




Estimating the Potential for Cost Effective Electric and Peak Demand Savings in Connecticut

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2004 ACEEE Summer Study on Energy Efficiency in Buildings

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Objective

- **Study in 2003-04 for the Connecticut Energy Conservation Management Board (ECMB)**
- **To estimate the Maximum Achievable Cost Effective Potential for energy conservation and energy efficiency resources over the period from 2003-2012 in three areas:**
  - Connecticut Statewide
  - The 52 towns in the constrained SW Area of CT
  - The 16 critical constrained towns in SW CT (Norwalk-Stamford area)

Definition of Maximum Achievable Cost Effective Potential

The maximum penetration of cost effective energy efficiency measures that would be adopted given unlimited funding, and assuming a concerted, sustained campaign involving highly aggressive programs and market intervention.

Steps to Estimate Potential

1. Identification of data sources
2. Identification of measures to be included
3. Estimate of measure inputs (cost, savings, life, etc.)
4. Calculation of measure-level cost effectiveness
5. Development of market baselines and forecast (e.g., equipment saturation, kWh and kW sales)
6. Development of efficiency supply curves
7. Estimate of technical and maximum achievable potential
8. Estimate of annual potential over ten year period

Data Sources for Connecticut Potential Study

Load Forecasts	8
Residential Sector	34
Commercial / Industrial Sectors	21
Recent Technical Potential Studies	10
CT Saturation Studies	4
State, Regional, & National Studies	14
Electronic Files Supplied by UI	17
Electronic Files Supplied by CL&P	38
Industry References	42
Other Data Sources	3
TOTAL	191

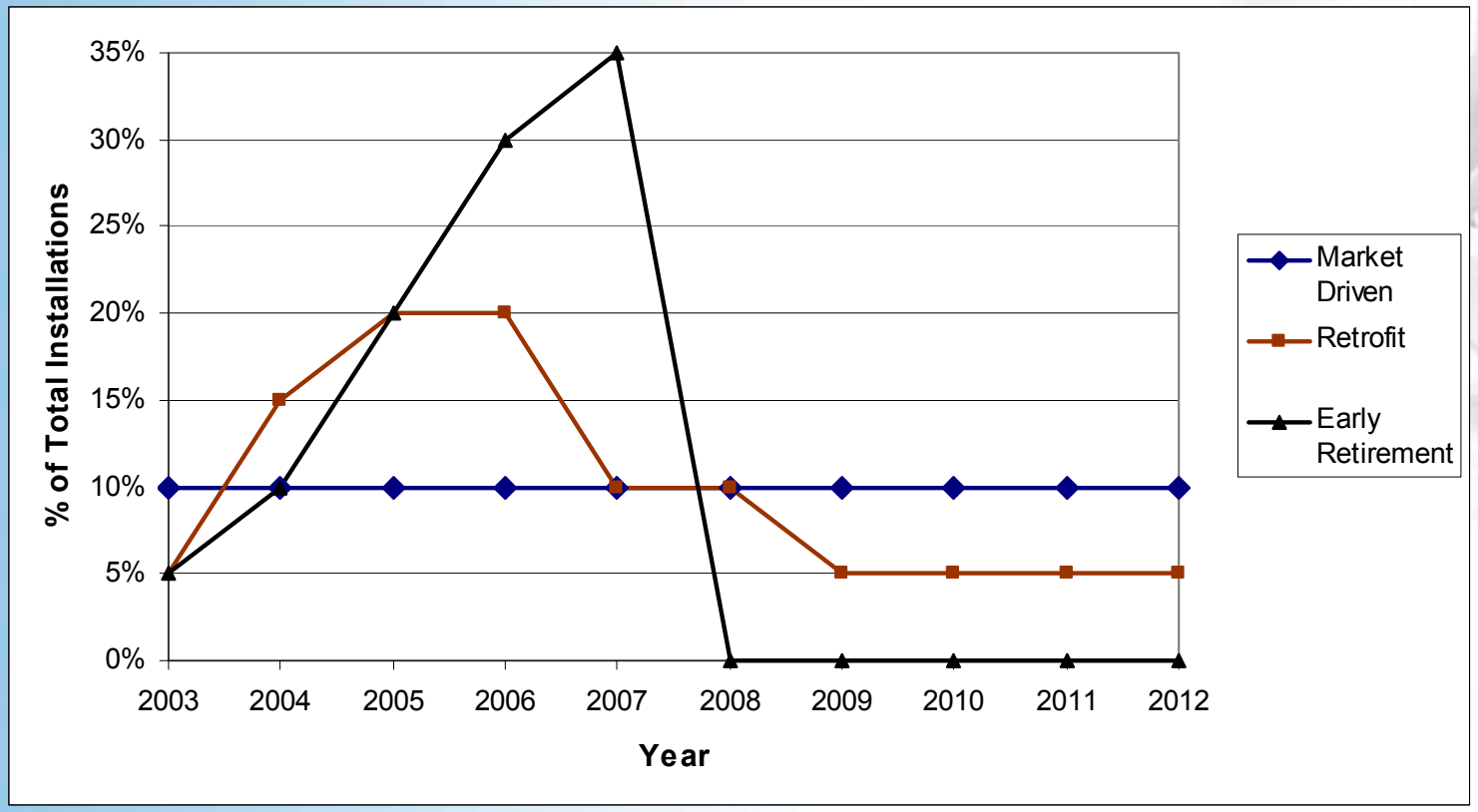
Results of Measure Cost Effectiveness Assessment

Results of Statewide Cost Effectiveness Screening Analysis		
Sector	*Number of Measures Assessed*	*Number of Measures with TRC ≥ 1.0*
Residential	68	29
Commercial	104	77
Industrial	106	100
Total	278	206

Assumptions for Measure Installations

- **Market Driven - replace with high efficiency equipment at the time of equipment burn-out**
  - Incremental cost and incremental savings
- **Retrofit – equipment is replaced at any time in order to move to more efficient product**
  - Full cost and total savings
- **Early Replacement – acceleration of replacement to capture energy and demand savings sooner**
  - Hybrid of approaches using assumption of when measure would have been replaced (~ 3-5 years out)

Estimated Ramp-In Rates for Energy Efficiency Measures



Development of Maximum Achievable Potential Estimates

- **Maximum achievable measure adoption potential is based on:**
  - a comprehensive review of actual penetration rates achieved by aggressive energy efficiency programs in other States
  - a literature review of market penetration studies
  - input received from a panel of experts convened for this study
- **Estimated maximum achievable penetration rate of energy efficiency measures is 80% across all sectors.**

Reordering Potential Estimates

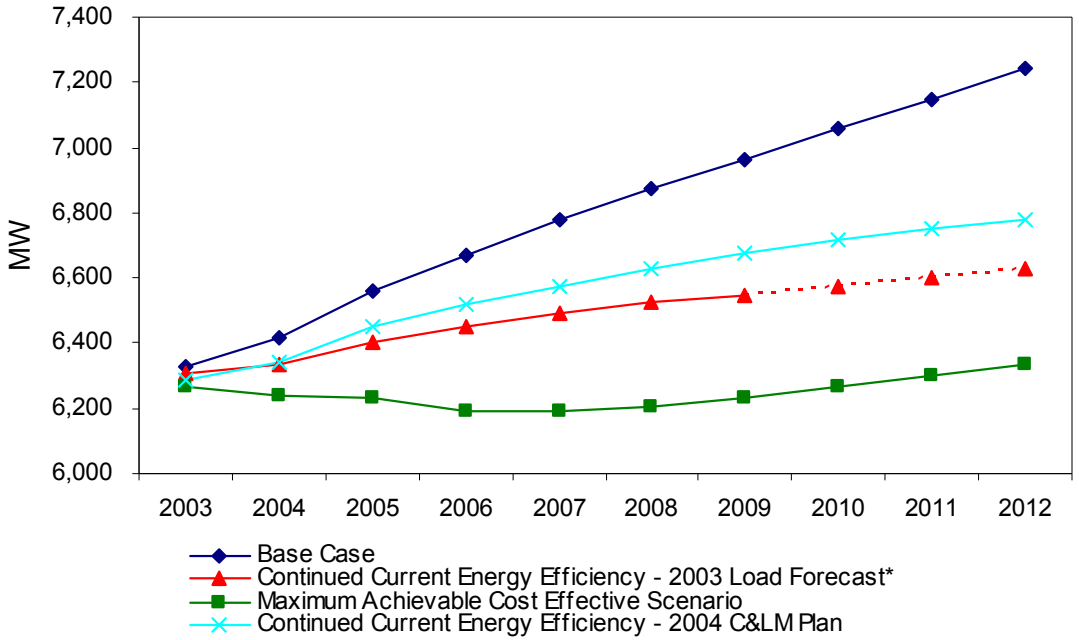
- **Potential studies commonly estimate technical potential, economic (cost effective) potential, and achievable potential, in that order**
- **CT study modified the common order, with an estimate of achievable potential developed before applying cost-effectiveness**
- **Why? Avoided costs were increasing; ECMB and others wanted to be able to use the study results with future changes in avoided costs**

Summary of Results

- For 2003-2012
- Technical potential: 1,748 MW on a statewide basis (24% reduction vs. the base forecast)
- Maximum achievable cost effective potential: 908 MW (13% reduction vs. base forecast)
- Maximum achievable cost effective potential: 4,466 GWh (13.4 percent by 2012)
- Capturing achievable cost effective potential statewide can save consumers and businesses $1.8 billion over the next decade, or about $1,228 for each of the 1.45 million households

Peak Load Savings Potential

Connecticut Summer Peak Load Forecast (MW): Base Case, Continued Current Energy Efficiency, and Maximum Achievable Cost Effective Potential



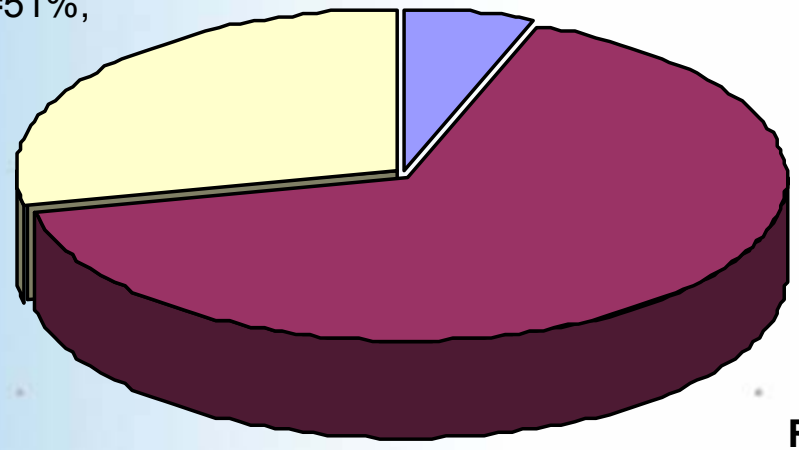
*For the "Continued Energy Efficiency" scenario from the 2003 Load Forecast, values for the CL&P service territory for years 2009 to 2012 are estimates based on the average of prior year values.

Distribution of GWh Savings

Achievable Cost-Effective Potential

Market Driven
(1,263 GWh)
28%
[Res=40%, Com=51%, Ind=9%]

Early Replacement
(242 GWh)
5%
[Commercial AC & Lighting]



Retrofit
(2,960 GWh)
67%
[Res=39%, Com=41%, Ind=21%]

Connecticut Statewide TRC

State of Connecticut	Total Resource Benefits, Costs, and Net Benefits			
	Present Value		PV of Net	Benefit-Cost
	Benefit	Cost	Benefits	Ratio
Commercial Sector	$1,411,460,062	$358,414,779	$1,053,045,283	3.94
Residential Sector	$1,062,432,855	$390,141,582	$672,291,273	2.72
Industrial Sector	$341,431,615	$79,413,671	$262,017,944	4.30
All Sectors	$2,815,324,532	$827,970,032	$1,987,354,500	3.40
O&M Benefits (inc. avoided inc. bulb purchases)		$(80,156,204)		
Other Program Costs (25%)*		$206,992,508		
All Sectors	$2,815,324,532	$954,806,336	$1,780,361,992	2.95

**Other program costs estimated as 25% of total incremental measure costs, net of any O&M savings. Values were calculated using version 9 of the "NSTAR" model, with CL&P avoided cost estimates..*

CT Results - Comparison

Sector	**Connecticut 2012**	**California 2011** (Rufo 2002; Coito 2003)	**Vermont 2012**[1] (Optimal 2002)	**Mass. 2007**[1] (RLW 2001)	**New York 2012**[2] (Optimal 2003)	**Southwest 2020**[3] (SWEEP 2002)
Technical Potential						
esidential	21%	22%			39%	26%[(6)]
R mmercial	25%	18%			42%	37%[(6)]
Co ndustrial	20%	15%			22%	33%[(6)]
I ***otal***	***24%***	***18%***			***38%***	***33%***[(6)]
T **Maximum Achievable Potential**						
esidential	17%		30%			
R mmercial	17%		32%			
Co ndustrial	15%		32%			
I ***otal***	***17%***		***31%***			
T **Maximum Achievable Cost Effective Potential**						
esidential	13%	10%		31%	28%	
R mmercial	14%	10%		21%	40%	
Co ndustrial	13%	9%		21%	20%	
I ***otal***	***13%***	***10%***		***24%***	***33%.***	

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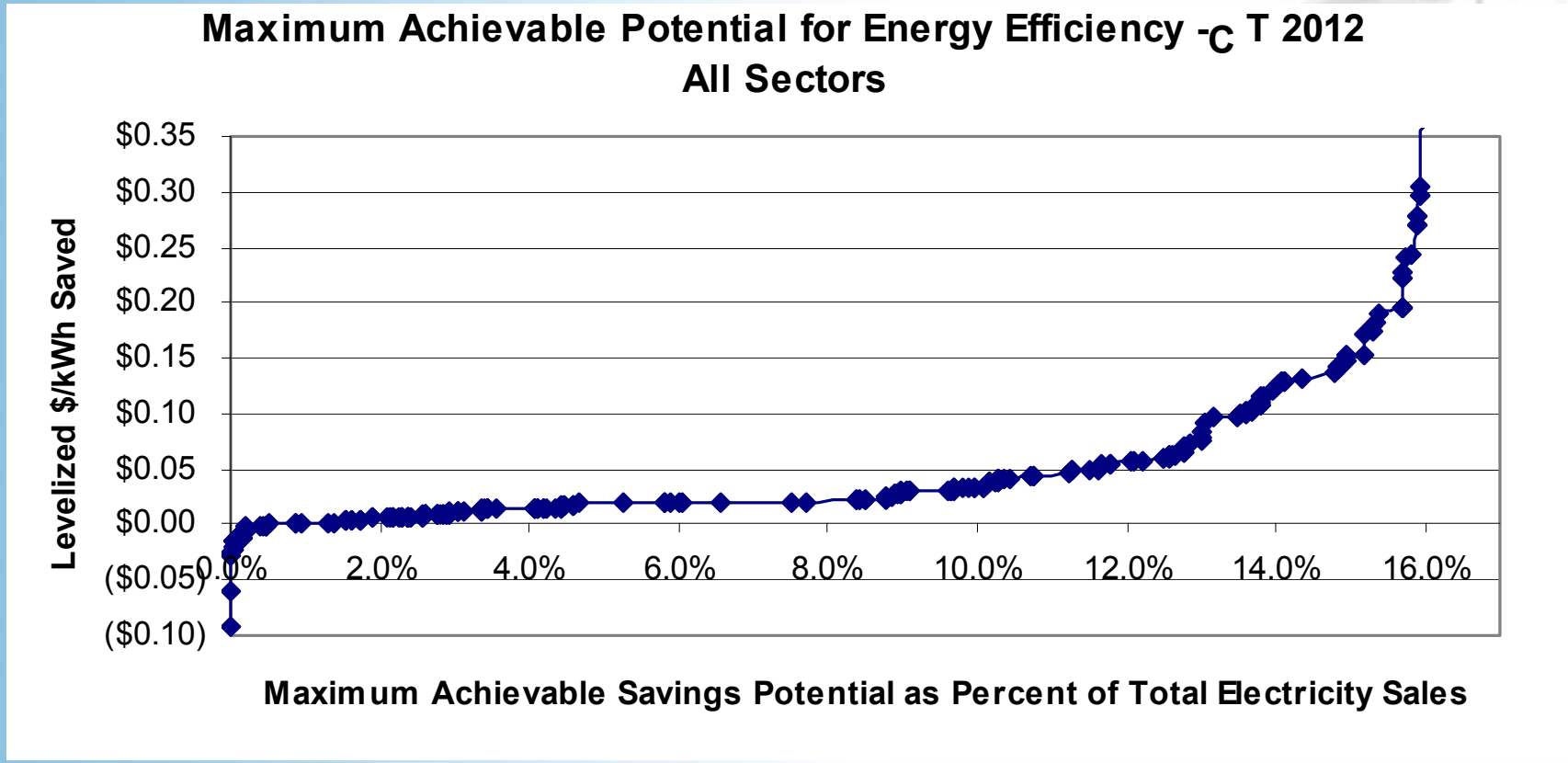
1. Vermont and Massachusetts studies reported commercial and industrial sectors together.
2. NY Maximum Achievable Cost Effective Potential values are Economic Potential Under High Avoided Costs.
3. Southwest values represent technical cost effective potential.

Use of Supply Curves

- Allows comparison of individual energy efficiency measures
- Y axis shows cost of conserved energy; X axis shows how much can be saved at various CCE levels
- Eliminates double counting
- Typically, but not always, reflect diminishing returns, i.e., as costs increase rapidly and savings decrease significantly at the end of the curve.
- Costs are usually annualized (levelized)

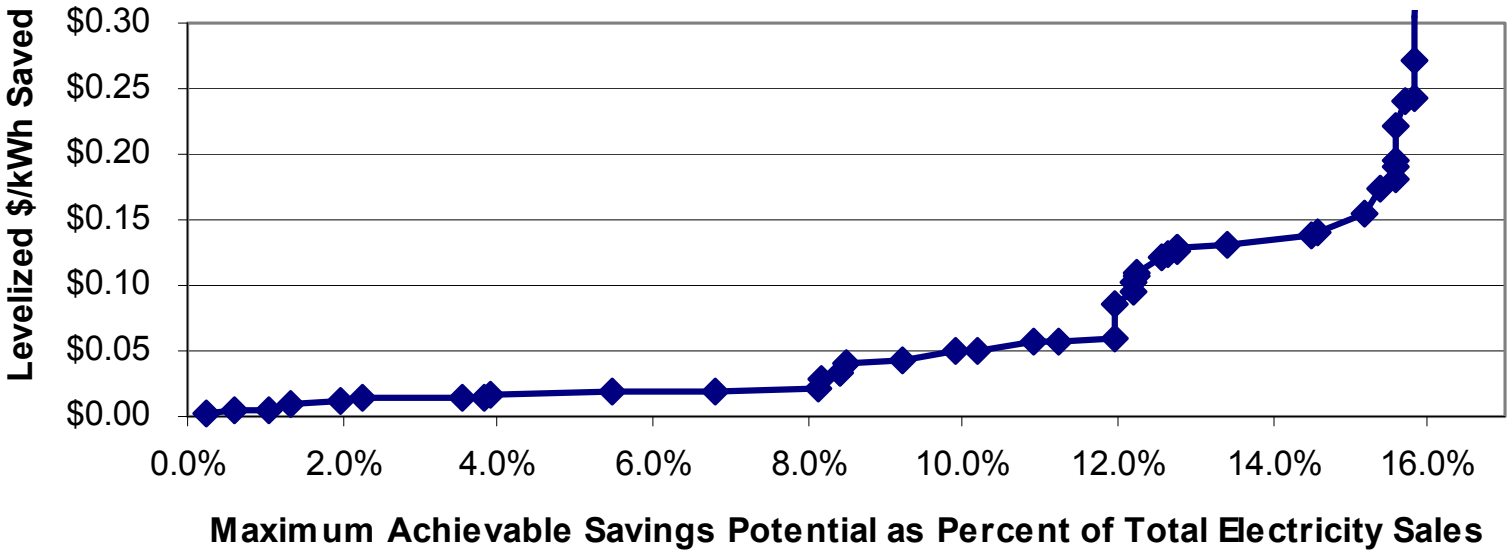
Connecticut Statewide Supply Curve



Residential Sector Potential

- **Major Electric Savings Opportunities:**
  - Electric Water Heating
  - Lighting (CFLs)
  - Resistant Heating Measures & High Efficiency Dishwashers Are Also Significant Energy Savers
- **Residential Lighting Measures have the Highest Energy Saving Potential**
- **Water Heating Pipe Wrap has the Lowest Cost of Conserved Energy (CCE).**

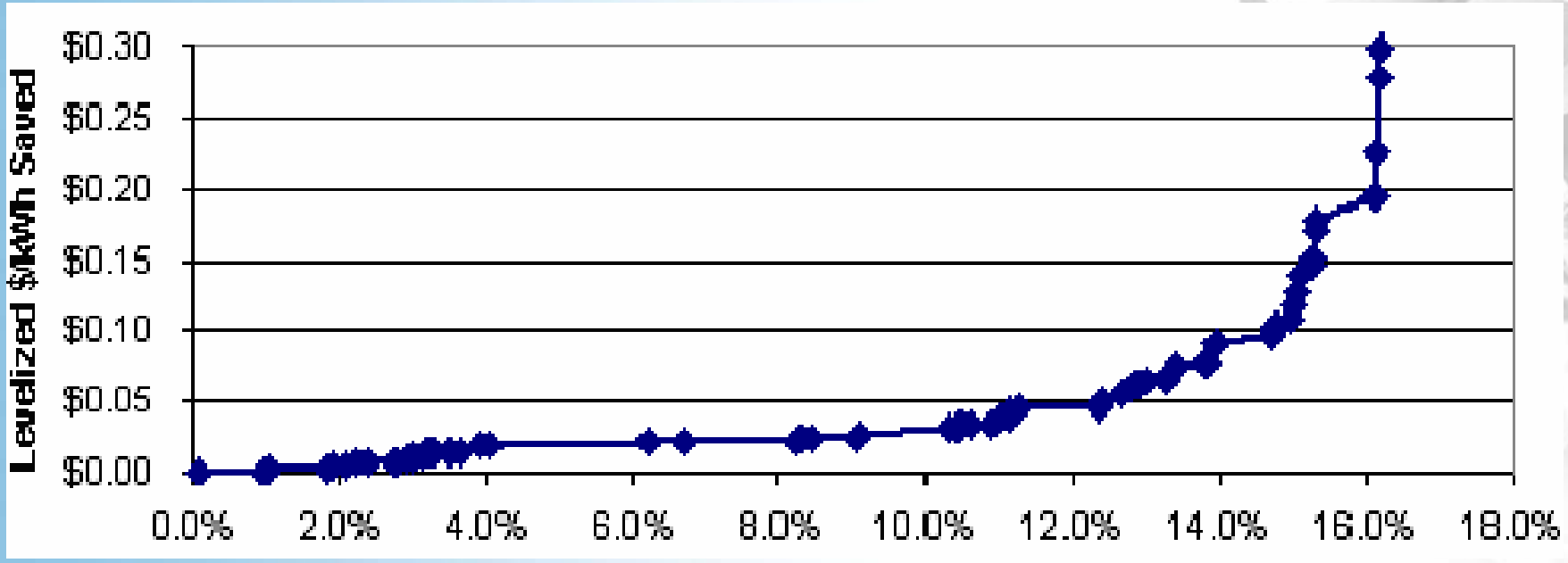
Residential Sector Supply Curve



Commercial Sector Potential

- **Major Electric Savings Opportunities:**
  - Lighting (largest savings of any end use category)
  - HVAC Equipment and Controls
  - Efficient Office Equipment and Controls
- **Installation of Super T-8's was found to have the most potential kWh savings for this sector**
- **Nighttime Shutdown of Desktop Computers was the Measure with the Lowest CCE at $0.0005/kWh**
- **The median CCE for the Commercial sector is $0.046/kWh ($0.0266 for measures with TRC > 1.0)**

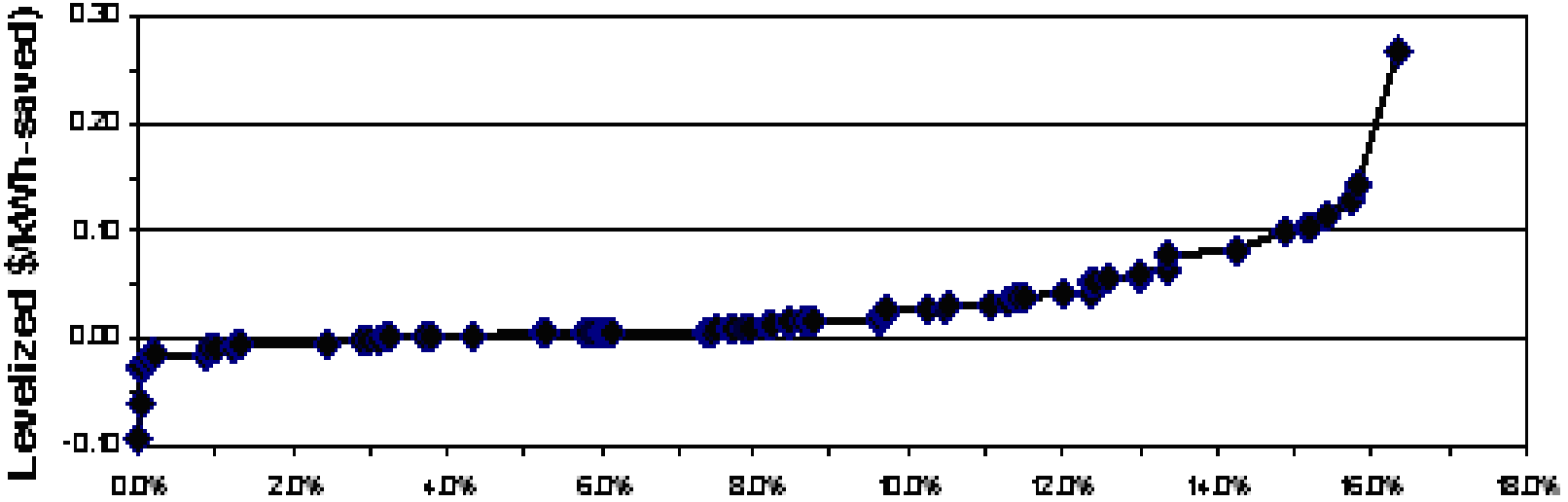
Commercial Sector Supply Curve



Industrial Sector Potential

- **Pump controls in paper manufacturing was found to have the most potential kWh savings**
- **Near Net Shape Casting in the metal manufacturing industry was the measure with the lowest CCE at -$0.09/kWh** ***(negative value is result of productivity and energy savings exceeding cost)***
- **The median CCE for the Industrial sector is $0.01/kWh**

Industrial Sector Supply Curve



Lessons Learned

- **Current saturations of energy efficient equipment are a critical input and were difficult to estimate due to very limited available data**
- **Program administration costs offer an area of uncertainty due to the magnitude of potential program scope**
- **Local utility input and technical support is essential in obtaining load forecasts and related data**

Conclusions

- **The maximum achievable cost effective potential for energy efficiency in CT is very large, and the potential NPV dollar savings to ratepayers in CT are over $1.8 billion with aggressive programs**
- **There are sufficient cost effective commercially available energy efficiency technologies to reduce peak load growth to less than a 0.1% annually from 2003 to 2012 (Base case = 1.5% annual growth)**
- **There are significant environmental benefits associated with the maximum achievable cost effective potential scenario**

Use of the Study

Context: CT C&LM (SBC) fund was being "redirected" by legislature to deficit reduction, and for other uses

Public policy objectives:

- **Demonstrate/document that there is a large amount of cost-effective energy efficiency potential remaining in Connecticut**
- **Reducing C&LM funding significantly reduces value to businesses and consumers**

How the study was/is being used:

- **Press release, public media**
- **Various public policy forums including state energy planning and forecasting, climate change, and CEAB preferential guidelines**