EM&V: Colorado's Approach

Keith Hay
Demand Side Analyst
Colorado Department of Regulatory Agencies
Public Utilities Commission
1560 Broadway, Suite 250
Denver, CO 80202
P 303.894.2534 | F 303.894.2065
Email: EMAILADDRESS

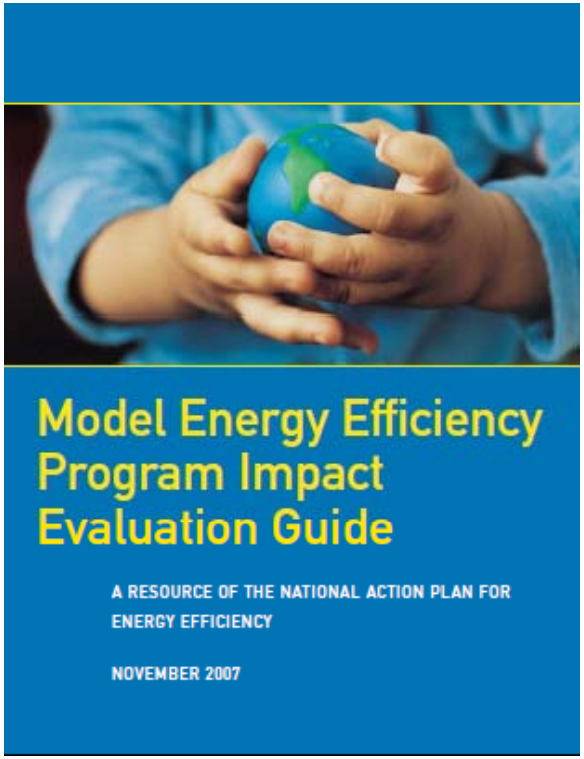
The Need for EM&V

Regulators / Ministry

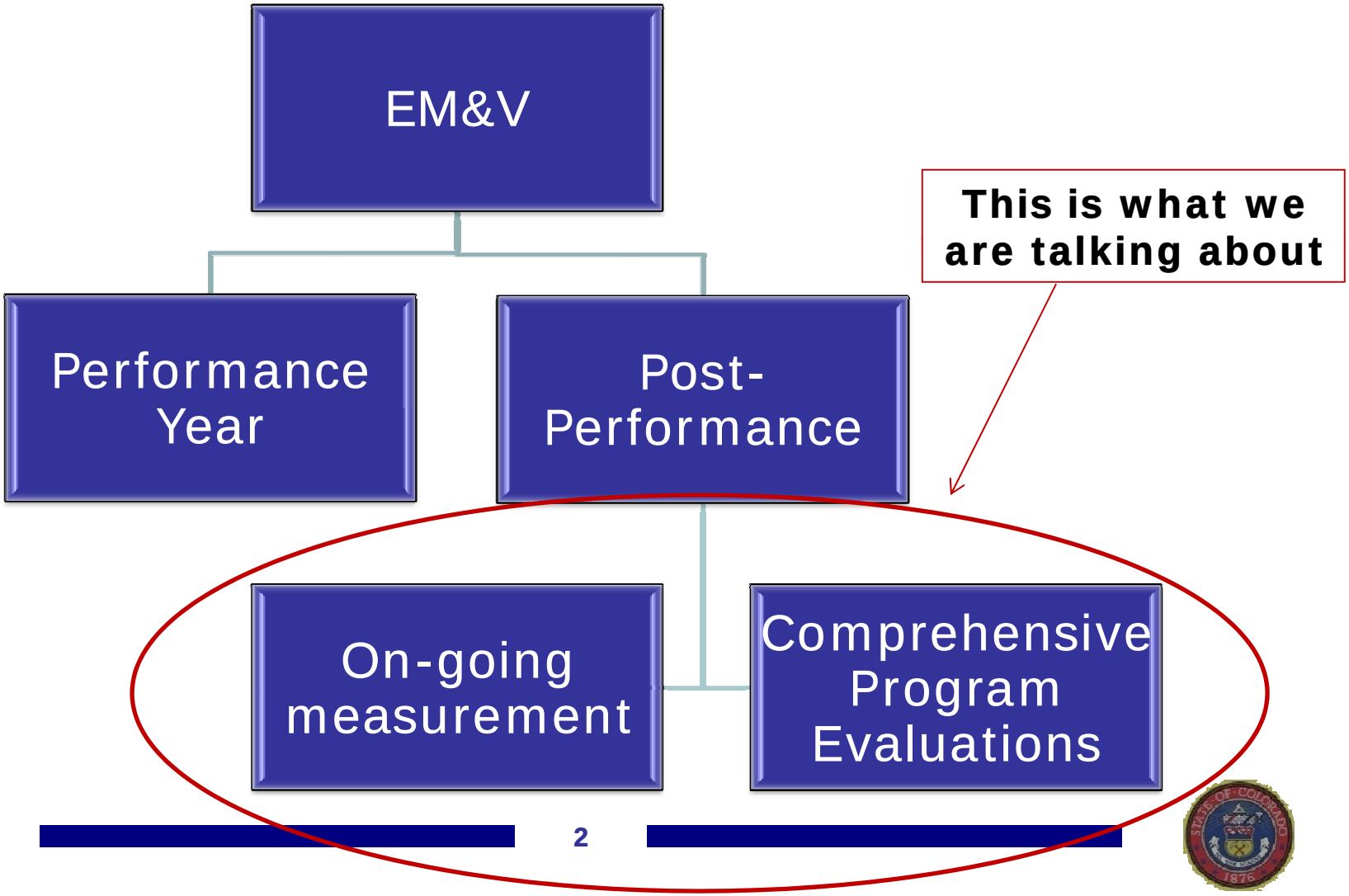
- Document total savings
- Assess the cost-effectiveness of efficiency compared to generation alternatives
- Assess the relative contribution of program administrators in achieving savings
- Determine market baselines and market program effects,
- Use the feedback to improve current and future portfolio offerings

Energy system planners

- Impact on the energy system (resource planning)

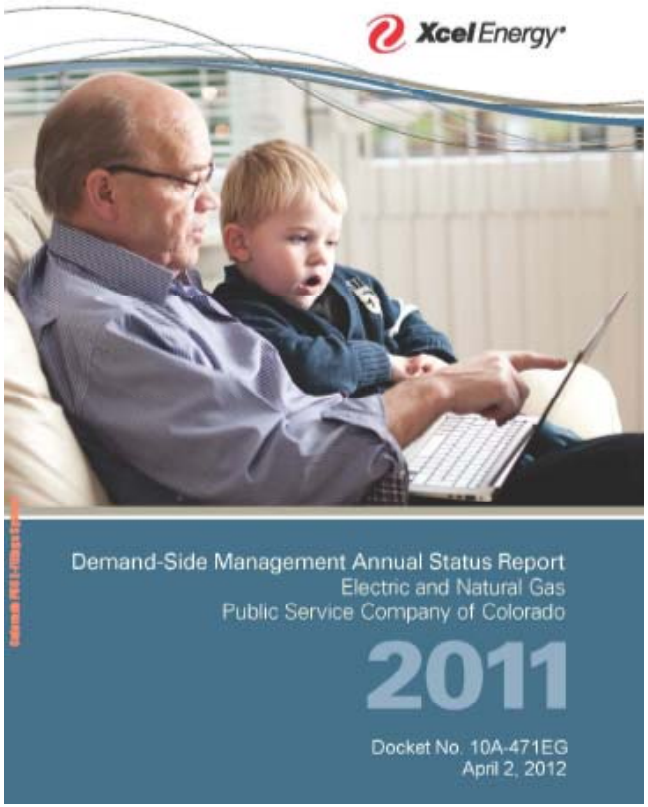


EM&V in the Utility Plan



On-Going Measurement

Prescriptive products use stipulated or deemed technical assumptions



Key parameters:

- Manufacturer
- Model number
- Efficiency rating
- Equipment size, capacity or output
- Application of measure Participant segment
- Quantity (e.g. number of light bulbs)

Table 1a: High-Level Electric Goals and Achievements for 2011

2011	Electric Budget	Electric Actual Spend	Generator kW Goal	Net Realized Generator kW	Generator kWh Goal	Net Realized Generator kWh	Goal Modified TRC Ratio	Achieved Modified TRC Ratio
Business Segment	$36,334,530	$34,103,558	35,447	33,639	161,706,399	179,143,313	2.71	2.64
Residential Segment	$21,712,770	$21,020,685	33,055	39,722	65,302,859	109,612,139	3.12	4.67
Low-Income Segment	$2,377,425	$2,317,014	881	983	13,068,915	11,848,032	2.36	2.00
Indirect Segment	$8,109,209	$6,381,841	1,379	1,314	15,829,466	11,039,684		
2011 TOTAL	**$68,533,933**	**$63,823,098**	**70,762**	**75,659**	**255,907,639**	**311,643,169**	**2.64**	**2.85**

Table 1c: Total Resource Cost Test Results with Financial Incentive

	Electric	Gas
Modified TRC Benefits w/ Adder	$348,190,604	$55,022,171
Modified TRC Costs	$122,205,834	$45,581,780
Modified TRC Ratio	2.85	1.21
Modified TRC Benefits w/ Adder	$348,190,604	$55,022,171
Incentive	$18,746,647	$1,888,078
Acknowledgement of Load Revenue (ALR)	N/A	$420,870
Modified TRC Costs w/ Incentive & ALR	$140,952,481	$47,890,728
Modified TRC Ratio w/ Incentive & ALR	2.47	1.15

Comprehensive Program Eval.

Principal purposes of comprehensive product evaluations are to:*

- assess customer satisfaction with the DSM product being evaluated
- determine changes that should be made to key inputs that determine the savings of programs

Source: 2012/2013 Demand Side Management Plan, PSCo

Methods to Measuring Savings

Deemed

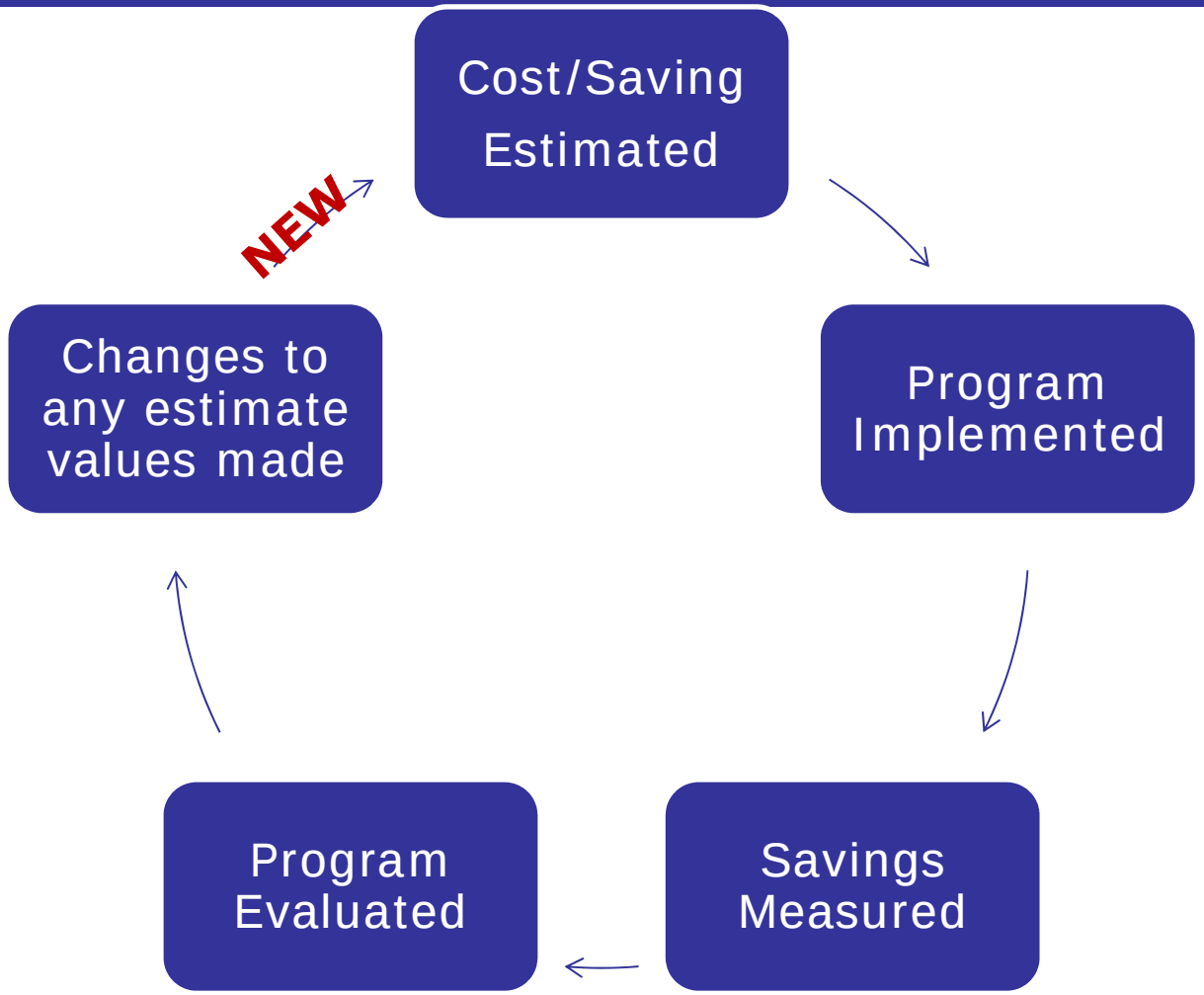
- Savings per measure are estimated
- Instillation is verified

Measurement

- Verification
- Evaluation of energy (demand) savings

Energy Savings
=
kWh save (including fuel) + non-energy benefits + avoided T&D losses,

Colorado's Deemed Savings Approach

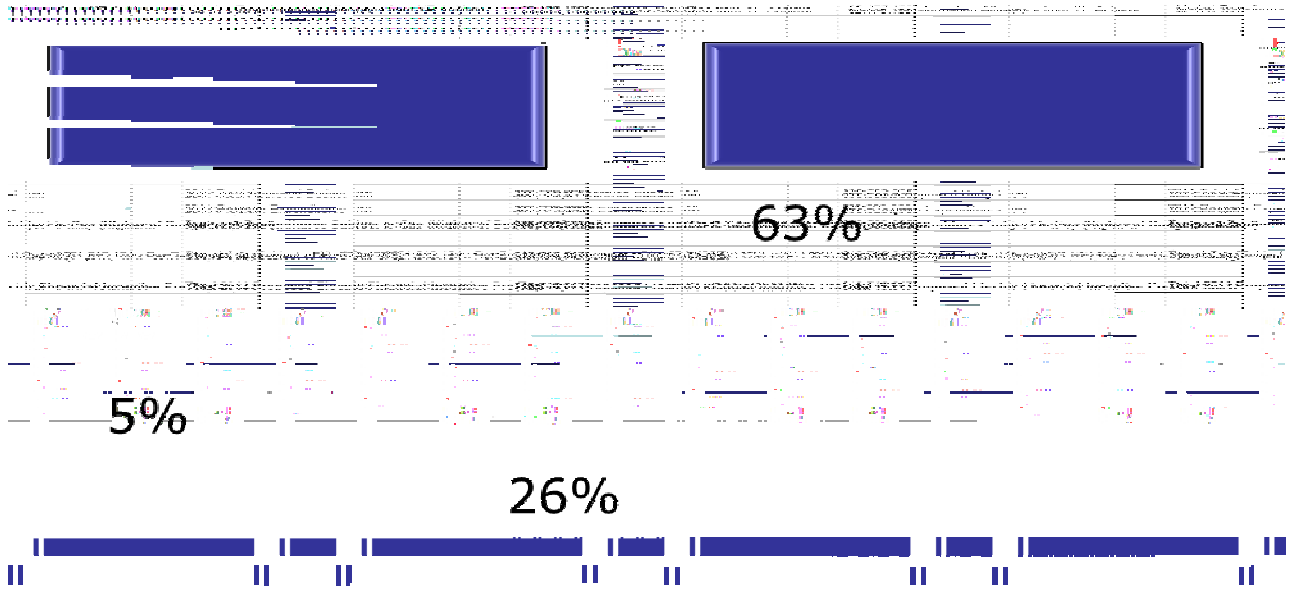


Cost of EM&V

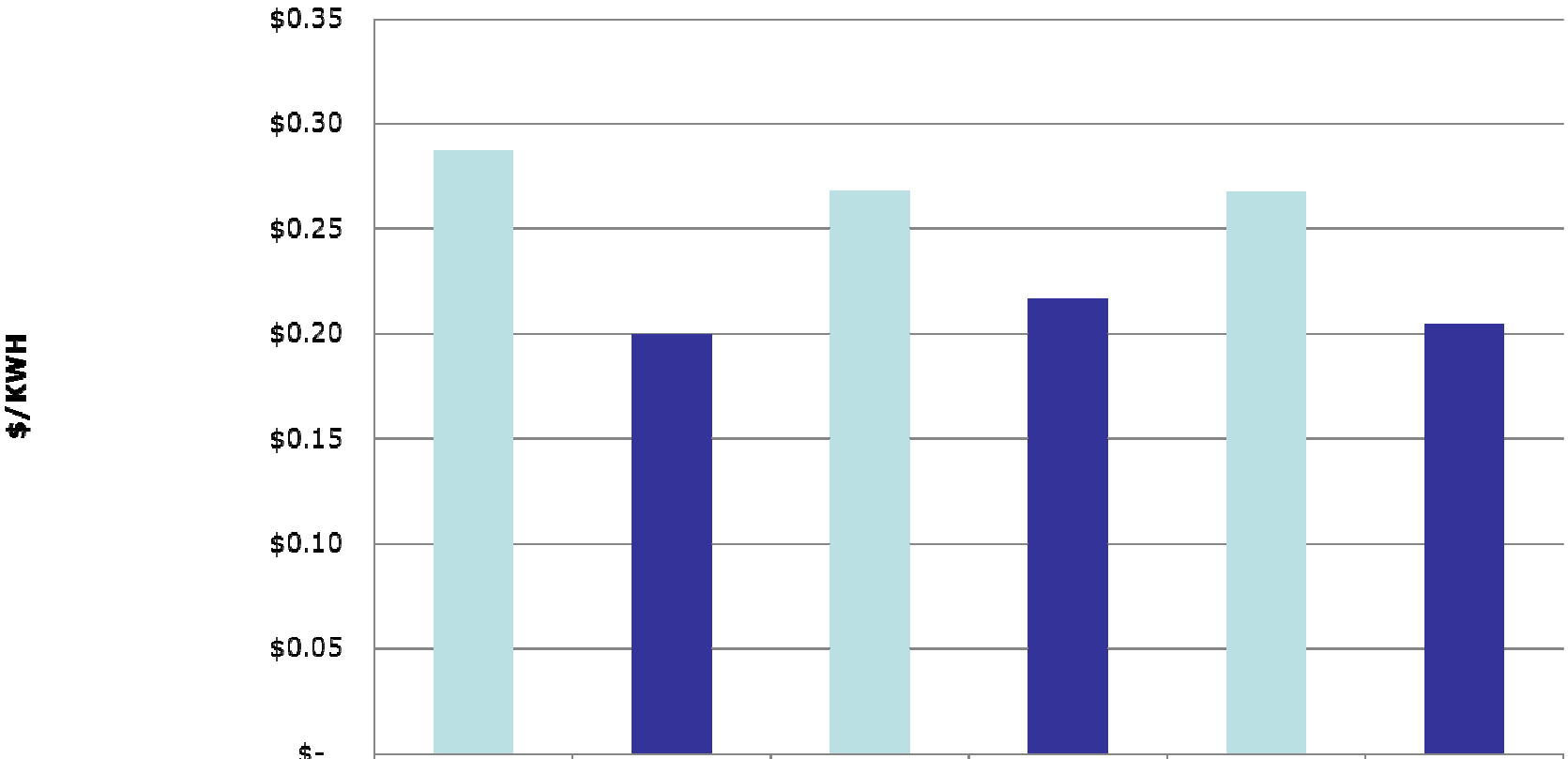
- Total Program Budget = 90,503,210
- EM&V costs = $662,409

Graphs of Colorado's DSM Results

2011 ACTUAL PERCENTAGE OF TOTAL SAVINGS BY SEGMENT

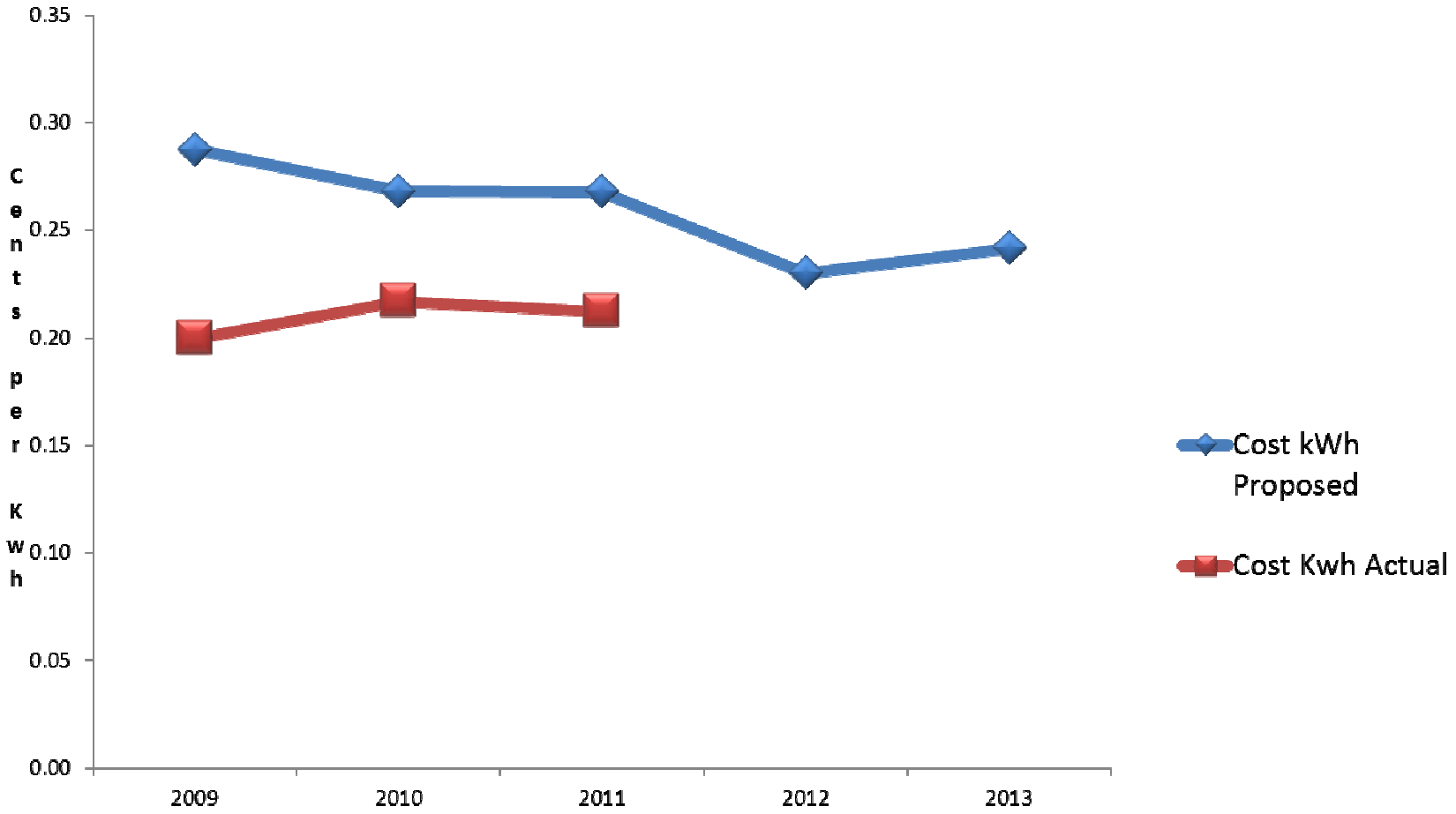


XCEL ENERGY - HISTORICAL $/KWH

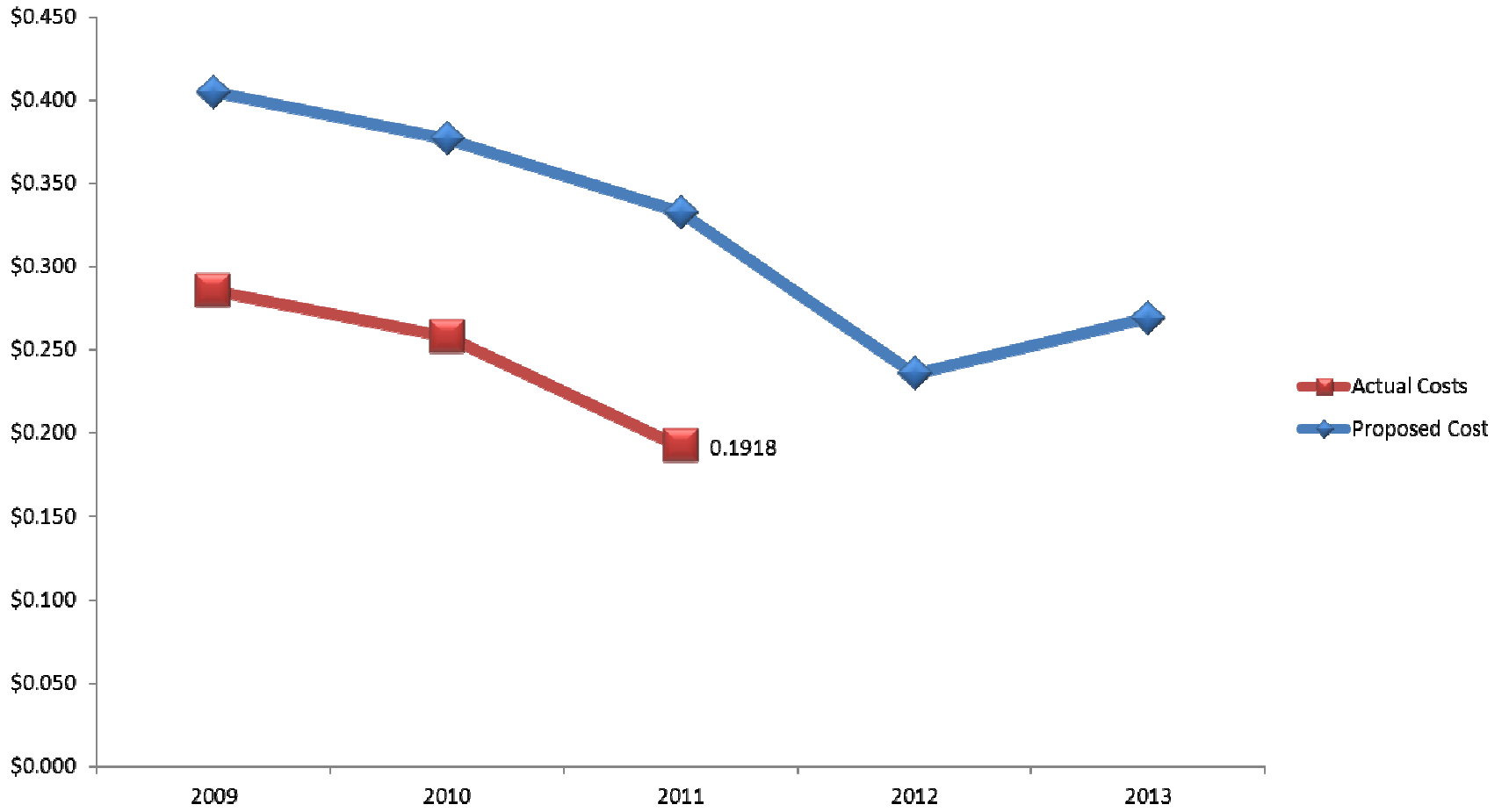


	PLANNED 2009	ACTUAL 2009	PLANNED 2010	ACTUAL 2010	PLANNED 2011	ACTUAL 2011
XCEL ENERGY - ELECTRIC	$0.29	$0.20	$0.27	$0.22	$0.27	$0.20

Total Program Cost per kWh



Residential DSM Cost/kWh



RESIDENTIAL PROGRAM TOTAL — 2012 — ELECTRIC — GOAL

2012 Net Present Cost Benefit Summary Analysis For All Participants

	Participant Test ($Total)	Utility Test ($Total)	Rate Impact Test ($Total)	Modified TRC Test ($Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	$59,483,248	$59,483,248	$59,483,248
Transmission & Distribution Cap	N/A	$10,989,945	$10,989,945	$10,989,945
Marginal Energy	N/A	$29,666,854	$29,666,854	$29,666,854
Avoided Emissions (CO2)	N/A	N/A	N/A	$0
Subtotal				$100,140,046
Non-Energy Benefits Adder (10%)				$10,014,005
Subtotal	N/A	$100,140,046	$100,140,046	$110,154,051
Other Benefits				
Bill Reduction - Electric	$87,261,796	N/A	N/A	N/A
Participant Rebates and Incentives	$13,598,433	N/A	N/A	$13,598,433
Incremental Capital Savings	$3,372,207	N/A	N/A	$0
Incremental O&M Savings	$0	N/A	N/A	$0
Subtotal	$104,232,436	N/A	N/A	$13,598,433
Total Benefits	$104,232,436	$100,140,046	$100,140,046	$123,752,483
Costs				
Utility Project Costs				
Program Planning & Design	N/A	$35,423	$35,423	$35,423
Administration & Program Delivery	N/A	$4,355,317	$4,355,317	$4,355,317
Advertising/Promotion/Customer I	N/A	$4,898,883	$4,898,883	$4,898,883
Participant Rebates and Incentives	N/A	$13,598,433	$13,598,433	$13,598,433
Equipment & Installation	N/A	$4,064,750	$4,064,750	$4,064,750
Measurement and Verification	N/A	$579,125	$579,125	$579,125
Subtotal	N/A	$27,531,932	$27,531,932	$27,531,932
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	$70,713,356	N/A
Subtotal	N/A	N/A	$70,713,356	N/A
Participant Costs				
Incremental Capital Costs	$0	N/A	N/A	$1,126,177
Incremental O&M Costs	$94,541	N/A	N/A	$47,359
Subtotal	$94,541	N/A	N/A	$1,173,536
Total Costs	$94,541	$27,531,932	$98,245,287	$28,705,467
Net Benefit (Cost)	$104,137,895	$72,608,114	$1,894,759	$95,047,016
Benefit/Cost Ratio	1,102.51	3.64	1.02	4.31

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

Input Summary and Totals

Program Inputs per Customer kW

Lifetime (Weighted on Generator kWh)	A	7 years
Annual Hours	B	8760
Gross Customer kW	C	1 kW
Generator Peak Coincidence Factor	D	24.44%
Gross Load Factor at Customer	E	7.58%
Net-to-Gross (Energy)	F	85.0%
Net-to-Gross (Demand)	G	88.3%
Transmission Loss Factor (Energy)	H	7.700%
Transmission Loss Factor (Demand)	I	7.700%
Installation Rate (Energy)	J	96.2%
Installation Rate (Demand)	K	99.1%
MTRC Net Benefit (Cost)	L	$514
MTRC Non-Energy Benefit Adder	M	$54
Net coincident kW Saved at Generator	(G x C x K) x D / (1 - I)	0.2517 kW
Gross Annual kWh Saved at Customer	(B x E x C)	664 kWh
Net Annual kWh Saved at Customer	(F x (B x E x C x J))	543 kWh
Net Annual kWh Saved at Generator	(F x (B x E x C x J)) / (1 - H)	588 kWh

Program Summary per Participant

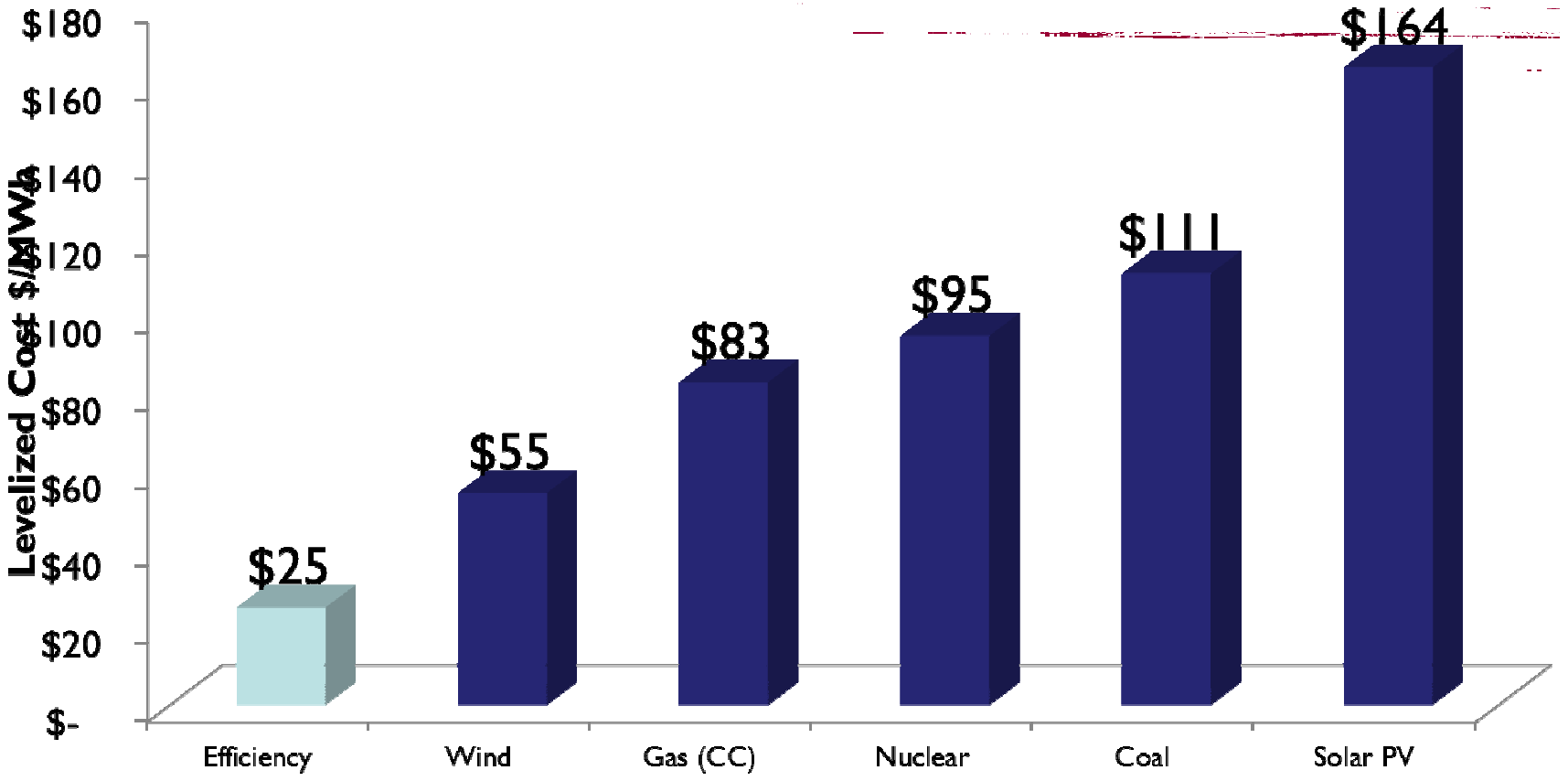
Gross kW Saved at Customer	P	0.31 kW
Net coincident kW Saved at Generator	(G x P x K) x D / (1 - I)	0.07 kW
Gross Annual kWh Saved at Customer	(B x E x P)	208 kWh
Net Annual kWh Saved at Customer	(F x (B x E x P x J))	170 kWh
Net Annual kWh Saved at Generator	(F x (B x E x P x J)) / (1 - H)	184 kWh

Program Summary All Participants

Total Participants	Q	591,289
Total Budget	R	**$27,531,932**
Gross kW Saved at Customer	(Q x P)	184,999 kW
Net coincident kW Saved at Generator	((G x P x K) x D / (1 - I)) x Q	**42,653 kW**
Gross Annual kWh Saved at Customer	(B x E x P) x Q	122,848,930 kWh
Gross Installed Annual kWh Saved at Customer	(B x E x P x J) x Q	118,146,749 kWh
Net Annual kWh Saved at Customer	(F x (B x E x P x J)) x Q	100,381,263 kWh
Net Annual kWh Saved at Generator	((F x (B x E x P x J)) / (1 - H)) x Q	**108,755,431 kWh**
TRC Net Benefits with Adder	(Q x P x L)	**$95,047,016**
TRC Net Benefits without Adder	(Q x P x (L - M))	**$85,033,011**

Utility Program Cost per kWh Lifetime	**$0.0343**
Utility Program Cost per kW at Gen	**$642**

Efficiency- The Lowest Cost Resource



Data source: Levelized Cost of Energy Analysis 5.0. Lazard. 2011