Jan/Feb

Steam

$379,038 Favorable for ConEd Steam rate decreases

Unit Cost Variance Factors for:

February, 2011	$62,567	Electric Rate Change
	($6,689)	Steam Rate Change
	($47,014)	Electric Fuel Adj & Other
	$270,062	Steam Fuel Adj & Other
FYTD	$62,830	Electric Rate Change
	$370,479	Steam Rate Change
	($642,079)	Electric Fuel Adj & Other
	$203,465	Steam Fuel Adj & Other

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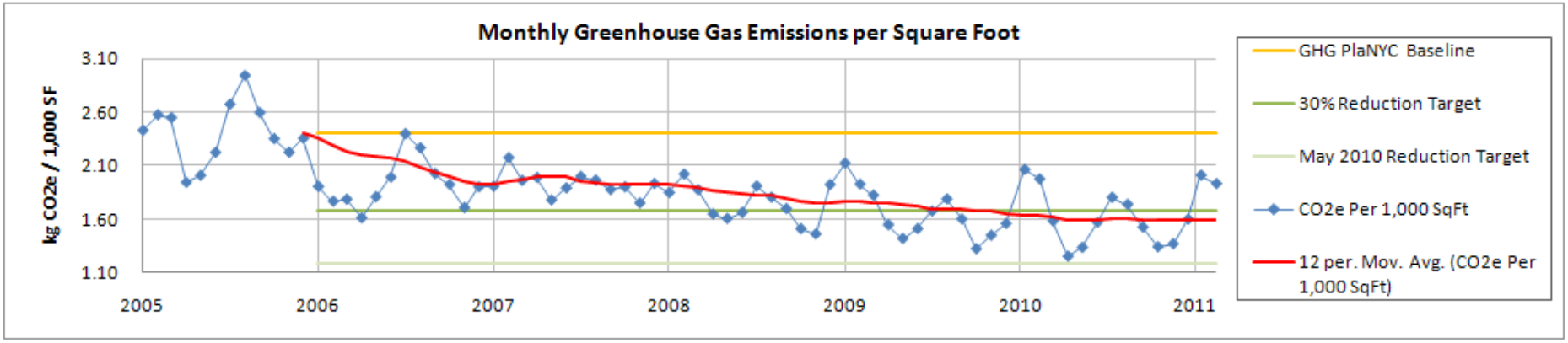
Executive Report - Carbon Emissions - PlaNYC

PlaNYC Greenhouse Gas Emissions

	2005	2006	2007	2008	2009	2010	2011 Rolling
Total CO_2e Emissions (Metric Tons):	91,776	78,489	78,601	71,220	67,064	65,048	64,720
Total Source Energy (MMBtu):	1,702,551	1,585,122	1,688,719	1,602,180	1,569,843	1,524,803	1,516,362
Building Area (SF):	3,180,660	3,403,660	3,403,660	3,403,660	3,403,660	3,403,660	3,403,660
Carbon Intensity (lbs CO2e/sq.ft.)	63.62	50.85	50.92	46.14	43.45	42.14	42
MMBTU / sq.ft.	0.54	0.47	0.50	0.47	0.46	0.45	0.45
CO_2e vs. 2005 Baseline:		**-20.08%**	**-19.97%**	**-27.48%**	**-31.71%**	**-33.77%**	**-34.10%**
MMBTU / sq.ft. vs. 2005 Baseline:		**-13.00%**	**-7.31%**	**-12.06%**	**-13.84%**	**-16.31%**	**-16.77%**



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NYISO and ConEd Programs

- Call on electricity end-users to reduce their consumption during critical times, when blackouts and brownouts are imminent
- Reduce stress on the grid and helping to alleviate the need for electricity providers to generate new power to meet demand
- Pay electricity end users for their participation
- ConEd DLRP Program Only: events are called within specific sub-zones of ConEd's utility territory where load constraints are acute

NYU Langone's Demand Response Participation

NYU Langone Medical Center has been an active participant in the NYISO demand response programs since 2006 and started participating in ConEd's program in 2007.

Aspects of NYU's Participation

- Continuous Improvement and Expansion of Demand Response
- Enabling Demand Response: Facilities Management Commitment to Excellence
- Enabling Demand Response / Peak Load Management: Controls & Optionality
- Enabling Demand Response: Business Continuity / Energy Reliability

Continuous Improvement and Expansion of Demand Response

In NYISO's Demand Response Program:

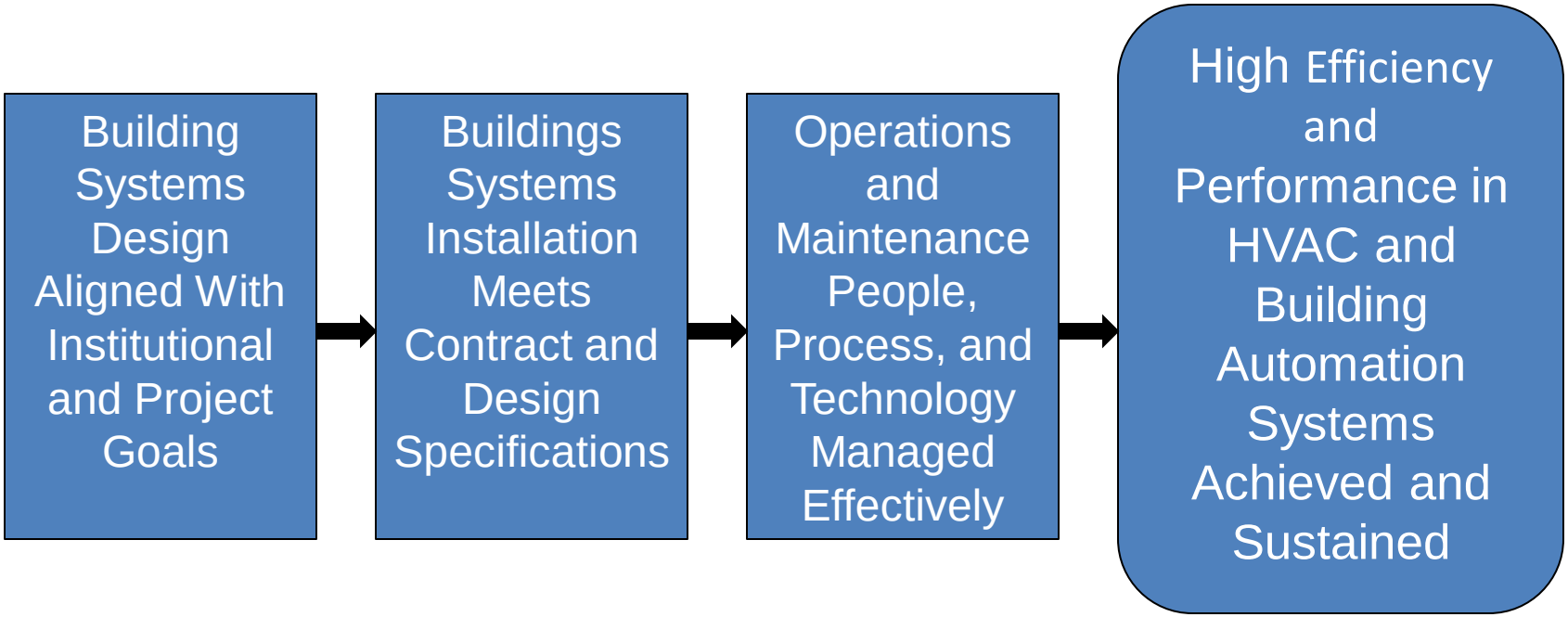
- NYULMC started participating in the NYISO's DR program in 2006
- Since then, has continued to be a committed and pioneering leader in energy conservation among institutions
- NYULMC has steadily increased its DR capabilities and commitments by adding more generators, more facilities, and more non-generation load curtailment to its total kW reduction commitment
- NYU Langone Medical Center has:
  - 13 buildings across its campus, for a total of close to 3 million square feet
  - representing approximately 19MWs of peak demand participating in its DR program.

Enabling DR: Facilities Management Commitment to Excellence

- Dedicated energy professionals and a high level sustainability committee leads all energy and sustainability efforts
- NYULMC's initial curtailment plan only leveraged its largest and most central emergency generators
- By working with Constellation Energy, additional curtailment opportunities were identified and cultivated at more buildings across the NYU campus that were not managed by the central facilities department.
- Building off the success of main campus buildings in the summer of 2006 and an attentive and supportive outreach effort by NYULMC and Constellation Energy, NYULMC was able to secure the buy-in and support of facility managers previously unfamiliar with DR, adding approximately another 900,000 sf of facilities to the program.

High Performance Energy Systems

Critical Path to Success



Enabling DR/ PLM: Controls & Optionality

Chiller

- Sophisticated chiller plant controls dispatch the best chillers to run and controls their contribution to a large interconnected piping system serving the entire campus
- Switching between electricity to steam during selected days/hours when the prices of electricity are high (peak load management) and/or a demand response event is called.
- Keys to Demand Response Success during an event
  - Reliability of chilled water delivery
  - Run very cold chilled water from steam driven plants
  - Reduce load at secondary systems , AHU's and secondary pumping, never at primary systems
  - 100% indoor environment delivery to critical areas and services

Enabling DR/ PLM: Controls & Optionality

Building Management System (BMS) Upgrade

- Before enrollment in the program, NYU added hundreds of new points on their BMS, providing greater precision on which air handling units, variable frequency drives, and other equipment can be temporarily ramped-down during demand response events in *non-critical areas.*
- Moreover, at a facility the size of NYU Langone Medical Center where hundreds of control points are involved, it is the only way that these types of curtailment measures can be effectuated quickly and reliably for both demand response and peak load management.

Future Upgrades

- NYU Langone Medical Center is currently evaluating and pursuing even more energy efficiency / peak load management projects such as, Utilivisor Chiller Plant Optimization, EMACx PLM Remote Monitoring and Commissioning expansion.

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Enabling DR: Business Continuity / Energy Reliability

Increasing system reliability and demand response capability by upgrading and installing additional emergency generation.

As part of its demand response services, Constellation Energy identified several projects with NYSERDA funding that fit in line with NYU's overall facility improvement plans,

Adding additional loads to an existing emergency generator to provide maximum reliability to the hospital and research facilities and to maximize demand response revenues.

NYU and Constellation Energy are also investing re-configuring the wiring, controls, and loads at two existing generators so that they can run in parallel and increase the total load and flexibility and DR of these generators

New – Chiller Plant Optimization for DR/Peak Load Management

EMACx Demand Control System

- Monitors Demand and reduces load
- Integrated with BMS and Chiller Plant Controls
- Automatically reduces load for DR events
- Automatically reduces load in the event of a reduction of chilled water capacity due to operator error or equipment failure
- Potential for spinning reserves or regulation market

Sustainability: Combined Heat & Power

- *At NYU Langone Medical Center, CHP is our greatest opportunity for improved energy efficiency, energy cost savings and reduced greenhouse gas emissions*

- Cogeneration is a system that uses fuel to generate electricity and heat simultaneously. The heat, usually wasted, produces steam for heating & cooling

- Cogeneration systems are 70-95% efficient vs. standard utility generation efficiency of 30-50%

New – VirtuWatt Installation

Next phase – generate sustainable commodity cost savings via:

- 1-minute interval meter data for energy management
- Automation of load shedding (if/as desired) – seamlessly connected to existing BAS systems as needed
- Integration of demand usage and pricing/cost data
- Participation in Reserves programs – if/when NYISO programs reduce cost of entry

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VirtuWatt links Energy Users to Wholesale Energy Markets

Customers / Energy Consumers

VirtuWatt Energy Manager integrates with control systems / devices

- Pre-defined load shedding scenarios
- Customizable scenarios
- Simplifies participation
- Improves performance and revenues

VirtuWatt Dashboard presents usage and present energy costs in real-time

- 1-minute interval metering
- Market Prices
- Tariff Rates

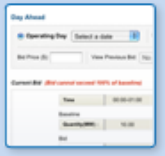
VirtuWatt™ Energy Manager

Automated load control solution

VirtuWatt™ Dashboard

Monitor real-time consumption and costs

VirtuWatt™ Marketplace



Links demand-side customers to energy markets to monetize energy reductions

Constellation Energy

- Demand Response provider; 24-hour monitoring and dispatch; enrollments; settlements

Wholesale Energy Markets

VirtuWatt Marketplace simplifies participation in the complex energy markets

- **Energy Cost Savings**
- **Economic Programs**
- **Ancillary Services**
- **Capacity/Reliability**

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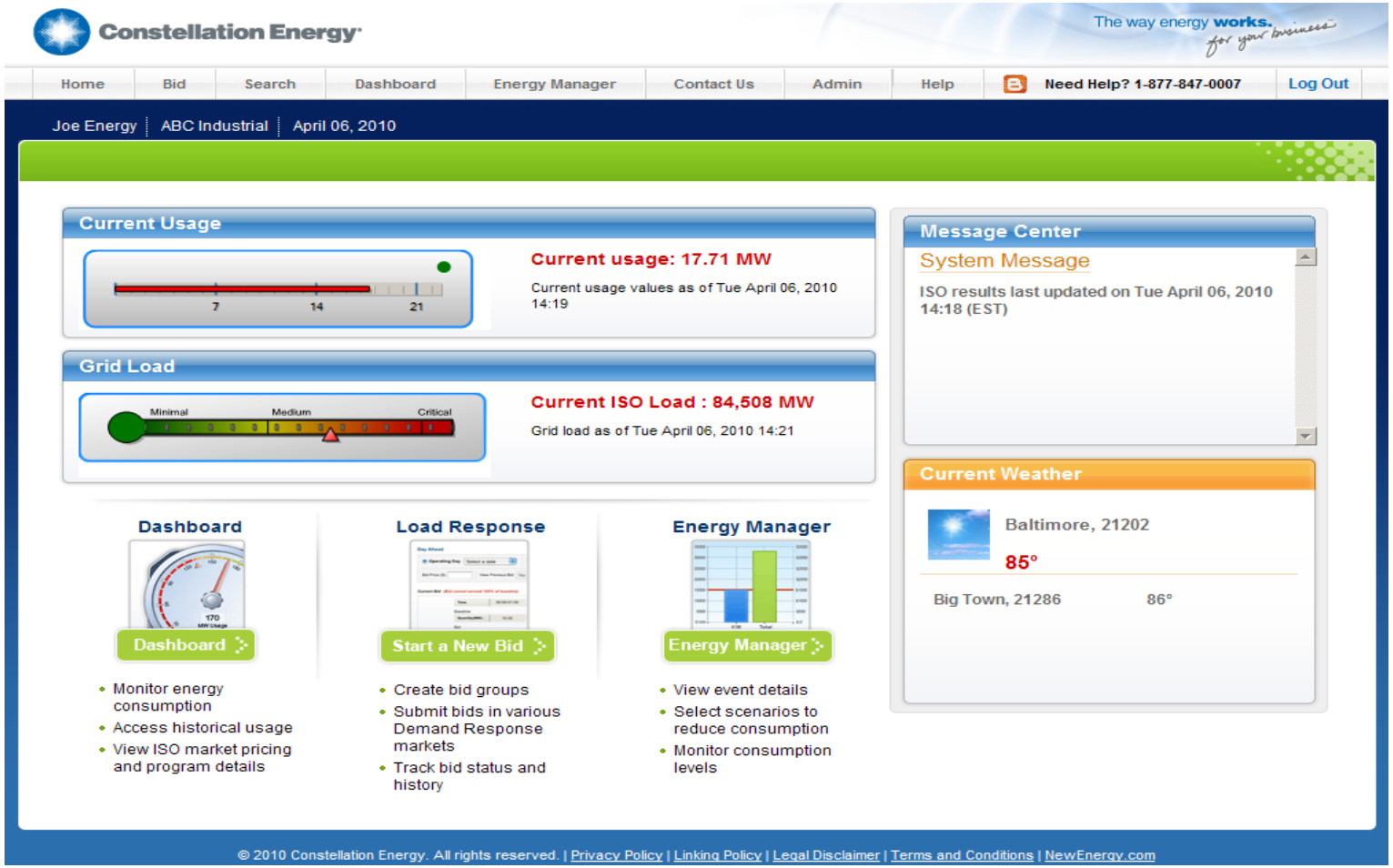
VirtuWatt Dashboard: Financial Reporting

Make smarter financial decisions

- View Real-Time market prices against actual energy consumption
- Respond to high electricity prices for savings
- Simple financial summaries for your CFO

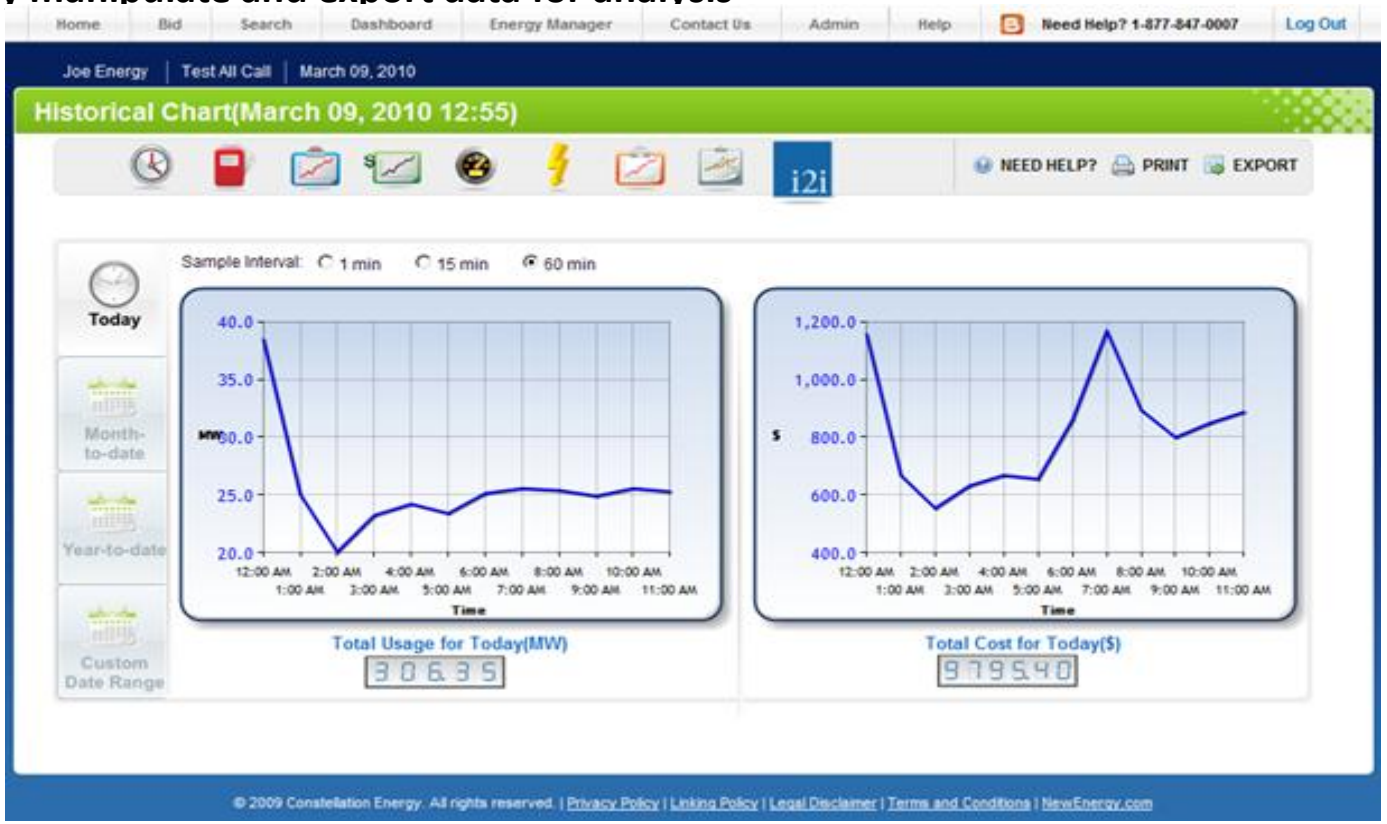
VirtuWatt Home: Unlock Additional Value

Data → Decisions → Achieve Objectives & Impact Bottom-line



VirtuWatt Home: Real Time Information

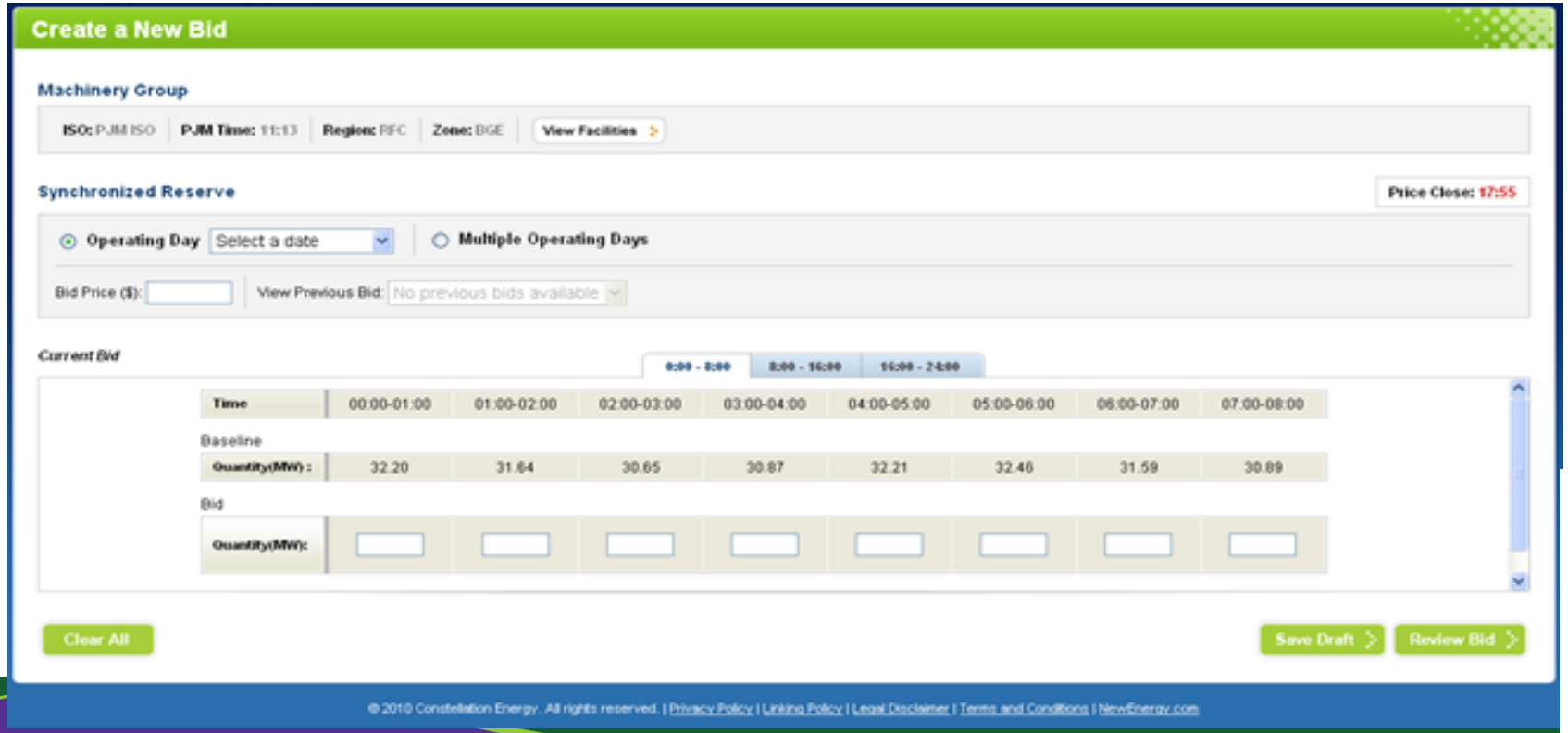
- View Real-Time and historical data in 1, 15 or 60 min intervals
- Compare energy usage to market costs to see direct impact on electric bills
- Better understand building operations to improve overall operating performance
- Easily manipulate and export data for analysis



VirtuWatt Market Place: DR Markets, Peak Load Management

Realize additional revenue through economic-based Load Response programs

- **Bid into economic programs when it makes sense for your business**
- **Simplify participation with easy bidding portal, automatic interface with the ISOs**
- **Set-up strategies in advance, view history of event terms and payments**
- **Easy management for one or many facilities**



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VirtuWatt Energy Manager: Automated Load Control

Elevate energy management from reactive to STRATEGIC

- Automate load control to improve performance and simply management
- Customize curtailment strategies to your business operations
- View estimates of immediate revenue and savings from improved demand-side management
- Self-schedule events for internal or market-based opportunities

Active Expired Completed Committed Pending

Event List

Site	Record ID	Amount (kW)	Date	Start Time	End Time	Est Value ($)	Event Type	Event Status
Machinery Group	56542	2255	05/17/2010	10:00 AM	12:00 PM	257	Other	Committed
Office Space	56637	1290	05/11/2010	11:00 AM	01:00 PM	280	Other	Expired
Machinery Group	57040	2525	05/10/2010	03:00 PM	05:00 PM	331	Other	Expired
Machinery Group	56539	1000	05/07/2010	07:00 AM	11:00 AM	270	Other	Completed
Office Space	57039	0	05/06/2010	01:17 PM	01:20 PM	0	Other	Expired
Machinery Group	57037	2400	05/06/2010	12:00 PM	02:00 PM	433	Other	Expired
Office Space	57038	0	05/06/2010	01:10 AM	01:12 PM	0	Other	Expired
Machinery Group	56937	2361	05/05/2010	04:00 PM	06:00 PM	578	Other	Expired
Machinery Group	56938	0	05/05/2010	03:15 PM	06:00 PM	0	Other	Expired
Machinery Group	56538	2300	05/05/2010	09:00 AM	11:00 AM	315	Other	Completed
Office Space	56838	2340	05/04/2010	08:00 PM	10:00 PM	461	Other	Expired

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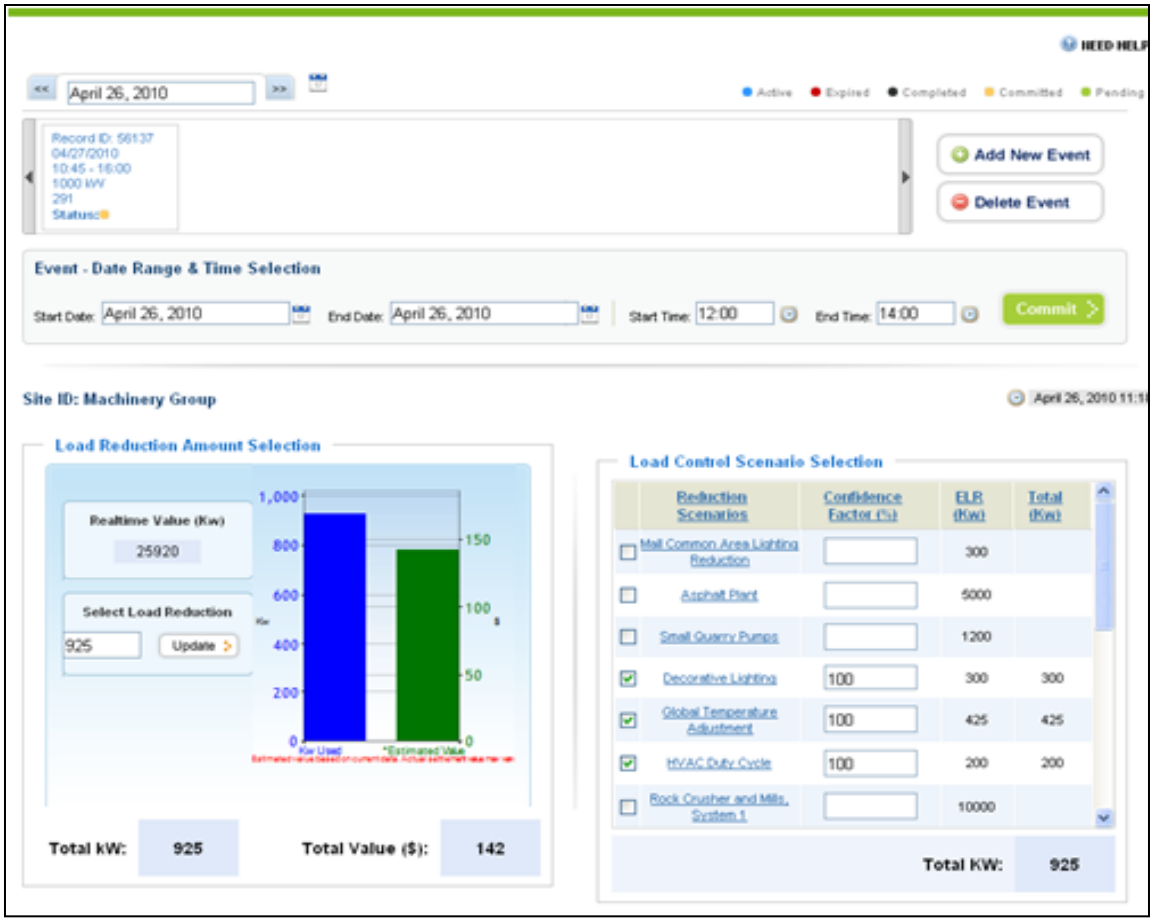
VirtuWatt Energy Manager: Automated Load Control

Automation optimizes operations into "Smart" buildings

- Minimize impact on building with customized curtailment strategies
- Create "scenarios" to easily manage schedules in response to energy, prices, or specific business needs
- Automation reduces constraints on resources, minimizes performance risk
- Leverage existing controls systems for low-cost solution



VirtuWatt Mobile

Operate in Real-Time

Access VirtuWatt anywhere, at any time, on your mobile device

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Questions???

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