Assessing Impacts from Energy Efficiency Investments

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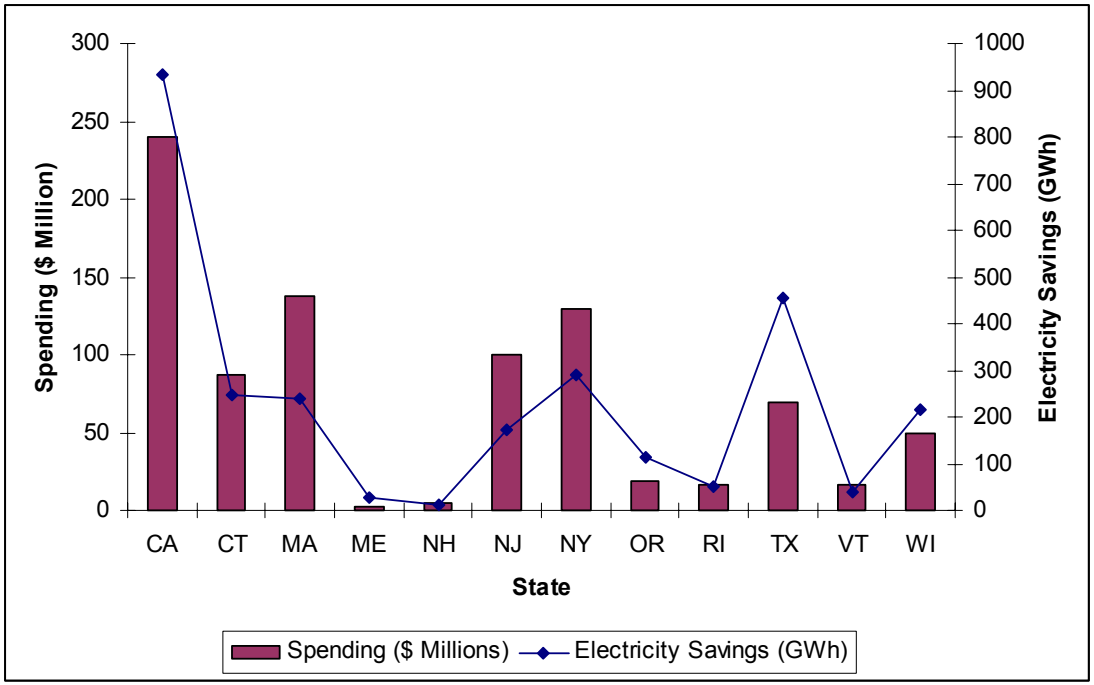
Energy Efficiency Spending and Savings

- Significant spending on energy efficiency as a resource
- Often called Demand Side Management, or DSM
- Increased spending over past 5 years
- Annual spending and savings from states with recent data sums to about $875 million and 2,900 GWh/year



Source: American Council for an Energy-Efficient Economy, *Five Years In: An Examination of the First Half-Decade of Public Benefit Energy Efficiency Policies*, April 2004.

Assessing Energy Savings

- Energy and demand savings are estimated using validated algorithms and calculations
- Less tangible than supply side approaches
- What is the "burden of proof" to assess and validate energy savings?
- An example from New York State

New York Energy $mart^{SM} Program

- Established by PSC Order, administered by NYSERDA
- Program runs 1998 – 2006
- Nearly $1 billion in funding for energy efficiency, low-income, renewable energy, and R&D
- $16.2 million for evaluation

New York Energy $mart[SM] Program Goals

- Improve system-wide reliability and peak reduction through end user efficiency actions.
- Improve energy efficiency and access to diverse energy options for underserved customers.
- Reduce environmental impacts of energy production and use.
- Facilitate retail electric competition to benefit end users.

New York Energy $mart[SM] Program Evaluation Components

- Measurement and verification of program-reported energy and demand savings impacts
- Attribution of energy and demand savings actually caused by the program
- Valuation of non-energy impacts
- Quantification of macroeconomic impacts
- Benefit-cost analyses

Measurement & Verification Evaluation

- 1st step to determine actual energy and demand savings
- Site visits, file reviews, metering, etc. to review engineering estimates, operating assumptions, and baseline practices
- May adjust program-reported savings
  - Realization rate (RR) >1 means program-reported savings were understated
  - RR <1 means program-reported savings were overstated
- RR for Energy Savings = 1.03
- RR for Demand Reductions = 0.88

Attribution of Energy Savings

- Assess what would have happened had the programs not existed
- Some level of naturally-occurring adoption
- Synthesis of information
  - Market progress indicators
  - Direct survey questions
  - Intermediate outcome indicators
  - Regional comparisons

Attribution of Energy Savings

- Free-riders: program participants who would have installed the efficiency measures even if the program were not in operation
- Spillover: additional measures taken at participating or non-participating sites attributable to the influence of the program
- Net-to-Gross Calculation:

NTG ratio = [1 – (free ridership)] x [1 + (participant inside spillover) + (participant outside spillover) + (non-participant spillover)]

- NTG ratios ranged from 0.7-1.32, with a program-wide NTG ratio of approximately 1.0

Non-Energy Impacts (NEIs)

- Positive or negative effects associated with energy-saving measures and activities
- Usually difficult to quantify and often subjective
  - Surveys/self-report
  - Direct measurements

Examples

Maintenance cost

Comfort, health, safety

Productivity

Aesthetics

Equipment lifetime

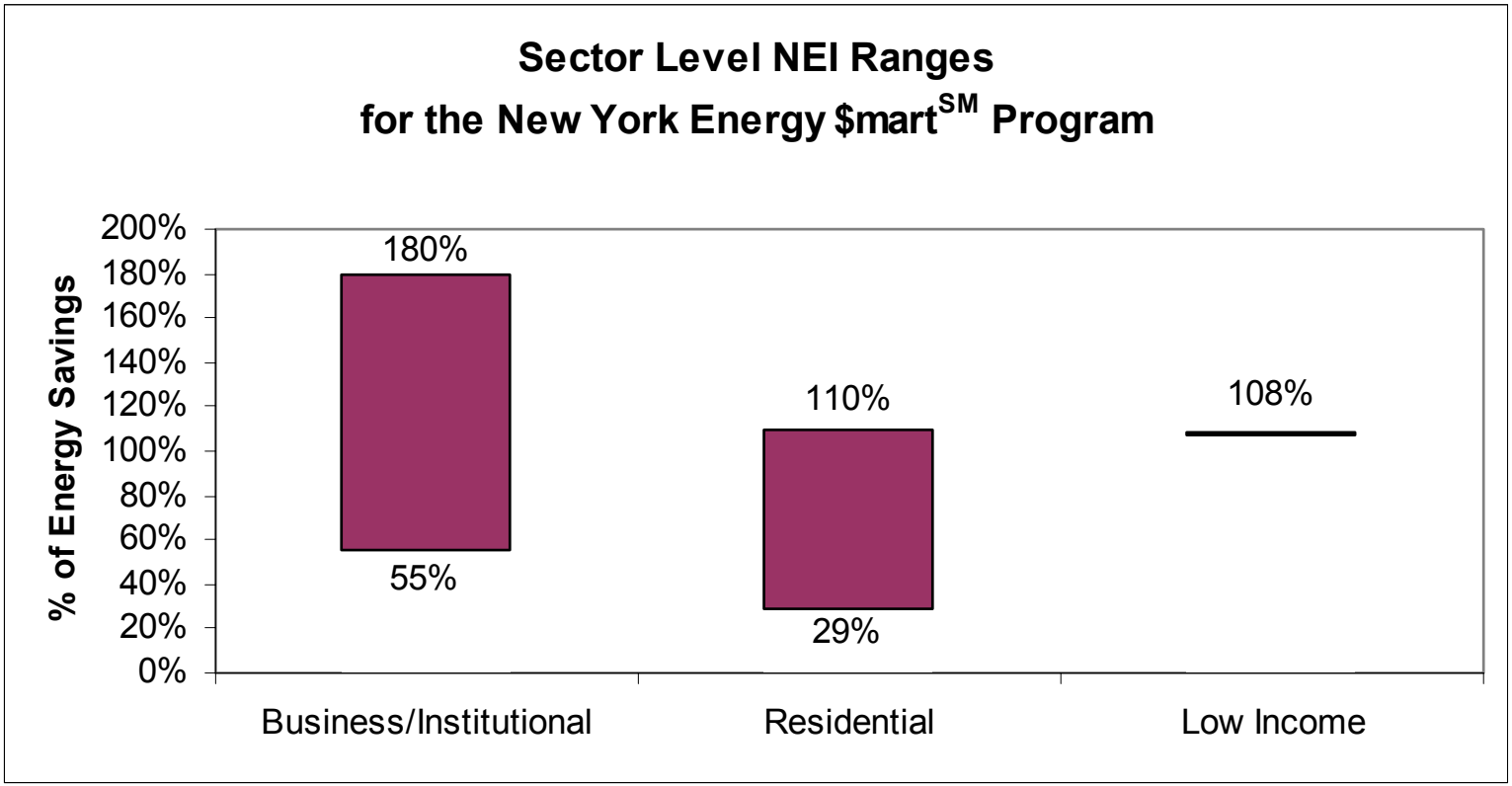
Quality of light

Tenant satisfaction

NYSERDA's Evaluation of NEIs

- 13 market evaluation studies (covering all major sectors) have included NEIs
- Survey/self-report method
- Results expressed as a % of energy savings
  - 100% = same "value" as energy savings
- Use of NEI results:
  - **New York Energy $mart**^{SM} benefit-cost (B-C) analysis
  - Program marketing
  - Policy decisions (some stakeholders value the importance of NEIs more than others)

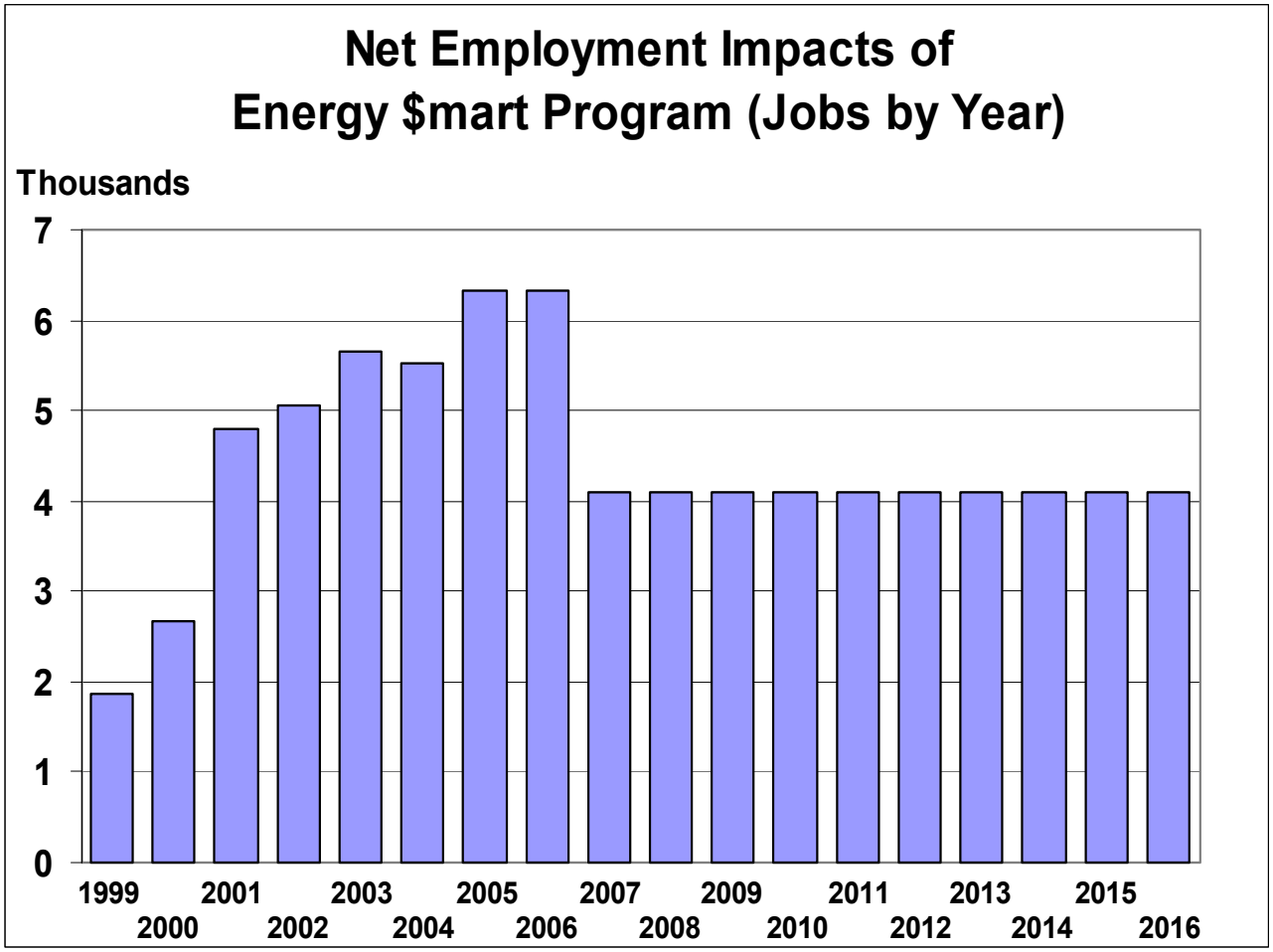
NEI Results to Date



Macroeconomic Analysis

- IMPLAN software (input-output model)
- Model contains a detailed representation of patterns of transactions in NY economy, and interrelationships among industries and sectors.
- Three levels of impacts:
  - (1) direct, (2) indirect, and (3) induced.
- Results are cumulative.
- Model two scenarios – "Program" scenario and "Base" scenario
- Model four sets of impacts:
  - Employment
  - Labor income
  - Total industry output
  - Value added

Example of Employment Impacts



Macroeconomic Impacts through December 2004

Economic Variable	Program Implementation Years	Years Following Program	Annual Average over 18-Years
	(1999 to 2006)	(2007 to 2016)	(1999 to 2016)
Jobs	4,779	4,109	4,407
Labor Income	$211 Million	$134 Million	$168 Million
Total Industry Output	$407 Million	$71 Million	$220 Million
Value Added	$205 Million	$5 Million	$94 Million

Benefit-Cost Analysis

- Total Market Effects Test (TMET)
  - Also called the total resource cost test, compares quantifiable life-cycle electric energy, fuel, and other benefits from program participants and spillover effects against both NYSERDA and customer costs incurred to achieve those benefits
  - TMET ratio > 1.0 means that the monetary benefits derived from the program exceed costs incurred by NYSERDA and customers
- Program-Efficiency Test (PET)
  - Also called the program administrator cost test, compares the same quantifiable life-cycle benefits against only NYSERDA's costs
  - A PET ratio > 1.0 means the monetary benefits exceed the costs incurred by NYSERDA

Benefit-Cost Results Summary

	TMET	PET
Scenario 1: Includes only the avoided costs associated with energy savings arising from participant actions and from market spillover	2.2	4.4
Scenario 2: Adds energy market price benefits	2.4	5.0
Scenario 3: Adds non-energy impacts	3.5-4.7	7.2-9.6
Scenario 4: Adds macroeconomic impacts	5.5-6.7	11.2-13.6

Lessons Learned

- Evaluations should apply rigorous approaches using:
  - Primary and secondary data,
  - Engineering and economic analyses, and
  - Methods to "bracket" the estimate of actual energy savings
- The "burden of proof" approach has helped NYSERDA to produce defensible results at a reasonable cost
- No one evaluation metric should be used as the sole deciding factor in whether to offer a program
- Impacts from the NYSERDA program are large, and having multiple, independent contractors involved in verifying these impacts benefits NYSERDA and policy makers

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