

# **Cost-Effectiveness and TRC Test in 2011 (Follow Up); Update on Avoided Costs**

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# Part 1: Cost Effectiveness/TRC Test in EE Program Planning (follow up from last meeting)

1. Cost effectiveness is determined using a Total Resource Cost (TRC) Test
2. TRC Test calculates a benefit cost ratio (BCR)
3.  $BCR = \text{ratio of total lifetime benefits and total costs}$
4. Benefits = value of the savings from program participation
5. Costs = all costs to the PA and the Participant that result from the program

# How Does the TRC Test Determine Cost-Effectiveness?

- TRC test is applied by dividing the total lifetime **benefits** of a program by the total **costs** of the program, to create a Benefit Cost Ratio (BCR):

$$\text{BCR} = \frac{\text{Total benefits (\$)}}{\text{Total costs (\$)}}$$

If the BCR is	it is considered	because
$\geq 1.0$	cost-effective	benefits exceed costs
$< 1.0$	not cost-effective	costs exceed benefits

# Benefit/Cost Ratio (BCR) and Net Benefits

- $BCR = \text{total lifetime benefits} / \text{total costs}$
- $\text{Net benefits} = \text{total lifetime benefits} - \text{total costs}$ 
  - When planning and assessing an entire energy efficiency portfolio, net benefits can indicate the magnitude of each sector's contribution to the total economic value of the efforts

<b>Massachusetts Three Year Gas and Electric Energy Efficiency Plans</b>				
	<b>Lifetime Benefits</b>	<b>Costs</b>	<b>BCR</b>	<b>Net Benefits</b>
<b>Residential</b>	\$1,727	\$650	2.66	\$1,077
<b>LI</b>	\$485	\$209	2.32	\$276
<b>C&amp;I</b>	\$3,759	\$1,275	2.95	\$2,484
<b>Total</b>	<b>\$5,971</b>	<b>\$2,134</b>	<b>2.80</b>	<b>\$3,837</b>

All values in \$ millions.

# Cost-Effectiveness for 2011 – Residential Gas (NGrid)

Total Resource Cost Test, 2011			
Sector	Lifetime Benefits	Costs	B/C Ratio
New Construction & Major Renovations	\$3,117,152	\$2,364,748	1.3
Heating and Water Heating	\$32,962,261	\$10,041,026	3.3
MassSAVE	\$0	\$2,546,829	0.0
Weatherization Program	\$20,738,239	\$13,178,803	1.6
Multifamily Retrofit	\$10,603,565	\$3,056,781	3.5
Behavioral/Feedback Program	\$3,311,622	\$2,536,257	1.3
Deep Energy Retrofit	\$0	\$864,416	0.0
Building Practices and Demo	\$0	\$258,868	0.0
Energy Analysis: Internet Audit Program	\$0	\$316,876	0.0
Community based pilots	\$0	\$147,916	0.0
Workforce Development	\$0	\$0	0.0
Statewide Marketing & Education	\$0	\$137,825	0.0
EEAC Consultants	\$0	\$346,166	0.0
DOER Assessment	\$0	\$208,124	0.0
Sponsorships & Subscriptions	\$0	\$158,818	0.0
<b>Residential</b>	<b>\$70,732,839</b>	<b>\$36,163,454</b>	<b>2.0</b>

# Part 2: Update on Regional Avoided Cost Study



# Regional Avoided Cost Study

- Six New England States (ISO-NE area)
- Conducted every two years
- Provides consistent values for avoided costs throughout all New England states
- Used for Energy Efficiency programs only
- To be completed by July 8, 2011
- Will be applied going forward for:
  - 2012 Mid-Term Modifications (MTMs)
  - Next Three-Year Plans (2013-2015)

# Example Calculation of Benefits

Benefits = net savings \* avoided costs of supply

9.215 kW electricity  
 13,823 kWh electricity  
 0 mmbtu natural gas  
 0 mmbtu other fuel  
 0 gallons water  
 0 units non-resources

\$50 per kW electric capacity  
 \$0.08 per kWh electric energy  
 \$10 per mmbtu natural gas  
 \$13 per mmbtu other fuel  
 \$0.01 per gallon water  
 \$(variable) per units non-resources

$$\text{Year 1 benefits} = (9.215 * \$50) + (13,823 * \$0.08) + (\$10 * 0) + \dots = \$1,566.59$$

- The benefits are calculated for each year of the widget life and present valued using a discount rate (calculated per D.P.U. Guidelines) to determine lifetime benefits



# Avoided Costs – Definitions (for electric)

**Avoided energy** = (wholesale electric energy price + REC cost and adjusted for wholesale risk premium). This is the largest component. Levelized annual values are about 18% lower than AESC 2009 due to lower natural gas prices, retirements, and more renewable generation

**Avoided capacity** = Revenue from bidding into Forward Capacity Market (FCM) OR value of reducing quantity of capacity from not bidding into FCM. Values for capacity bid into FCM are about 89% higher than AESC 2009 due to projections of new capacity requirements.

**Energy DRIPE** = Impact of kWh reductions on energy market prices. Values are approximately one-half AESC 2009, primarily due to changes in wholesale energy prices from AESC 2009.

**Capacity DRIPE** = Impact of kW reductions on FCM prices. Values are higher than AESC 2009 due to higher projections of capacity prices compared to AESC 2009.

**Avoided CO<sub>2</sub> environmental externalities** = cost of controlling CO<sub>2</sub> that is not reflected in wholesale energy market prices. Values are approximately 10% higher than AESC 2009 due to more efficient generating units on the margin offset by lower and delayed CO<sub>2</sub> pricing.

**Avoided local T&D infrastructure.** These costs are calculated by Program Administrators to be determined.

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# Electric Avoided Costs

Preliminary Avoided Electricity Costs for WCMA zone (Summer On Peak) AESC 2009 vs. AESC 2011 - Intrastate Energy DRIPE (Results are 15 year levelized in 2011\$)					
Component	AESC 2009	AESC 2011		Difference Relative to AESC 2009	
	cents/kWh	cents/kWh		cents/kWh	% Difference
Avoided Energy Costs	9.6	8.7		-0.9	-9.6%
Avoided Capacity Costs <sup>1,2</sup>	0.6	1.1		0.5	86.5%
<b>Energy and Capacity Subtotal</b>	<b>10.2</b>	<b>9.8</b>		<b>-0.4</b>	<b>-4.1%</b>
Intrastate DRIPE					
Intrastate Only Energy <sup>3</sup>	2.8	1.5		-1.2	-45.0%
Capacity <sup>2</sup>	0.3	1.2		1.0	371.9%
<b>Intrastate DRIPE Subtotal*</b>	<b>3.0</b>	<b>2.7</b>		<b>-0.3</b>	<b>-9.1%</b>
<b>SUBTOTAL: Avoided Energy and Capacity + Intrastate DRIPE</b>	<b>13.2</b>	<b>12.5</b>		<b>-0.7</b>	<b>-5.2%</b>
CO <sub>2</sub> Externality	3.0	3.2		0.2	8.2%
<b>Total*</b>	<b>16.2</b>	<b>15.7</b>		<b>-0.4</b>	<b>-2.8%</b>

Values may not sum due to rounding. Avoided energy costs for Summer Peak incorporate avoided Class I REC costs.

AESC 2009 values levelized (2010-2024) escalated to 2011\$

1) Avoided capacity costs assumes 100% **selling** into Forward Capacity Markets

2) Assuming a 55% load factor

3) Values are for **Intrastate** energy DRIPE

4) Draft per 2011 CO<sub>2</sub> prices but 2009 CO<sub>2</sub> physical emissions

# Natural Gas Avoided Costs

COMPARISON OF LEVELIZED AVOIDED COSTS OF GAS DELIVERED TO RETAIL CUSTOMERS  
BY END USE: AESC 2009 AND AESC 2011  
**ASSUMING SOME AVOIDABLE RETAIL MARGIN**  
(2011\$/Dekatherm except where indicated as 2009\$/DT)

RESIDENTIAL				COMMERCIAL & INDUSTRIAL			ALL RETAIL
Non Heating	Hot Water	Heating	All	Non Heating	Heating	All	

Northern & Central New England: Massachusetts								
AESC 2009 (2009\$/DT)	10.87	10.87	13.54	12.67	10.02	12.05	11.40	12.03
AESC 2009 (a) (2011\$/DT)	11.08	11.08	13.79	12.91	10.21	12.28	11.61	12.25
AESC 2011 (2011\$/DT)	7.47	7.47	8.96	8.73	7.59	8.79	8.43	8.58
2009 to 2011 change	-32.57%	-32.57%	-35.03%	-32.38%	-25.64%	-28.37%	-27.41%	-29.99%

(a) Factor to convert 2009\$ to 2011 \$ 1.0186

Note: AESC 2009 levelized costs for 15 years, 2010 - 2024 at a discount rate of 2.22%.

AESC 2011 levelized costs for 15 years 2012 - 2026 at a discount rate of 2.465%.