Philadelphia Gas Works
Five-Year Gas Demand-Side Management Plan

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Philadelphia Gas Works
Five-Year Gas Demand-Side Management Plan

I. SUMMARY

Over the next five years, Philadelphia Gas Works (PGW) plans to implement a portfolio of seven demand-side management (DSM) programs designed to reduce customers' energy consumption through end-use efficiency investments. These programs provide technical and financial services to residential and nonresidential customers to help them upgrade the efficiency with which they use energy in their homes and businesses. PGW plans to invest a total of $58 million[1] ($45 million present worth in 2009 dollars) through 2014 to implement these programs, and expects to save 1,321 Billion British Thermal Units (BBTU) annually by the end of 2014.[2] The portfolio's energy savings also reduce greenhouse gas emissions by 1 million tons of carbon dioxide over the lifetimes of all the measure installed over the five-year DSM plan.

Consumption reductions resulting from the DSM portfolio will lower the amount of natural gas PGW has to procure and deliver to serve its customers. Avoided gas supply costs represent the long-term benefits of PGW's DSM plan over the lifetimes of the efficiency measures installed. Today's present worth of these avoided gas supply costs amounts to $99 million, netting $54 million in present worth of cost reductions to the PGW gas system, or a benefit/cost ratio of 2.2.

By the end of the fifth year of portfolio investment, average non-CRP residential customer bills will decrease by 1.2 percent, compared to what they would have been absent PGW's DSM investment. Average rates for this customer class are projected to be 1.0% higher in 2014.[3] Commercial customers will experience an average rate increase of 0.1% at the end of the five-year portfolio investment, along with average bill reductions of 1.1%. Average rates for industrial customers are projected to decrease by 0.4% at the end of the five-year investment period, resulting in an average bill reduction of 0.8%. After the fifth and final year of program expenditures, the portfolio will continue to produce large bill reductions over the remaining lifetimes of the efficiency measures installed due to the DSM portfolio.

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1 This is the sum of nominal dollars assuming 2.0% general inflation (mixed-current dollars, undiscounted). Real portfolio spending totals $54 million in 2009 dollars.

2 PGW seeks recovery of the costs of the program, including revenue lost as a direct result of the program.

3 Portfolio spending, activity levels, and savings are all stated in calendar years, as distinct from PGW's fiscal years, which are accounted for in the analysis of rate and bill impacts from the portfolio.

These net cost reductions to all PGW's customers from lower gas and electric requirements will increase household disposable income and strengthen business profitability throughout Philadelphia, stimulating the creation of between 600 and 1,000 jobs.

PGW's gas DSM plan concentrates on residential retrofits in two phases. First, PGW will enhance the existing low-income program by deepening efficiency investment in treated homes and extending program services to more customers in need. After launching the enhanced low-income program in 2011, PGW plans on expanding the program to the City's non-low income residents. Both retrofit programs upgrade the thermal integrity of the building with added insulation and instrumented air sealing, and in some instances also retire old, inefficient gas furnaces and boilers and water heaters and replace them with new, high-efficiency equipment.

The enhanced low-income program will provide efficiency retrofit services free of charge to the individual customer, just as it does currently. For the rest of PGW's residential customers, the comprehensive retrofit program will offer financial incentives calculated to reduce the investment required by the customer to two year's worth of estimated bill savings. In conjunction with the financial incentive, PGW will assist non-CRP residential customers with accessing third-party financing over a minimum of three years for their investment contributions. The objective of this two-part financial strategy is to provide participating customers with immediate positive cash flow. By the end of the initial five year period, PGW plans to have treated 38,153 customers (15,338 low-income and 22,815 non-CRP residential) through both residential retrofit programs, reaching a combined annual pace of 10,834 per year by 2014. PGW plans to continue the program beyond five years with appropriate regulatory approval.

PGW proposes that both residential retrofit programs will also offer free direct installation of a diverse array of high-efficiency lighting products in customers' homes. These additional measures will produce significant cost-effective electricity savings at costs well below what would have been spent to realize them with a stand-alone electric program. PGW will seek planning and cooperation with other programs, but is prepared to proceed independently because of the significant opportunity the residential retrofit program presents to provide incremental energy savings to customers at very low cost.

Another high priority for 2011 is PGW's plan to work with the City to invest in comprehensive efficiency retrofits in City-owned facilities. In doing so, PGW will help the City undertake the technical and economic assessments required for accessing financial incentives and other services offered by Philadelphia Electric ("PECO").

In the second half of 2011, PGW plans to launch a program to increase the efficiency of gas appliances and heating equipment purchased by residential customers; the plan calls for a companion program for business equipment also beginning in 2012. Also to be initiated in 2012 are a business retrofit program and a new instruction/remodel/renovation program investing in gas and electric efficiency improvements. Due in part to the

predominance of electric efficiency savings opportunities compared to gas in commercial buildings, PGW will investigate opportunities to coordinate implementation of these programs with others, but will assume full program administration responsibilities, if partnering proves infeasible.

Table 1 summarizes the present value of costs and benefits of the program portfolio.

Table 1

PROGRAM	Total Resource PV Benefits	Total Resource PV Costs	PGW PV Costs	Total Resource PV Net Benefits	Total Resource B/C Ratio
Comprehensive Residential Heating Retrofit	$ 37,679,103	$ 21,617,885	$ 10,950,799	$ 16,061,218	1.74
Enhanced Low-income retrofit	$ 37,044,268	$ 21,972,192	$ 22,316,612	$ 15,072,076	1.69
Premium efficiency gas appliances and heating equipment	$ 26,519,663	$ 4,740,331	$ 4,740,331	$ 21,779,332	5.59
Commercial and industrial equipment efficiency upgrades	$ 1,656,514	$ 1,366,816	$ 1,170,821	$ 289,698	1.21
Municipal facilities comprehensive efficiency retrofit	$ 3,676,093	$ 3,290,862	$ 1,734,161	$ 385,230	1.12
High-efficiency construction	$ 3,268,894	$ 1,925,587	$ 1,925,587	$ 1,343,307	1.70
Commercial and industrial retrofit	$ 3,313,027	$ 2,040,365	$ 995,061	$ 1,272,662	1.62
Portfolio-Wide Costs		$ 854,207	$ 854,207	$ (854,207)	
Total Portfolio	$ 113,157,561	$ 57,808,244	$ 44,687,579	$ 55,349,317	1.96

Table 2 summarizes each program's target market and efficiency technologies, market strategies, and delivery mechanism

Table 2

PROGRAM	Target Market	Efficiency Technologies Targeted			Market Actors Targeted	Financial Strategies	Delivery Mechanism	PGW Role
		Gas	Electric	Water				
Comprehensive Residential Heating Retrofit	High-use heating customers (customers ranked in the highest 40% in terms of annual	Instrumented air-sealing; attic/wall insulation; high-efficiency windows; high-efficiency furnace early replacement	High-efficiency lighting;	High-efficiency showerheads and aerators; high-efficiency clothes washers	HPwES-certified contractors; material and equipment suppliers	Financial incentives to buy down projects to a 2-year payback period	Private contractors	Lead program administrator for residential retrofit in Philadelphia; explore coordination with other programs
Enhanced Low-income Retrofit	CRP and senior citizen customers				ECA, Honeywell, other providers to be selected through competitive solicitation	Free installation	Implementation contractor(s)	
Premium Efficiency Gas Appliances and Heating Equipment	Buyers, sellers, and installers of gas space and water heating equipment to residential and small business customers	High-efficiency clothes washers, space- and water-heating equipment	Not applicable		Equipment manufacturers, distributors, retailers/vendors, engineers, contractors, customer buyers	Financial incentives covering 80% of the incremental cost of premium-efficiency equipment	Supply chain	Program administrator; explore coordination with other programs
Commercial and industrial equipment efficiency upgrades	Buyers and sellers of commercial/industrial gas heating and nonheating equipment	High-efficiency heating and process equipment						
Municipal Facilities Comprehensive Efficiency Retrofit	City-owned and -operated public buildings and facilities	High-efficiency boilers and furnaces for space and water heating; high-efficiency building controls; high-efficiency shell improvements	High-efficiency lighting, HVAC, refrigeration	Low-water toilets; high-efficiency clothes washers	Facility managers, department heads, financial officers	Advice on project financing for cost-effective gas-saving measures	Private energy-service contractors selected through competitive bids	Assistance with engineering and economic assessment of retrofit efficiency options, explore coordination with participation in other programs
High-efficiency Construction	New construction, remodelling, and renovation efficiency improvements for residential and commerical buildings				Property developers, managers, owners, real estate agents, architects, engineers, builders, contractors	Financial incentives covering 80% of the incremental cost of premium-efficiency equipment and efficiency technologies	Supply chain	Either sole program administrator or explore partnership in coordination with other program(s)
Commercial and Industrial Retrofit	Supplemental measures (e.g., boiler controls), early retirement of inefficient equipment; investments planned in coordination with other program(s)					Customized incentives calculated based on payback buydown, including electric and other resource savings.	TBD	

II. OBJECTIVES OF PGW'S GAS DSM PLAN

PGW's DSM plan has five broad goals.

- Reduce customer bills
- Maximize customer value
- Contribute to the fulfillment of the City's sustainability plan.
- Reduce PGW cash flow requirements
- Help the Commonwealth and the nation reduce greenhouse gas emissions

In pursuit of these goals, PGW has designed and will implement the planned DSM portfolio according to the following principles:

- Field a portfolio of programs that targets cost-effective gas efficiency savings among all PGW's firm heating customers
- Maximize delivery efficiency to minimize costs and maximize coverage from the available budget
- Stage program implementation to permit orderly and sustainable expansion
- Treat customers in greatest economic need and with most cost-effective opportunities first
- Support economic development in the City, both directly through more intensive employment of local resources to save natural gas, and indirectly through the economic stimulus generated by increasing the amount of money City households and businesses have available to spend for non-gas goods and services
- For retrofit and new construction customers, avoid lost opportunities by seeking comprehensive energy savings of both gas and electric consumption

III.PGW's PROPOSED GAS DSM BUDGETS

PGW's five-year DSM portfolio budget totals $58.3 million (nominal dollars). The next section presents annual program-by-program spending (in constant 2009 dollars). The subsequent section compares PGW's DSM spending and savings with those of other gas utilities.

A. Five-Year DSM Program Budgets

PGW plans to increase annual DSM spending from approximately $2.2 million in 2009 to approximately $10.1 million in calendar year 2011, depending on the date of Commission approval. Annual spending will continue to rise each year, consistent with PGW's plan to phase in and ramp up programs over time. As shown in Table 3, annual spending reaches $15.7 million by 2014.

Table 3

Program Budgets (Constant 2009 Dollars)

Portfolio

	2010	2011	2012	2013	2014
Customer Incentives	$ -	$ 7,894,006	$ 9,976,546	$ 11,274,294	$ 11,966,140
Administration and Management	$ 200,000	$ 700,000	$ 750,000	$ 750,000	$ 750,000
Marketing and Business Development	$ 150,000	$ 350,000	$ 375,000	$ 375,000	$ 375,000
Contractor Costs	$ -	$ 1,013,547	$ 1,255,741	$ 1,497,935	$ 1,497,935
Inspection and Verification	$ -	$ 64,780	$ 114,876	$ 138,434	$ 148,614
On-site Technical Assessment	$ -	$ -	$ 615,600	$ 615,600	$ 615,600
Evaluation	$ -	$ 75,000	$ 150,000	$ 225,000	$ 300,000
Total	$ 350,000	$ 10,097,332	$ 13,237,763	$ 14,876,262	$ 15,653,289
Utility Costs minus Customer Incentives	$ 350,000	$ 2,203,326	$ 3,261,216	$ 3,601,969	$ 3,687,149
	100%	22%	25%	24%	24%

Comprehensive Residential Heating Retrofit

	2010	2011	2012	2013	2014
Customer Incentives	$ -	$ 1,401,356	$ 2,102,035	$ 2,802,713	$ 2,802,713
Administration and Management	$ 50,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Marketing and Business Development	$ 50,000	$ 50,000	$ 50,000	$ 50,000	$ 50,000
Contractor Costs	$ -	$ 484,388	$ 726,582	$ 968,777	$ 968,777
Inspection and Verification	$ -	$ 43,876	$ 52,651	$ 52,651	$ 35,101
Evaluation	$ -	$ -	$ 75,000	$ -	$ 75,000
Total	$ 100,000	$ 2,079,620	$ 3,106,268	$ 3,974,140	$ 4,031,590

Enhanced Low-income Retrofit

Item	2010	2011	2012	2013	2014
Interest Rate Buydown (do not alter this row)	$ -	$ -	$ -	$ -	$ -
Customer Incentives	$ -	$ 6,019,696	$ 6,019,696	$ 6,019,696	$ 6,019,696
Administration and Management	$ 50,000	$ 150,000	$ 150,000	$ 150,000	$ 150,000
Marketing and Business Development	$ -	$ -	$ -	$ -	$ -
Contractor Costs	$ -	$ 529,158	$ 529,158	$ 529,158	$ 529,158
Inspection and Verification	$ -	$ 9,586	$ 9,586	$ 9,586	$ 9,586
Evaluation	$ -	$ 75,000	$ -	$ 75,000	$ -
Total	$ 50,000	$ 6,783,440	$ 6,708,440	$ 6,783,440	$ 6,708,440

Premium Efficiency Gas Appliances and Heating Equipment						
Customer Incentives	$ -	$ 472,954	$ 1,418,861	$ 1,418,861	$ 1,418,861	
Administration and Management	$ 50,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000	
Total	$ 100,000	$ 659,271	$ 1,702,814	$ 1,627,814	$ 1,702,814	
Commercial and Industrial Equipment Efficiency Upgrades						
Customer Incentives	$ -	$ -	$ 120,416	$ 270,936	$ 361,247	
Administration and Management	$ -	$ 75,000	$ 100,000	$ 100,000	$ 100,000	
Total	$ -	$ 125,000	$ 274,740	$ 505,666	$ 524,221	
Municipal Facilities Comprehensive Efficiency Retrofit						
Customer Incentives	$ -	$ -	$ -	$ -	$ -	
Administration and Management	$ -	$ 50,000	$ 50,000	$ 50,000	$ 50,000	
On-site Technical Assessment	$ -	$ -	$ 615,600	$ 615,600	$ 615,600	
Evaluation	$ -	$ -	$ -	$ -	$ -	
Total	$ -	$ 50,000	$ 667,139	$ 667,139	$ 667,139	
High-Efficiency Construction						
Customer Incentives	$ -	$ -	$ 208,503	$ 521,257	$ 1,042,514	
Administration and Management	$ -	$ 75,000	$ 75,000	$ 75,000	$ 75,000	
Total	$ -	$ 125,000	$ 342,000	$ 667,501	$ 1,285,002	
Commercial and Industrial Retrofit						
Customer Incentives	$ -	$ -	$ 107,036	$ 240,832	$ 321,109	
Administration and Management	$ -	$ 50,000	$ 75,000	$ 75,000	$ 75,000	
Total	$ -	$ 75,000	$ 236,361	$ 450,562	$ 459,083	

Portfolio-wide Costs

Item	2010	2011	2012	2013	2014
Administration and Management	$ 50,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Marketing and Business Development	$ 50,000	$ 100,000	$ 100,000	$ 100,000	$ 100,000
Evaluation	$ -	$ -	$ -	$ -	$ 75,000
Total	$ 100,000	$ 200,000	$ 200,000	$ 200,000	$ 275,000

B. PGW's Spending and Savings Compared with Other Gas Utility DSM Portfolios

PGW's ambitious DSM investment portfolio follows in the footsteps of leading gas DSM program administrators around the U.S. and Canada. Figure 1 shows on a U.S. map where gas DSM programs are either active or planned.

Figure 1

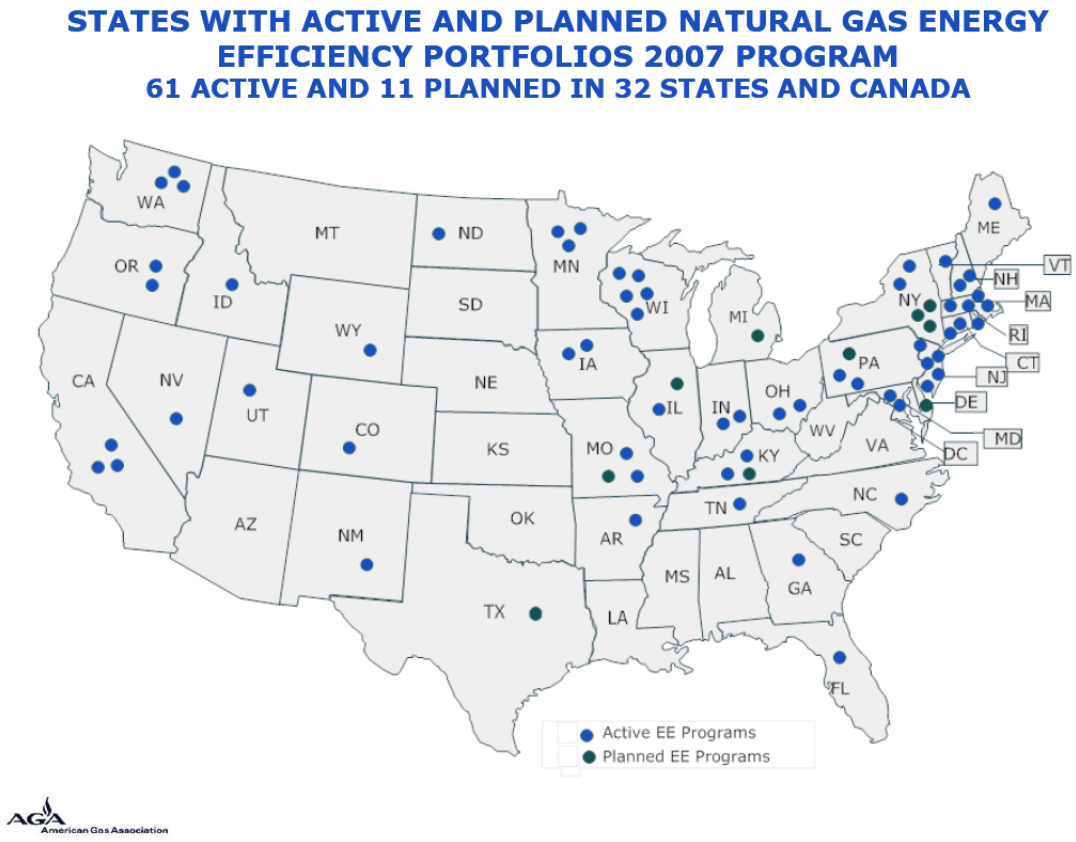


Table 4 presents utility gas DSM spending and savings by PGW and several industry leaders. Initially, PGW's spending is below average for the other utilities surveyed – at about $0.02 per therm sold, with savings also below the average at about 0.39% of sales compared to the US/Canada average of 0.53% of sales. By the fifth year, however, PGW's spending and savings increase to more than twice the average spending and one and half times the average savings of other North American gas DSM portfolios.

Table 4

	Residential					Non-Residential					Total						
	Cost (Nominal $M)	Savings (Million Therms)	Sales (Million Therms)	Savings % of Sales	Spending per Annual Therm Saved	Cost (Nominal $M)	Savings (Million Therms)	Sales (Million Therms)	Savings % of Sales	Spending per Annual Therm Saved	Cost (Nominal $M)	Savings (Million Therms)	Sales (Million Therms)	Savings % of Sales	Spending per Annual Therm Saved	Spending per Lifetime Therm Saved	Spending per Therm Sold
PGW PROJECTIONS																	
Philadephia Gas Works																	
2010	$ 0.30	-	394	0.00%	$0.00	$ 0.05	0.00	114	0.00%	$0.00	$ 0.35	-	508	0.00%	$0.00	$0.00	$ 0.001
2011	$ 9.92	1.96	392	0.50%	$5.06	$ 0.48	0.00	114	0.00%	$0.00	$ 10.40	1.96	506	0.39%	$5.31	$0.54	$ 0.021
2012	$ 12.19	3.01	390	0.77%	$4.05	$ 1.69	0.33	113	0.29%	$5.13	$ 13.88	3.34	503	0.66%	$4.15	$0.42	$ 0.028
2013	$ 13.36	3.30	388	0.85%	$4.05	$ 2.46	0.55	113	0.49%	$4.45	$ 15.81	3.85	501	0.77%	$4.11	$0.42	$ 0.032
2014	$ 13.73	3.30	386	0.85%	$4.16	$ 3.25	0.77	112	0.68%	$4.23	$ 16.97	4.06	498	0.82%	$4.18	$0.43	$ 0.034
ACTUAL																	
NSTAR (Massachussets)																	
2004	$ 3.06	0.29	231	0.13%	$10.38	$ 1.02	0.44	239	0.18%	$2.32	$ 4.08	0.73	470	0.16%	$5.55	$0.57	$ 0.0087
2006	$ 2.98	0.28	193	0.14%	$10.75	$ 0.96	0.61	225	0.27%	$1.58	$ 3.94	0.89	418	0.21%	$4.45	$0.45	$ 0.0094
2007	$ 3.18	0.26	218	0.12%	$12.14	$ 1.04	0.51	249	0.21%	$2.02	$ 4.22	0.78	467	0.17%	$5.43	$0.55	$ 0.0090
Southern California Gas (California)																	
2006	$ 12.98	2.82	2,480	0.11%	$4.61	$ 13.22	8.81	3790	0.23%	$1.50	$ 26.20	11.62	6,270	0.19%	$2.25	$0.23	$ 0.0042
2007	$ 41.15	3.54	2,460	0.14%	$11.63	$ 24.74	23.28	3880	0.60%	$1.06	$ 65.89	26.81	6,340	0.42%	$2.46	$0.25	$ 0.0104
Enbridge (Canada & US)																	
2007		18.65	1,581	1.18%			14.63	2571	0.57%		$ 22.00	33.28	4,152	0.80%	$0.66	$0.07	$ 0.0053
Union Gas (Ontario)																	
2007	$ 4.09	4.70	1,031	0.46%	$0.87	$ 5.80	26.93	3869	0.70%	$0.22	$ 16.13	31.63	4,900	0.65%	$0.51	$0.05	$ 0.0033
Northern Utilities (New Hampshire)																	
2004	$ 0.29	0.01	17	0.07%	$25.65	$ 0.62	0.06	50	0.12%	$ 10.71	$ 0.91	0.07	67	0.10%	$ 13.13	$ 0.66	$ 0.0135
2005	$ 0.23	0.05	16	0.28%	$4.86	$ 0.41	0.03	49	0.06%	$ 14.62	$ 0.64	0.08	65	0.11%	$ 8.52	$ 0.43	$ 0.0098
2006	$ 0.20	0.05	14	0.34%	$4.22	$ 0.41	0.11	47	0.23%	$ 3.74	$ 0.61	0.16	61	0.26%	$ 3.89	$ 0.19	$ 0.0100
2007	$ 0.28	0.03	16	0.20%	$8.60	$ 0.43	0.10	55	0.17%	$ 4.55	$ 0.71	0.13	72	0.18%	$ 5.57	$ 0.28	$ 0.0099
EnergyNorth Natural Gas, Inc. (NH)																	
2004	$ 0.58	0.23	54	0.42%	$2.56	$ 0.35	0.18	69	0.27%	$10.71	$ 0.93	0.41	123	0.33%	$ 2.26	$ 0.66	$ 0.0076
2005	$ 0.98	0.30	61	0.49%	$3.23	$ 0.60	0.25	77	0.33%	$14.62	$ 1.58	0.56	139	0.40%	$ 2.84	$ 0.43	$ 0.0114
2006	$ 0.84	0.24	53	0.46%	$3.46	$ 0.90	0.34	72	0.47%	$3.74	$ 1.74	0.58	125	0.47%	$ 3.00	$ 0.19	$ 0.0140
2007	$ 1.01	0.23	48	0.48%	$4.45	$ 0.82	0.42	77	0.55%	$4.55	$ 1.83	0.65	125	0.52%	$ 2.83	$ 0.28	$ 0.0147
Vermont Gas Systems, Inc. (Vermont)																	
2003											$ 1.14	0.81	84	0.97%	$ 1.40	$0.14	$ 0.0136
2004											$ 1.12	0.57	86	0.66%	$ 1.97	$0.20	$ 0.0130
2005											$ 1.23	0.74	83	0.89%	$ 1.66	$0.17	$ 0.0148
2006	$ 0.77	0.25	29	0.87%	$3.09	$ 0.51	0.34	51	0.66%	$1.51	$ 1.28	0.59	80	0.73%	$ 2.18	$0.22	$ 0.0160
2007	$ 0.85	0.26	32	0.80%	$3.32	$ 0.66	0.53	56	0.94%	$1.25	$ 1.51	0.79	88	0.89%	$ 1.92	$0.20	$ 0.0171
2008	$ 1.00	0.31	32	0.96%	$3.22	$ 0.70	0.67	57	1.17%	$1.04	$ 1.70	0.98	90	1.10%	$ 1.73	$0.18	$ 0.0189
Iowa (All Investor Owned Utilities)																	
2001	$ 16.56	4.89	670	0.73%	$3.38	$ 1.45	0.89	404	0.22%	$1.63	$ 18.01	5.78	1,074	0.54%	$ 3.12	$0.32	$ 0.0168
2002	$ 14.98	4.14	679	0.61%	$3.62	$ 2.16	0.95	412	0.23%	$2.28	$ 17.14	5.09	1,091	0.47%	$ 3.37	$0.34	$ 0.0157
2003	$ 20.06	4.73	707	0.67%	$4.24	$ 2.18	1.47	420	0.35%	$1.48	$ 22.24	6.20	1,126	0.55%	$ 3.59	$0.37	$ 0.0197
2004	$ 20.47	5.30	654	0.81%	$3.86	$ 2.22	1.31	397	0.33%	$1.70	$ 22.69	6.61	1,051	0.63%	$ 3.43	$0.35	$ 0.0216
2005	$ 25.12	6.61	636	1.04%	$3.80	$ 3.18	2.11	405	0.52%	$1.51	$ 28.30	8.72	1,041	0.84%	$ 3.24	$0.33	$ 0.0272
2006	$ 27.42	6.92	587	1.18%	$3.96	$ 3.65	1.76	382	0.46%	$2.08	$ 31.07	8.68	969	0.90%	$ 3.58	$0.36	$ 0.0321
2007	$ 24.10	5.92	651	0.91%	$4.07	$ 4.34	2.14	521	0.41%	$2.03	$ 28.43	8.06	1,172	0.69%	$ 3.53	$0.36	$ 0.0243
Minnesota Energy Resources Corporation - PNG (Minnesota)																	
2006	$ 1.47	0.54			$2.70	$ 0.28	0.97			$0.29	$ 1.75	1.52			$1.16	$0.12	
2007	$ 1.11	0.42			$2.62	$ 0.45	0.77			$0.59	$ 1.56	1.19			$1.31	$0.13	
Xcel Energy (Minnesota)																	
2007	$ 3.25	1.48			$2.20	$ 2.51	7.41			$0.34	$ 5.76	8.88			$0.65	$0.07	
Great Plains Natural Gas Co. (Minnesota)																	
2006	$ 0.21	0.07			$3.02	$ 0.03	0.07			$0.45	$ 0.24	0.14			$1.74	$0.18	
2007	$ 0.20	0.05			$3.75	$ 0.04	0.12			$0.36	$ 0.24	0.18			$1.38	$0.14	
2008	$ 0.26	0.09			$2.77	$ 0.00	0.00			$0.54	$ 0.26	0.09			$2.71	$0.28	
CenterPoint Energy (Minnesota)																	
2006	$ 3.43	1.60			$2.15	$ 3.65	7.59			$0.48	$ 7.08	9.19			$0.77	$0.08	
2007	$ 3.81	1.65			$2.31	$ 3.42	6.60			$0.52	$ 7.23	8.25			$0.88	$0.09	
2008	$ 4.24	1.74			$2.44	$ 3.63	6.54			$0.56	$ 7.87	8.27			$0.95	$0.10	
Interstate Power and Lighting (Minnesota)																	
2005	$ 0.22	0.10			$2.26	$ 0.23	0.16			$1.44	$ 0.45	0.26			$ 1.74	$0.18	
2006	$ 0.19	0.08			$2.38	$ 0.29	0.16			$1.83	$ 0.48	0.24			$ 2.01	$0.20	
2007	$ 0.18	0.08			$2.25	$ 0.10	0.07			$1.45	$ 0.28	0.15			$ 1.87	$0.19	
2008	$ 0.19	0.07			$2.61	$ 0.17	0.11			$1.51	$ 0.36	0.18			$ 1.95	$0.20	
AVERAGE OF ACTUAL EXPENDITURES AND SAVINGS																	
	$ 6.94	**2.11**	**$ 503.33**	**0.55%**	**$ 4.64**	**$ 2.26**	**2.82**	**$ 633.07**	**0.39%**	**$ 2.78**	**$ 9.09**	**4.65**	**######**	**0.53%**	**$ 2.93**	**$ 0.273**	**$ 0.02**

	Residential					Non-Residential					Total						
	Cost (Nominal $M)	Savings (Million Therms)	Sales (Million Therms)	Savings % of Sales	Spending per Annual Therm Saved	Cost (Nominal $M)	Savings (Million Therms)	Sales (Million Therms)	Savings % of Sales	Spending per Annual Therm Saved	Cost (Nominal $M)	Savings (Million Therms)	Sales (Million Therms)	Savings % of Sales	Spending per Annual Therm Saved	Spending per Lifetime Therm Saved	Spending per Therm Sold
PLANNED																	
Terasen (Canada)																	
2008	$ 7.46	0.93	771	0.12%	$7.99	$ 8.33	1.69	1074	0.16%	$4.92	$ 15.79	2.63	1,844	0.14%	$6.01	$0.61	$ 0.0086
2009	$ 7.59	1.18	771	0.15%	$6.42	$ 10.04	2.49	1074	0.23%	$4.03	$ 17.63	3.67	1,844	0.20%	$4.80	$0.49	$ 0.0096
2010	$ 6.65	0.95	771	0.12%	$6.98	$ 12.84	3.47	1074	0.32%	$3.70	$ 19.49	4.42	1,844	0.24%	$4.41	$0.45	$ 0.0106
Southern California Gas (California)																	
2008											$ 62.00	23.30	6,340	0.37%	$2.66	$0.27	$ 0.0098
2009											$ 73.20	27.20	6,340	0.43%	$2.69	$0.27	$ 0.0115
2010											$ 76.80	28.30	6,340	0.45%	$2.71	$0.28	$ 0.0121
2011											$ 82.20	29.90	6,340	0.47%	$2.75	$0.28	$ 0.0130
2012											$ 89.60	32.30	6,340	0.51%	$2.77	$0.28	$ 0.0141
2013											$ 100.30	35.80	6,340	0.56%	$2.80	$0.29	$ 0.0158
Mid-American (Iowa)																	
2009	$ 15.43					$ 3.55					$ 18.98	3.96	622	0.64%	$4.79	$0.49	$ 0.0305
2010	$ 16.95					$ 5.25					$ 22.20	4.74	624	0.76%	$4.68	$0.48	$ 0.0356
2011	$ 17.95					$ 5.48					$ 23.43	4.97	626	0.79%	$4.71	$0.48	$ 0.0374
2012	$ 19.14					$ 6.37					$ 25.51	5.25	629	0.84%	$4.86	$0.49	$ 0.0406
2013	$ 19.92					$ 6.48					$ 26.41	5.35	631	0.85%	$4.93	$0.50	$ 0.0418
Keyspan Long Island (New York)																	
2009	$ 1.78	0.22	407	0.05%	$8.01												
2010	$ 2.29	0.30	407	0.07%	$7.71												
2011	$ 3.46	0.37	407	0.09%	$9.47												
Keyspan New York (New York)																	
2009	$ 1.99	0.19	1,003	0.02%	$10.30												
2010	$ 3.40	0.35	1,003	0.04%	$9.64												
2011	$ 5.76	0.66	1,003	0.07%	$8.79												
Central Hudson Gas & Electric (New York)																	
2009						$ 0.05	0.01			$7.61							
2010						$ 0.17	0.03			$6.43							
2011						$ 0.17	0.03			$6.43							
Consolidated Edison of New York (New York)																	
2009						$ 0.37	0.04			$9.13							
2010						$ 4.17	0.80			$5.22							
2011						$ 6.05	1.14			$5.30							
NYSERDA FlexTech (New York)																	
2010											$ 1.33	2.37			$0.56	$0.06	
2011											$ 1.70	2.85			$0.59	$0.06	
2012											$ 0.81	1.18			$0.68	$0.07	
2013											$ 0.40	1.18			$0.34	$0.03	
National Grid NY and National Grid Commercial (New York)																	
2009	$ 0.76	1.78			$0.43	$ 3.76	0.83			$4.54	$ 4.52	2.61			$1.73	$0.18	
2010	$ 2.69	0.65			$4.12	$ 12.10	2.45			$4.95	$ 14.79	3.10			$4.77	$0.49	
2011	$ 2.69	0.65			$4.12	$ 12.08	2.45			$4.94	$ 14.77	3.10			$4.77	$0.49	
AVERAGE OF PROJECTED EXPENDITURES AND SAVINGS																	
	$ 8.16	**0.57**	**$ 705.11**	**0.06%**	**$ 6.95**	**$ 4.72**	**0.86**	**#DIV/0!**	**#DIV/0!**	**$ 6.06**	**$ 35.50**	**12.08**	**######**	**0.61%**	**$ 2.99**	**$ 0.305**	**$ 0.02**
AVERAGE OF ACTUAL AND PROJECTED EXPENDITURES AND SAVINGS																	
	$ 7.00	**1.75**	**$ 577.04**	**0.43%**	**$ 5.32**	**$ 3.39**	**2.70**	**$ 768.25**	**0.39%**	**$ 3.45**	**$ 16.85**	**6.88**	**######**	**0.53%**	**$ 3.00**	**$ 0.287**	**$ 0.02**

IV. PGW DSM PORTFOLIO IMPLEMENTATION

This section addresses three crucial aspects of PGW's management of its gas DSM programs:

- Program administration and management
- Program integration with other programs
- Staged program implementation

A. Program Administration and Management

Program administration and management refers to the set of functions associated with designing, developing, planning program services and activities; contractor supervision; data management and reporting, installation verification of high-efficiency gas measures through the various DSM programs.

1. Implementation Management

PGW is responsible for achieving the performance goals of its DSM investment portfolio, according to the guiding principles for achieving the core objectives of the plan. The scope of PGW's implementation management responsibilities encompasses:

- Customer recruitment and intake
- Opportunity assessment
- Measure installation
- Financial incentive processing
- Inspection and verification
- Data management

2. Staffing and Sourcing

PGW personnel will manage the implementation of energy-efficiency programs. Installation of efficiency measures will be done by independent contractors that PGW will select through competitive, public RFP solicitation. This model builds on PGW's successful experience managing the delivery of its low-income retrofit program to approximately 2,500 customers per year. PGW will also retain outside experts to assist it in preparing specifications for implementation contractor solicitation, assessing competing bids, structuring contracts, and establishing performance goals.

3. Program Marketing and Business Development

PGW will be responsible for all outreach to customers and to members of the supply chain for gas appliances and equipment such as vendors, wholesalers, and manufacturers. A critical component of successful marketing will be market research. PGW will rely on in-house personnel as well as contractors as necessary to develop and execute marketing strategies to maximize participation. PGW will work closely with retrofit program implementation contractors to maximize individual customers' trust and acceptance. PGW will also work with civic and other organizations on coordinated campaigns to maximize participation in targeted areas.

4. Tracking and Reporting

PGW will expand its existing information management systems to track the cost and performance information.

PGW will file regular reports on spending, participation, energy savings, and benefits. The following table presents the information PGW proposes to track and report periodically to the PUC.

Figure 2: Sample Program Annual Report

Program Name

Program Start Date:	1/1/1900
Gross to Net Adjustment Factor:	0%

	Actual Previous Program Year	Actual Current Program Year	Projected Program Year	Projected Next Program Year	Total Program Reported to Date [22]
PARTICIPATION					
Pending [1]	-	-	n/a	n/a	n/a
Analyses/Audits with No Installs [2]	-	-	n/a	n/a	n/a
Analyses/Audits [3]	-	-	-	-	-
Customers with Installations [4]	-	-	-	-	-
COSTS					
Utility Costs [12]	$ -	$ -	$ -	$ -	$ -
Customer Incentives [5]	$ -	$ -	$ -	$ -	$ -
Administration and Management [6]	$ -	$ -	$ -	$ -	$ -
Marketing and Business Development [7]	$ -	$ -	$ -	$ -	$ -
Contractor Costs [8]	$ -	$ -	$ -	$ -	$ -
Inspection and Verification [9]	$ -	$ -	$ -	$ -	$ -
On-site Technical Assessment [10]	$ -	$ -	$ -	$ -	$ -
Evaluation [11]	$ -	$ -	$ -	$ -	$ -
Participant Costs [13]	$ -	$ -	$ -	$ -	$ -
Total [14]	$ -	$ -	$ -	$ -	$ -
BENEFITS [15]					
Annualized BBtu [16]	-	-	-	-	-
Lifetime BBtu [17]	-	-	-	-	-
Peak Day BBtu [18]	-	-	-	-	-
Annualized BBtu [19]	-	-	-	-	-
Weighted Lifetime (years) [20]	-	-	-	-	-

Program Year Activity

End-Use Breakdown	Annualized BBtu Saved [16]	Peak Day BBtu Savings [18]	Number of Customers with Installations [21]	Weighted Lifetime [20]
Heating				
Water Heating				
Air Infiltration				
Heat Recovery				
Shell (envelope)				
Process				
Total				

Descriptions of Fields	
[1]	Number of customers who requested service who are still waiting to receive it on December 31 of the year specified in the column heading.
[2]	Number of customers who had analyses or audits completed during the reporting year, but who have not yet had verified installations by December 31 of the year specified in the column heading.
[3]	Number of customers who had analyses or audits completed between January 1 and December 31.
[4]	Number of customers with verified installations in the period January 1 to December 31.
[5]	Incentive payments to customers and/or trade allies, excluding direct installation costs
[6]	Any costs incurred by the utility not directly attributed to items [7]. [8], [9], [10], and [11]
[7]	Costs associated directly with the marketing and business development activies of the program
[8]	Non-incentive payments to third-party contractors, including direct installation.
[9]	Payments to utlity staff or contractors for performing analyses, audits, inspections, and verifications Also includes cost for energy ratings.
[10]	Costs incurred from in-depth onsite potential studies. Applies to Municipal and C&I Retrofit programs
[11]	Evaluation costs, excluding tracking and reporting expenses.
[12]	Sum of items [5] through [11]
[13]	Customer expenditures, including loan amount
[14]	[12] + [13]
[15]	Savings adjusted by the free rider percentage where applicable.
[16]	Estimated annual savings for measures installed and verified during the reporting year for a one-year period.
[17]	The lifetime estimated BBtu savings for measures installed and verified during the reporting year. Estimated annualized savings times the estimated life of the measure.
[18]	Estimated impact of measure on peak day. Since measures are installed throughout the year, does not reflect Mcf avoided on peak day of the reporting year.
[19]	Total Mcf saved divided by the total participants.
[20]	Average lifetime, in years, of measures in the program weighted by savings.
[21]	Number of customers with verified installations of measures within that end-use. Where a customer had more than one measure installed within an end-use, i.e. both wall and attic installation within the "shell" end-use, they are counted only once.
[22]	Cumulative activity from program start date until December 31. Individual program start dates are listed on the upper right-hand corner of each summary sheet.

5. Measurement, Verification and Evaluation

PGW will apply the same approach to measurement, verification, and evaluation that it currently employs in the administration of the low-income program.

PGW will establish a technical reference manual codifying and updating methods and assumptions for calculating savings from the full array of prescriptive gas efficiency measures. Specialized retrofit projects, especially for commercial and industrial projects, will be characterized on a customized basis in terms of their lifetime costs and performance. PGW will use these characterizations to calculate and track the economic benefits and costs of both prescriptive and customized efficiency projects.

PGW will also verify that measures are actually installed as recommended and analyzed.

PGW has conducted extensive evaluation of its low-income program, which is delivered by two implementation contractors, DMC/Honeywell and the Energy Coordination Agency of Philadelphia. PGW will continue to use the results of independent evaluation to update savings estimates and redirect program activities. PGW will also develop a program evaluation plan for the entire portfolio to be submitted with its detailed work plans following Commission approval of this DSM plan. The program timetable presented in Section IV.C indicates the timing of the evaluations PGW plans to undertake starting in 2011; the program budgets in Section III.A, above, provide the funds PGW estimates will be required for these studies.

Primary evaluation issues to be addressed in the initial set of evaluations will include:

- Costs and savings from enhanced efficiency services in the both the residential retrofit programs
- Effectiveness of PGW's proposed financial strategies in attracting participants in the non-low income retrofit program
- Effectiveness of PGW's end-user and upstream financial strategies in raising the market penetration of and lowering the price premium for the highest-efficiency heating equipment

In 2014, PGW proposes to conduct a portfolio-wide evaluation of its implementation of its DSM portfolio. This will include a comparative analysis of PGW's performance against that of its peers.

B. Integrated Approach to Customer Efficiency Investment

To maximize value from its gas DSM portfolio, PGW will take advantage of incremental opportunities to save gas as well as other resource savings, including electricity. Decades of DSM program experience prove that failure to do so would lead to missed opportunities, duplication of effort, needlessly high costs, and customer confusion. Incremental energy saving opportunities will also reduce the customer's carbon footprint and increase the ability of PGW customers to pay their gas bills on time and in full. For example, improving building thermal performance will save heating gas as well as electricity used for cooling. Especially for residential customers and small commercial customers, it makes the most sense for PGW or, if feasible, PGW and other partners, to combine forces to offer customers one-stop shopping for efficiency measures addressing electricity and gas. Consequently, PGW will seek to integrate gas efficiency opportunities with other non-gas efficiency efforts. Any cost sharing between PGW and other organizations will be guided by the value of gas benefits relative to the value of other resource savings generated by the programs.

PGW will assume lead responsibility for implementing comprehensive retrofits for City residents and in City-owned and/or managed facilities. PGW will explore the feasibility of partnering with other programs designed and implemented to achieve cost-effective efficiency savings in residential and business construction and in comprehensive business retrofits, but will administer these programs independently, if necessary. PGW will also explore the feasibility of coordinating its residential appliance and heating and business equipment efficiency programs with other programs aimed at the same markets. While PGW believes that such partnering may provide enhanced efficiencies and benefits, this plan does not assume or depend upon cooperation with other organizations.

1. Electric efficiency measures to be integrated into PGW programs

Residential retrofit

PGW plans on integrating two types of electric efficiency measures into its Comprehensive Residential Heating Retrofit and Enhanced Low-Income Retrofit Programs.

In conjunction with its Heating Retrofit activities, PGW will provide direct installation of full range of latest high-efficiency lighting products available in each participating home. The average American household has 30 or more lighting fixtures. PGW contract installers (who will also be doing the heating retrofits) will be trained to install as many compact fluorescent lamps as the customer will accept. The installer will leave behind at least one "multi-pack" of replacement lamps to ensure that customers have ready access to replacement lamps, pending roll-out of a retail efficiency products program by others. A key aspect of this proposal is that, because the net incremental cost of the CFL installations is so low, it will permit the delivery of electric energy efficiency measures to a market segment that it might not otherwise be cost-effective to address.

Lighting direct installation will lead to substantial economic and environmental benefits. Table 5 provides a breakdown of gas and electricity benefits for the comprehensive residential retrofit program.

Table 5

Comprehensive Residential Heating Retrofit: Gas Savings Compared to Electric Savings		
	Gas	**Electric**
Present Value of Benefits ($2009)	$28,665,111	$ 9,013,992
Present Value of Costs ($2009)	$10,950,799	$ -
Present Value of Net Benefits ($2009)	$17,714,311	$ 9,013,992
Benefit-Cost Ratio	2.62	0.00
Cumulative Annual Energy Saved in 5th Year (Net of Freeriders)	3.7 Million Therms	21.1 GWh
Electric energy saved measured at generation.		

Residential appliances and heating equipment

In addition to incentives for high-efficiency gas appliances and equipment, PGW will assist customers find other programs that may provide supplemental incentives for new purchases of:

- High-efficiency furnaces with ECMs (electrically-commutated motors)
- High-efficiency clothes washers

Prescriptive cost-effectiveness analysis will be performed in advance to establish cost-effectiveness of high-efficiency gas equipment.

Municipal facilities retrofit

PGW will help the City identify other programs that may offer electric efficiency incentives with the goal of providing immediate positive cashflow for comprehensive packages of the following technologies:

- Lighting retrofit (Super T8, T5, LED fixtures; controls; lighting system redesign)
- HVAC retrofit (early retirement; unitary to central conversions; proper sizing of equipment to match load; distribution controls)
- Refrigeration (early retirement, supplemental controls)

PGW will work with the City and state and financial institutions that provide energy loans to structure short-term financing for the balance of capital investment required (gas measures plus electric efficiency investment costs not covered by other incentives).

All efficiency measures (gas and electric) will be subjected to individualized cost-effectiveness analysis to direct investment toward economically optimal packages. The cost-effectiveness analysis for this program does not include the effects of electric efficiency investment, which will increase the net benefits expected from the program.

2. Gas efficiency measures ideally integrated into other programs

In three markets, electricity savings potential is as large as or larger than gas efficiency potential. These are high-efficiency construction (residential and commercial), and commercial and industrial retrofit. PGW plans to work closely on devising financial incentives that address both gas and electric efficiency measures as a package in construction, renovation, and retrofit of commercial and industrial properties, and in new residential construction. PGW will explore the potential to integrate with other parties and programs, but if agreement on integration is not reached, PGW will design the incentives for the gas-saving measures based partly on the incentives and benefits of the related electric-saving equipment.

3. Coordinating with other programs

PGW will investigate opportunities to coordinate the design and implementation of programs promoting high-efficiency appliances and heating equipment with other programs. While not as closely linked as in other markets, PGW programs and other programs addressing electric efficiency should at least have consistent efficiency performance thresholds that do not favor one energy source over the other. PGW will explore the feasibility of coordination with other programs promoting residential appliance and heating equipment efficiency upgrades, and for commercial and industrial equipment efficiency upgrades.

C. Program Staging

As shown in Table 3, PGW plans to scale up DSM spending rapidly and substantially. Fortunately, the bulk of the expansion in terms of money and savings is scaling up and fine-tuning PGW's successful low-income retrofit program. 2011 will therefore focus on scaling up the low-income program. 2011 will also involve designing and launching the comprehensive residential retrofit program, and identifying opportunities for comprehensive efficiency retrofits in City facilities. All programs scale up to their maximum participation rates in 2014. Table 6 shows the relative pace of implementation in each year.

Table 6

PHILADELPHIA GAS WORKS						
Five Year Gas Demand-Side Management Plan						
PROGRAM INPUTS						
		Staging % of Maximum Customer Participation in Year				
PROGRAM	Maximum Annual Customer Participation	2010	2011	2012	2013	2014
Comprehensive Residential Heating Retrofit	7,020	0%	50%	75%	100%	100%
Enhanced Low-income Retrofit	3,834	0%	100%	100%	100%	100%
Premium Efficiency Gas Appliances and Heating Equipment	13,581	0%	33%	100%	100%	100%
Commercial and industrial equipment efficiency upgrades	519	0%	0%	33%	75%	100%
Municipal Facilities Comprehensive Efficiency Retrofit	62	0%	0%	100%	100%	100%
High-efficiency Construction	1,700	0%	0%	20%	50%	100%
Commercial and Industrial Retrofit	519	0%	0%	33%	75%	100%

Table 7 offers a more detailed look at each program's time table.

Table 7: Program Implementation Timelines

PHILADELPHIA GAS WORKS
Five Year Gas Demand-Side Management Plan
Program Implementation Timelines

Program Activity	2010				2011				2012				2013				2014			
	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec
Comprehensive Residential Heating Retrofit																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				
Enhanced Low-income retrofit																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				
Premium efficiency gas appliances and heating equipment																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				
Commercial and industrial equipment efficiency upgrades																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				
Municipal facilities comprehensive efficiency retrofit																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				
High-efficiency construction																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				
Commercial and industrial retrofit																				
Design, development, planning																				
Contractor solicitation and selection																				
Marketing and business development																				
Program service delivery																				
Evaluation																				

Design, development, planning
Contractor solicitation and selection
Marketing and business development
Program service delivery
Evaluation

V. ENERGY, ECONOMIC, AND ENVIRONMENTAL IMPACTS OF PGW'S DSM PLAN

This section provides more detail on PGW's estimates of energy savings from its planned DSM portfolio, and their monetary, employment, and pollution impacts.

A. Energy Savings

Table 8 shows the annual gas and electricity savings PGW projects from its DSM portfolio.

Table 8

PHILADELPHIA GAS WORKS GAS DSM PORTFOLIO GAS AND ELECTRICITY SAVINGS BY YEAR						
Program Year:	**1**	**2**	**3**	**4**	**5**
Year:	**2010**	**2011**	**2012**	**2013**	**2014**
Gas					
Incremental annual BBtu Gas Saved (Net)	0	196	334	385	406
Cumulative annual BBtu Saved (Net)	0	196	530	915	1,321
Electricity					
Incremental annual MWh Saved (Net at meter)	0	5,730	7,130	8,530	8,530
Cumulative annual MWh Saved (Net, at meter)	0	5,730	12,860	21,390	29,920
Incremental annual Summer kW Saved (Net at m	0	1,598	2,016	2,433	2,433
Cumulative annual Summer kW Saved (Net, at m	0	1,598	3,614	6,048	8,481

Gas savings are significant. As shown earlier in Table 4, the annual incremental savings increase fivefold between 2011 and 2014. Electricity savings from air conditioning and lighting direct installation as part of the residential retrofit programs are small but extremely valuable, as shown below.

B. Cost Savings

The benefits of PGW's DSM program are the avoided costs of gas and other resource savings. This section presents the monetary values PGW applied to these resource savings to estimate gas DSM benefits. It also assesses program cost-effectiveness from the perspective of the economy at large and from the vantage point of energy ratepayers. This section presents PGW's estimates of the rate and bill impacts from the plan over time.

1. Avoided supply costs

Table 9 presents the unit values of resources PGW estimated for gas, electricity, and water savings by year. PGW estimated the value of three gas-saving load profiles: space heating, water heating, and base use.

Table 9

All Avoided Costs Are in Constant 2009 Dollars

Period:	Electric Avoided Costs including losses		Natural Gas Avoided Costs			Other Resource Avoided Costs
	All-Year Energy	Summer GenerationCapacity	NG Base	NG Space Heat	NG DHW	Water
Units:	$/kWh	$/kW-yr	$/MMBtu	$/MMBtu	$/MMBtu	$/gal
2010	0.0602	85.05	7.34	8.74	7.69	$ 0.0100
2011	0.0632	66.60	7.46	8.84	7.80	$ 0.0100
2012	0.0640	53.12	7.42	8.76	7.75	$ 0.0100
2013	0.0641	57.52	7.39	8.71	7.72	$ 0.0100
2014	0.0656	64.00	7.42	8.75	7.75	$ 0.0100
2015	0.0679	64.00	7.49	8.83	7.83	$ 0.0100
2016	0.0705	64.00	7.63	8.98	7.97	$ 0.0100
2017	0.0738	64.00	7.84	9.21	8.18	$ 0.0100
2018	0.0775	64.00	8.10	9.51	8.45	$ 0.0100
2019	0.0813	64.00	8.24	9.66	8.60	$ 0.0100
2020	0.0816	64.00	8.23	9.65	8.59	$ 0.0100
2021	0.0806	64.00	8.27	9.69	8.62	$ 0.0100
2022	0.0826	64.00	8.37	9.80	8.73	$ 0.0100
2023	0.0850	64.00	8.65	10.12	9.02	$ 0.0100
2024	0.0902	64.00	8.99	10.49	9.36	$ 0.0100
2025	0.0947	64.00	9.30	10.83	9.68	$ 0.0100
2026	0.0992	64.00	9.60	11.17	9.99	$ 0.0100
2027	0.1037	64.00	9.86	11.46	10.26	$ 0.0100
2028	0.1077	64.00	10.06	11.68	10.46	$ 0.0100

Assumptions and calculations behind these estimates are presented in Section VII.E, below.

2. Net economic benefits of PGW's DSM Plan

PGW analyzed the benefits and costs of its proposed DSM programs from two perspectives. The first and primary test of cost-effectiveness is the total resource cost (TRC) perspective. It measures the gain in economic welfare from making the investment by comparing the present worth of resource benefits with the present worth of resource costs of the DSM plan. Total resource benefits are the avoided gas, electric, and water costs. Total resource costs consist of PGW's expenditures on program measures and on "non-measure," i.e., administration costs. They also include the customers' direct

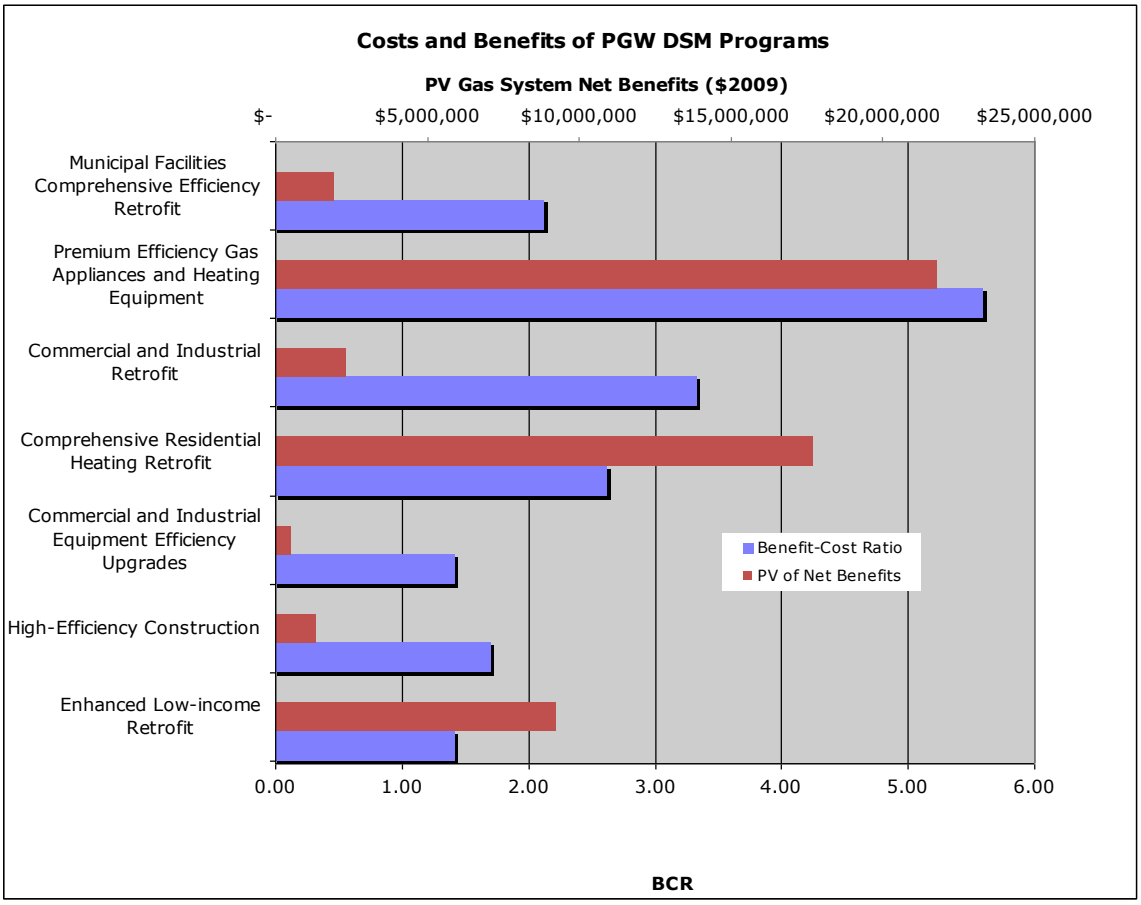
contribution to the efficiency investments, that is, the portion of efficiency measure costs not covered by PGW program expenditures.

PGW also analyzed benefits and costs from the perspective of the utility system. This calculation ignores the costs not borne or avoided by PGW, i.e., the costs participants pay themselves. While not a true indicator of economic merit, it does provide a reasonable indication of the extent to which the investment represents a good use of ratepayer funds. We provide results for the gas system alone and for the electricity system from electric efficiency measures. The electric system analysis does not reflect any electric utility contribution toward the administrative costs of the residential programs. Nor does the analysis reflect any total resource benefits or costs of other electric efficiency measures besides lighting and air conditioning in the residential retrofit programs, or any electric efficiency measures in the commercial and industrial programs.

Two measures of cost-effectiveness are presented. The net benefits are the difference between benefits and costs. This is the most indicative of economic merit, since it calculates the magnitude of the welfare gain. Maximizing net benefits from the portfolio maximizes customer value. The benefit/cost ratio (BCR) is also presented as a rough indicator of relative value. Maximizing the BCR does not necessarily lead to maximum customer value; doing so would automatically leave behind cost-effective savings, i.e., gas savings that cost less than the supply they avoid.

Figure 3 graphically depicts the net benefits of each program. The maroon bar is the magnitude of net benefits for each program, reading off the top horizontal scale. The blue bar is the program's BCR, read off the bottom horizontal scale.

Figure 3



Figures 4 and 5 depict benefits and costs of the residential and nonresidential programs, respectively. In each figure, the stacked vertical bars represent the sum of each sector's measure and non-measure costs, reading off the left-hand vertical scale. The blue area indicates the cumulative value of these investments over the lifetime of the measures installed, reading off the right-hand vertical scale.

Figure 4

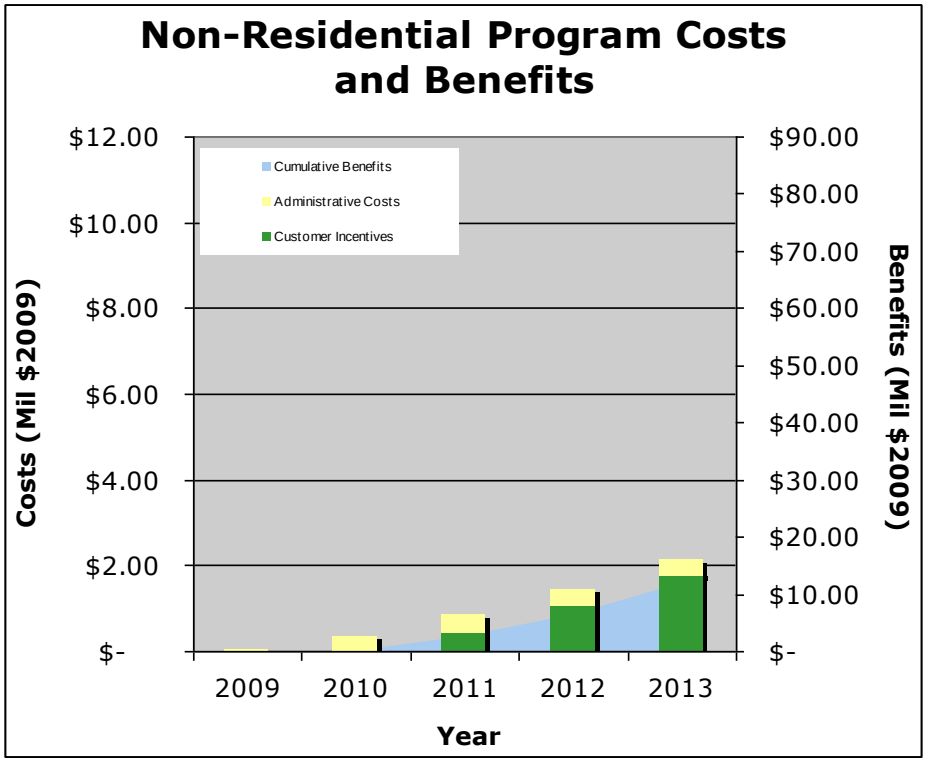


Figure 5

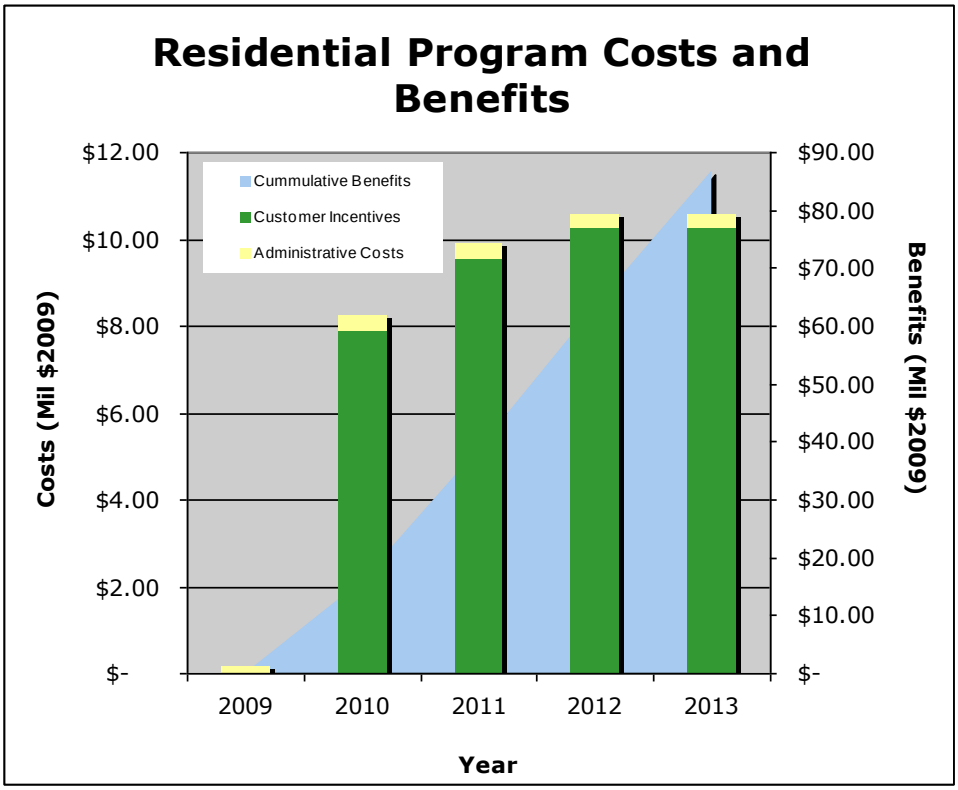


Table 10 projects and compares the present value benefits and costs of each program under four cost-effectiveness perspectives.

Table 10

PHILADELPHIA GAS WORKS
DSM PROGRAM PLAN
COST-EFFECTIVENESS ANALYSIS

	Total Resource					Electric Energy System				Gas Energy System					Electric & Gas Energy System			
	Present Value		PV of Net	Benefit-Cost	Levelized Cost	Present Value		PV of Net	Benefit-Cost	Present Value		PV of Net	Benefit-Cost	Levelized Cost	Present Value		PV of Net	Benefit-Cost
	Benefit [2]	Cost [3]	Benefits [4]	Ratio [5]	$/MMBTU	Benefit [6]	Cost [7]	Benefits [8]	Ratio [9]	Benefit [10]	Cost [11]	Benefits [12]	Ratio [13]	$/MCF	Benefit [14]	Cost [15]	Benefits [16]	Ratio [17]
Portfolio Total	$113,157,561	$57,808,244	$55,349,317	1.96	5.33	$14,491,497	-	$14,491,497	-	$98,666,064	$44,687,579	$53,978,485	2.21	4.11	$113,157,561	$44,687,579	$68,469,983	2.53
Non-Measure Costs		$11,302,468					$0				$11,302,468					$11,302,468		
Total Measure Costs	$113,157,561	$46,505,776	$66,651,785	2.43	4.33	$14,491,497	-	$14,491,497	-	$98,666,064	$33,385,111	$65,280,953	2.96	3.11	$113,157,561	$33,385,111	$79,772,451	3.39
Program																		
Comprehensive Residential Heating Retrofit																		
Program Total	$37,679,103	$21,617,885	$16,061,218	1.74	7.14	$9,013,992	-	$9,013,992	-	$28,665,111	$10,950,799	$17,714,311	2.62	3.59	$37,679,103	$10,950,799	$26,728,304	3.44
Non-Measure Costs		$3,599,166					$0				$3,599,166					$3,599,166		
Total Measure Costs	$37,679,103	$18,018,718	$19,660,385	2.09	6.01	$9,013,992	-	$9,013,992	-	$28,665,111	$7,351,633	$21,313,477	3.90	2.45	$37,679,103	$7,351,633	$30,327,470	5.13
Enhanced Low-income Retrofit																		
Program Total	$37,044,268	$21,972,192	$15,072,076	1.69	6.58	$5,477,505	-	$5,477,505	-	$31,566,763	$22,316,612	$9,250,151	1.41	6.69	$37,044,268	$22,316,612	$14,727,656	1.66
Non-Measure Costs		$2,575,906					$0				$2,575,906					$2,575,906		
Total Measure Costs	$37,044,268	$19,396,286	$17,647,982	1.91	5.85	$5,477,505	-	$5,477,505	-	$31,566,763	$19,740,705	$11,826,058	1.60	5.95	$37,044,268	$19,740,705	$17,303,563	1.88
Premium Efficiency Gas Appliances and Heating Equipment																		
Program Total	$26,519,663	$4,740,331	$21,779,332	5.59	1.50	-	-	-	-	$26,519,663	$4,740,331	$21,779,332	5.59	1.50	$26,519,663	$4,740,331	$21,779,332	5.59
Non-Measure Costs		$930,799					$0				$930,799					$930,799		
Total Measure Costs	$26,519,663	$3,809,532	$22,710,131	6.96	1.22	-	-	-	-	$26,519,663	$3,809,532	$22,710,131	6.96	1.22	$26,519,663	$3,809,532	$22,710,131	6.96
Commercial and Industrial Equipment Efficiency Upgrades																		
Program Total	$1,656,514	$1,366,816	$289,698	1.21	6.92	-	-	-	-	$1,656,514	$1,170,821	$485,692	1.41	5.90	$1,656,514	$1,170,821	$485,692	1.41
Non-Measure Costs		$582,838					$0				$582,838					$582,838		
Total Measure Costs	$1,656,514	$783,978	$872,536	2.11	4.06	-	-	-	-	$1,656,514	$587,983	$1,068,530	2.82	3.05	$1,656,514	$587,983	$1,068,530	2.82
Municipal Facilities Comprehensive Efficiency Retrofit																		
Program Total	$3,676,093	$3,290,862	$385,230	1.12	8.34	-	-	-	-	$3,676,093	$1,734,161	$1,941,932	2.12	4.27	$3,676,093	$1,734,161	$1,941,932	2.12
Non-Measure Costs		$1,734,161					$0				$1,734,161					$1,734,161		
Total Measure Costs	$3,676,093	$1,556,702	$2,119,391	2.36	4.06	-	-	-	-	$3,676,093	-	$3,676,093	-	-	$3,676,093	-	$3,676,093	-
High-Efficiency Construction																		
Program Total	$3,268,894	$1,925,587	$1,343,307	1.70	5.61	-	-	-	-	$3,268,894	$1,925,587	$1,343,307	1.70	5.61	$3,268,894	$1,925,587	$1,343,307	1.70
Non-Measure Costs		$552,982					$0				$552,982					$552,982		
Total Measure Costs	$3,268,894	$1,372,605	$1,896,289	2.38	4.06	-	-	-	-	$3,268,894	$1,372,605	$1,896,289	2.38	4.06	$3,268,894	$1,372,605	$1,896,289	2.38
Commercial and Industrial Retrofit																		
Program Total	$3,313,027	$2,040,365	$1,272,662	1.62	5.22	-	-	-	-	$3,313,027	$995,061	$2,317,966	3.33	2.51	$3,313,027	$995,061	$2,317,966	3.33
Non-Measure Costs		$472,409					$0				$472,409					$472,409		
Total Measure Costs	$3,313,027	$1,567,956	$1,745,071	2.11	4.06	-	-	-	-	$3,313,027	$522,652	$2,790,375	6.34	1.35	$3,313,027	$522,652	$2,790,375	6.34
Portfolio-wide Costs																		
Program Total	-	$854,207	$(854,207)	-	#DIV/0!	-	-	-	-	-	$854,207	$(854,207)	-	#DIV/0!	-	$854,207	$(854,207)	-
Non-Measure		$854,207					$0				$854,207					$854,207		

3. DSM portfolio bill and rate impacts

The net benefits of PGW DSM investment are realized over the entire life expectancy of the efficiency measures installed, which averages 15-20 years. The costs are incurred during the next five years. Recovering the portfolio costs over a smaller sales base puts upward pressure on bills and rates in the early years; after that, the benefits of the gas savings continue for the next 15 years in the form of lower bills.

PGW analyzed the near-term impact on rates and bills from its gas DSM plan. Average bills for all customers combined (participants and nonparticipants) will rise in the early years and then generally decline thereafter. For example, average bills for municipal customers rise the most, by 3.7% in 2013, and then fall to 2.3% in 2014. [4] Rates for non-CRP residential customers will be 2.3% higher in 2013 than they would have been absent the DSM portfolio investment, but by 2014 their average bills will decline by 1.2%. Not shown in the 5-year rate/bill analysis are the substantial bill reductions realized after 2014. These modest near-term rate and bill impacts are acceptable considering the magnitude of the ensuing bill reductions over the remaining lifetime of the investment.

Tables 11 – 13 show the pre and post DSM effects on bills as well as rate impacts broken out by customer classes.

[4] This analysis does not include any electric rate or bill reductions from electric energy impacts.

Table 11: Pre-DSM

	2010-11	2011-12	2012-13	2013-14	2014-15
Pre-DSM					
Gas Revenues ($000)					
Non-CRP Residential	$ 550,858	$ 572,914	$ 581,818	$ 594,403	$ 599,317
Commercial	$ 159,159	$ 167,091	$ 171,863	$ 178,004	$ 182,059
Industrial	$ 13,645	$ 14,157	$ 14,402	$ 14,709	$ 14,839
Municipal	$ 14,450	$ 15,250	$ 15,728	$ 16,283	$ 16,624
Housing Authority - GS	$ 3,688	$ 3,855	$ 3,938	$ 4,042	$ 4,088
Housing Authority - PHA	$ 9,786	$ 10,199	$ 10,371	$ 10,597	$ 10,659
Number of Customers					
Non-CRP Residential	379,778	375,986	372,232	371,034	367,502
Commercial	25,254	25,396	26,077	24,071	24,364
Industrial	779	805	780	1,076	1,071
Municipal	924	976	941	556	565
Housing Authority - GS	1,956	1,956	1,956	1,956	1,956
Housing Authority - PHA	828	938	819	813	808
Average Monthly Bill					
Non-CRP Residential	$ 121	$ 127	$ 130	$ 134	$ 136
Commercial	$ 525	$ 548	$ 549	$ 616	$ 623
Industrial	$ 1,460	$ 1,465	$ 1,539	$ 1,140	$ 1,154
Municipal	$ 1,304	$ 1,303	$ 1,393	$ 2,442	$ 2,451
Housing Authority - GS	$ 157	$ 164	$ 168	$ 172	$ 174
Housing Authority - PHA	$ 985	$ 907	$ 1,056	$ 1,086	$ 1,100
Sales Volume (Mcf)					
Non-CRP Residential	29,280	29,170	28,957	28,801	28,662
Commercial	10,601	10,757	10,912	11,075	11,247
Industrial	991	991	992	992	993
Municipal	1,306	1,315	1,327	1,337	1,346
Housing Authority - GS	209	209	209	209	209
Housing Authority - PHA	590	587	583	579	576
Average Rate ($/therm)					
Non-CRP Residential	1.88	1.96	2.01	2.06	2.09
Commercial	1.50	1.55	1.58	1.61	1.62
Industrial	1.38	1.43	1.45	1.48	1.49
Municipal	1.11	1.16	1.19	1.22	1.23
Housing Authority - GS	1.76	1.84	1.88	1.93	1.95
Housing Authority - PHA	1.66	1.74	1.78	1.83	1.85

Table 12: Post-DSM

	2010-11	2011-12	2012-13	2013-14	2014-15
Post-DSM					
DSM Benefit ($000)					
Non-CRP Residential	$ (462)	$ (1,601)	$ (3,194)	$ (5,016)	$ (5,756)
Commercial	$ (33)	$ (213)	$ (548)	$ (1,001)	$ (1,187)
Industrial	$ -	$ (4)	$ (15)	$ (33)	$ (41)
Municipal	$ (3)	$ (110)	$ (272)	$ (444)	$ (513)
Housing Authority - GS	$ (1)	$ (4)	$ (9)	$ (15)	$ (17)
Housing Authority - PHA	$ (3)	$ (13)	$ (27)	$ (43)	$ (49)
DSM Spending ($000)					
Non-CRP Residential	$ 2,026	$ 3,997	$ 5,444	$ 6,285	$ 2,169
Commercial	$ 245	$ 692	$ 1,217	$ 1,514	$ 525
Industrial	$ 9	$ 28	$ 58	$ 75	$ 26
Municipal	$ 45	$ 521	$ 760	$ 786	$ 265
Housing Authority - GS	$ 3	$ 8	$ 11	$ 14	$ 5
Housing Authority - PHA	$ 9	$ 23	$ 32	$ 41	$ 15
USC Credit ($000)					
Non-CRP Residential	$ 2,674	$ 3,166	$ 2,022	$ 814	$ (3,329)
Commercial	$ 968	$ 1,167	$ 762	$ 313	$ (1,306)
Industrial	$ 90	$ 108	$ 69	$ 28	$ (115)
Municipal	$ 119	$ 143	$ 93	$ 38	$ (156)
Housing Authority - GS	$ 19	$ 23	$ 15	$ 6	$ (24)
Housing Authority - PHA	$ 54	$ 64	$ 41	$ 16	$ (67)
Gas Revenues ($000)					
Non-CRP Residential	$ 555,096	$ 578,476	$ 586,091	$ 596,486	$ 592,400
Commercial	$ 160,339	$ 168,736	$ 173,293	$ 178,831	$ 180,090
Industrial	$ 13,745	$ 14,289	$ 14,514	$ 14,779	$ 14,709
Municipal	$ 14,611	$ 15,804	$ 16,308	$ 16,662	$ 16,220
Housing Authority - GS	$ 3,709	$ 3,881	$ 3,954	$ 4,047	$ 4,052
Housing Authority - PHA	$ 9,846	$ 10,273	$ 10,416	$ 10,611	$ 10,558
Average Monthly Bill					
Non-CRP Residential	$ 122	$ 128	$ 131	$ 134	$ 134
Commercial	$ 529	$ 554	$ 554	$ 619	$ 616
Industrial	$ 1,471	$ 1,479	$ 1,551	$ 1,145	$ 1,144
Municipal	$ 1,318	$ 1,350	$ 1,444	$ 2,498	$ 2,391
Housing Authority - GS	$ 158	$ 165	$ 168	$ 172	$ 173
Housing Authority - PHA	$ 991	$ 913	$ 1,060	$ 1,087	$ 1,089
Average Bill Impact					
Non-CRP Residential	**0.8%**	**1.0%**	**0.7%**	**0.4%**	**-1.2%**
Commercial	**0.7%**	**1.0%**	**0.8%**	**0.5%**	**-1.1%**
Industrial	**0.7%**	**0.9%**	**0.8%**	**0.5%**	**-0.9%**
Municipal	**1.1%**	**3.6%**	**3.7%**	**2.3%**	**-2.4%**
Housing Authority - GS	**0.6%**	**0.7%**	**0.4%**	**0.1%**	**-0.9%**
Housing Authority - PHA	**0.6%**	**0.7%**	**0.4%**	**0.1%**	**-0.9%**

Table 13: Rate Impact

	2010-11	2011-12	2012-13	2013-14	2014-15
Rate Impact					
DSM Savings (Mcf)					
Non-CRP Residential	(53)	(184)	(362)	(556)	(622)
Commercial	(4)	(26)	(67)	(119)	(138)
Industrial	0	(0)	(2)	(4)	(5)
Municipal	(0)	(12)	(30)	(48)	(54)
Housing Authority - GS	(0)	(1)	(1)	(2)	(2)
Housing Authority - PHA	(0)	(2)	(3)	(5)	(6)
Average Rate ($/therm)					
Non-CRP Residential	1.90	2.00	2.05	2.11	2.11
Commercial	1.51	1.57	1.60	1.63	1.62
Industrial	1.39	1.44	1.47	1.50	1.49
Municipal	1.12	1.21	1.26	1.29	1.25
Housing Authority - GS	1.77	1.86	1.90	1.95	1.95
Housing Authority - PHA	1.67	1.76	1.80	1.85	1.85
Average Rate Impact					
Non-CRP Residential	**1.0%**	**1.6%**	**2.0%**	**2.3%**	**1.0%**
Commercial	**0.8%**	**1.2%**	**1.5%**	**1.6%**	**0.1%**
Industrial	**0.7%**	**1.0%**	**1.0%**	**0.9%**	**-0.4%**
Municipal	**1.1%**	**4.6%**	**6.1%**	**6.1%**	**1.6%**
Housing Authority - GS	**0.6%**	**0.9%**	**1.0%**	**1.0%**	**0.1%**
Housing Authority - PHA	**0.7%**	**1.0%**	**1.0%**	**1.0%**	**0.0%**

C. Job Creation

Investing in cost-effective energy-efficiency creates jobs in two ways, one direct, and the other indirect. Direct job creation results hiring related to implementing the programs created. Indirect job creation results from the substitution of local capital spent in the local economy rather than sending the capital otherwise spent for natural gas delivered from afar. Several times more jobs are created by the indirect or income effect from cost-effective energy-efficiency investment. The net economic benefits from efficiency investment reduce household and business gas bills and raise household disposable incomes and business profitability. Customers will tend to spend most of this additional money and save the rest. This additional spending creates a "multiplier" effect through the cycle of re-spending of the initial cost savings, which stimulates aggregate demand for goods and services. Satisfying increased demand for goods and services requires more labor. While some of the jobs created leak into the broader U.S. and global economy, a good portion (possibly higher than 80%) of jobs created due to EE stay within the Commonwealth.[5]

The number of jobs created from investments in EE directly relates to the total resource value of the energy that these measures save Studies of employment impacts of DSM

[5] How many of theses jobs would be created within the Philadelphia metro area cannot be stated with precision. Studies show that the number is bound to be substantial. The direct labor requirements for installing the efficiency measures are almost entirely local. The efficiency technologies have significant but unknown local value added. The indirect employment effects depend on how much of the extra spending money generated by gas cost savings gets spent within the local economy. Such issues would require additional research and analysis to quantify the range of likely local job creation.

use energy savings as a surrogate for total resource value. A recent meta-study of U.S. data found that estimates for the number of jobs created range from 9 to 125 for every one trillion Btu (TBtu) saved. Most studies estimate that between 30 and 60 net jobs are created by saving one TBtu (Laitner and McKinney 2008). In New York, New Jersey, and Pennsylvania, the American Council for an Energy Efficient Economy (ACEEE) projected that 164,320 jobs, or 59 for every TBtu saved, could be attributed to EE in 1997 through 2010 (Nadel et al 1997).

PGW estimates that its gas DSM portfolio will generate between 579 and 965[6] net additional jobs over the lifetime of the efficiency measures installed over the next five years. This range is based on assuming that each TBTU of gas savings creates between 30 and 50 full-time equivalent jobs in Pennsylvania.

D. Greenhouse Gas Reductions

Table 14 provides the estimated reduction in carbon dioxide from each of the programs over the next five years.

[6] These estimates do not include the additional jobs created from the electric savings that result from the PGW proposed programs.

Table 14

PHILADELPHIA GAS WORKS
GAS DSM PLAN
GREENHOUSE GAS EMISSION REDUCTIONS

	Emissions Reductions from Gas Savings					
Cumulative Annual CO_2 (Short Tons)	**2010**	**2011**	**2012**	**2013**	**2014**	**Lifetime Reductions**
Comprehensive Residential Heating Retrofit	-	3,011	7,528	13,551	19,574	293,608
Enhanced Low-income Retrofit	-	5,328	10,657	15,985	21,314	319,705
Premium Efficiency Gas Appliances and Heating Equipment	-	2,039	8,158	14,276	20,395	305,920
Commercial and Industrial Equipment Efficiency Upgrades	-	-	208	677	1,301	19,516
Municipal Facilities Comprehensive Efficiency Retrofit	-	-	845	1,691	2,536	38,039
High-Efficiency Construction	-	-	270	946	2,298	34,468
Commercial and Industrial Retrofit	-	-	416	1,353	2,602	39,032
Portfolio Total	-	10,379	28,083	48,479	70,019	1,050,287

	Emissions Reductions from Electricity Savings					
Cumulative Annual CO_2 (Short Tons)	**2010**	**2011**	**2012**	**2013**	**2014**	**Lifetime Reductions**
Comprehensive Residential Heating Retrofit	-	2,988	7,470	13,445	19,421	157,207
Enhanced Low-income Retrofit	-	3,127	6,255	9,382	12,510	99,589
Premium Efficiency Gas Appliances and Heating Equipment	-	-	-	-	-	-
Commercial and Industrial Equipment Efficiency Upgrades	-	-	-	-	-	-
Municipal Facilities Comprehensive Efficiency Retrofit	-	-	-	-	-	-
High-Efficiency Construction	-	-	-	-	-	-
Commercial and Industrial Retrofit	-	-	-	-	-	-
Portfolio Total	-	6,115	13,724	22,827	31,931	256,796

	Emissions Reductions from Gas and Electricity Savings					
Cumulative Annual CO_2 (Short Tons)	**2010**	**2011**	**2012**	**2013**	**2014**	**Lifetime Reductions**
Comprehensive Residential Heating Retrofit	-	5,999	14,998	26,996	38,995	450,815
Enhanced Low-income Retrofit	-	8,456	16,912	25,367	33,823	419,294
Premium Efficiency Gas Appliances and Heating Equipment	-	2,039	8,158	14,276	20,395	305,920
Commercial and Industrial Equipment Efficiency Upgrades	-	-	208	677	1,301	19,516
Municipal Facilities Comprehensive Efficiency Retrofit	-	-	845	1,691	2,536	38,039
High-Efficiency Construction	-	-	270	946	2,298	34,468
Commercial and Industrial Retrofit	-	-	416	1,353	2,602	39,032
Portfolio Total	-	16,494	41,808	71,307	101,950	1,307,083

VI. PGW GAS DSM PROGRAM DESCRIPTIONS

Following are narrative descriptions of each of the seven DSM programs PGW plans to implement over the next five years. Each program description summarizes the target market, efficiency technologies, marketing strategy, delivery and over sight, and participation and savings goals.

The first four programs have more detail due to the earlier start of program activities. The last three programs have less detail since the level of detail required for full-scale launch in 2011 would be premature. Throughout 2011, PGW will work on designing and implementing pilot versions of these programs. The latter two are particularly difficult to characterize in more detail because PGW has yet to work out how the design and implementation of these programs will be integrated and coordinated with other parties.

A. Comprehensive Residential Heating Retrofit (Home Performance with ENERGY STAR™)

A comprehensive retrofit program designed for high-use heating customers, this program utilizes the existing federal Home Performance with ENERGY STAR™ program to identify potential technologies that private contractors then use with customers.

Comprehensive Residential Heating Retrofit					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Customer Incentives	$ -	$ 1,401,356.45	$ 2,102,034.67	$ 2,802,712.89	$ 2,802,712.89
Administration and Management	$ 50,000.00	$ 100,000.00	$ 100,000.00	$ 100,000.00	$ 100,000.00
Marketing and Business Development	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
Contractor Costs	$ -	$ 484,388.28	$ 726,582.42	$ 968,776.56	$ 968,776.56
Inspection and Verification	$ -	$ 43,875.75	$ 52,650.90	$ 52,650.90	$ 35,100.60
On-site Technical Assessment	$ -	$ -	$ -	$ -	$ -
Evaluation	$ -	$ -	$ 75,000.00	$ -	$ 75,000.00
TOTAL:	**$ 100,000.00**	**$ 2,079,620.48**	**$ 3,031,267.99**	**$ 3,974,140.35**	**$ 3,956,590.05**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	57	85	114	114
Cumulative Annual:	-	57	142	256	369

1. Target Market

The Comprehensive Residential Heating Retrofit Program is designed to help residential customers with higher than average gas usage find ways to improve the energy efficiency of their homes. The program targets the 40% of residential customers with the highest annual energy consumption. Using recent consumption data, an eligible home will use 81 MCF per year. Currently, there are 35,107 eligible customer households. After the consumption criteria have been met, all one to four unit owner occupied residences are eligible. For non-owner occupied homes, explicit approval must be obtained from the landlord before an energy audit may be scheduled.

2. Target Measures

The program utilizes an energy audit to address low-cost maintenance issues and identify cost-effective weatherization early-replacements of furnaces and clothes washers. Incentives will be provided on a project level and not at the individual measure level. Please see the Financial Strategies section for more detail on project incentives.

The basis of the program is an energy audit, in which a "core treatment" is administered and further efficiency opportunities are identified at no cost to the customer. The core treatment consists of a walk-through where the auditor will perform basic low-cost treatments and maintenance, including but not limited to:

1. A blower-door test to quantify the amount of air leakage and determine what additional air-sealing measures would be required. These typically include door sweeps, weather stripping and caulking.

2. An examination of the home's HVAC system and the implementation of some low-cost measures such as duct sealing, radiator bleeding repairs, and the installation of radiator reflectors. For furnaces, often a "clean, test, and tune" (CTT) service, including filter replacement, will get the furnace burning efficiently and avoid the need for early replacement.

3. Measures to increase the efficiency of water heating, such as fixing hot water leaks, water heater wrapping, and installing low-flow showerheads and faucet aerators.

4. With the permission of the homeowner, the auditor will replace incandescent light-bulbs with more efficient compact fluorescent lamps (CFLs) at no cost to the customer.

After the walkthrough, the auditor will have a sit down presentation to discuss measures to be installed and their associated savings. The auditor will discuss the customer's energy usage goals, as well as potential benefits to the customer's health, comfort, safety, and quality of life. The auditor will also provide literature on savings tips and any efficiency programs for which the customer may be eligible. Measures that the auditor will test for cost-effectiveness fall into three categories: weatherization, heating system, and hot water usage.

Weatherization efforts, beyond those offered through the core treatment, are mainly focused on increasing roof and attic insulation, although all cost-effective insulation will be explored. Roof repairs will be made where needed to make insulation effective. Implementers will also install an under-porch partition where deemed appropriate. An under-porch partition is an insulated and sealed wall to partition off the section of basement areas that extend underneath the front porch of some homes.

In examining heating systems, two main measures are utilized, the first being set back thermostats. To achieve maximum savings, extensive training is provided along with the installation of the thermostats. In houses with multiple occupants, the thermostat is used to maintain a steady setting, returning to a customer-established baseline ever few hours, rather than the typical set-up/set-back strategy. The program will also target early replacement of heating systems with high-efficiency units. A high-efficiency furnace must have at an Annual Furnace Utilization Efficiency[7] (AFUE) of 85% or higher.

3. Marketing and Outreach

PGW will determine how to best divide marketing efforts and how to utilize network connections to leverage marketing. Both customers and energy service providers such as contractors and material and equipment suppliers will be covered by the plan. Table 15 describes a variety of potential marketing efforts geared towards customer enrollment along with sample market actors.

Table 15: Marketing Efforts to Drive Customer Adoption of Program

Technique	Description	Market Actors
Brochures	Program promotional materials for distribution through various marketing activities. Brochures will be provided in multiple languages.	PGW
Targeted Direct Mailings	Individual letters (separate from bills) addressed to customers with high savings potential.	PGW
Bill Inserts	Inserting program information into the bills of the customers.	PGW
Email Blasts	Standardized emails that are sent to a distribution list. This is a low cost way to reach a large audience	PGW
Website	Program information that is accessible online. In addition, application forms will be available for electronic submission.	PGW
Canvassing	Going door-to-door to get customers to enroll in the program. If customers are not home, promotional program material will be left behind.	PGW

[7] AFUE shows the percentage of fuel energy converted into heat. A higher number indicates less energy consumption for the same amount of heat.

Technique	Description	Market Actors
Seasonal Press Releases	Coordinating awareness with seasonal heating demand.	PGW
Print/Radio Advertising	Promotional spots will include in-language advertisements to target various customer segments.	PGW
Community Events	Participation in local community events with the potential to reach eligible customers. This will usually be done in cooperation with other local/state organizations	PGW and Local/State Government
Cross-promotion	Coordination with other programs, retailers & manufacturers to promote a menu of programs	PGW, Retailers, Manufacturers, and other Organizations
Coordination with Local Agencies	Working with a variety of local agencies to make them aware of the program and to have the agencies encourage their clients to enroll. Potential organizations include those that serve seniors, single-mothers, or provide housing aid.	PGW, Community Development Corporations, and other Non-profit Organizations
Customer Contact	Training customer service representatives to notify customers of their eligibility for the program.	PGW
Telemarketing	Targeting specific customers for contact over the phone and direct solicitation for enrollment in the program.	PGW Sub-contractor

Other efforts will be pursued beyond driving customer enrollment. PGW will work to educate and raise awareness of energy efficiency efforts amongst contractors and suppliers of material and equipment. Potential actions include training sessions and general workshops on installing and servicing energy efficient measures. Through coordination and cooperation, PGW will develop and implement a comprehensive marketing strategy to reach both users and suppliers of energy efficiency services.

4. Delivery and Oversight

A customer contacts PGW. After eligibility has been established, PGW schedules an audit with the customer. The audit consists of a core treatment (described in the Target Measures section), assessment of savings potential, and a discussion of the options with the customer. After the initial audit, PGW negotiates with the customer on measure

options, costs, and incentives. When a package of measures and an acceptable incentive have been agreed upon, the customer is responsible for overseeing the installation of the agreed upon measures. PGW will provide a list of certified contractors and any further assistance as needed. PGW then verifies that the installation was correct and that the customer knows how to use the new equipment before the incentive is paid. As detailed above, most of the customer interaction is handled by a subcontractor, which in turn is overseen by PGW.

PGW selects the subcontractor through a competitive bid process and then trains and works with the subcontractor to market the program, providing customer data as appropriate for determining eligibility and carrying out marketing efforts. PGW also oversees the general program budget. In its role as overseer, PGW will monitor vendor performance and overall program results, including customer satisfaction and market responsiveness. To encourage the subcontractor to seek deeper savings, an incentive will be provided if certain savings goals are exceeded. If the subcontractor fails to achieve a lower threshold of savings, they will pay a predefined penalty. PGW will independently verify savings through a number of random onsite inspections.

The subcontractor works on marketing and outreach with PGW. They provide the energy audit and oversee the installation of measures and payment of incentives. They also provide their own post-installation inspection and verification of savings. They work together with PGW on raising awareness and training contractors and coordinating with other state and local programs.

5. Financial Strategies

PGW will work with the customer to determine financing options and establish a basis for customer cash flow. Using these projections, PGW will provide an incentive that buys the project down to a two-year simple payback. All CFLs will be offered at no cost to the customer to achieve maximum savings from basic lighting opportunities.

Financing options will be offered through PGW's cooperation with other state and local programs. The most relevant, being the Keystone HELP program, which offers both secured and unsecured, below market rate loans for energy efficiency retrofits to Pennsylvania residents. PGW will work with Keystone HELP to make sure that program requirements align, and that only one energy audit will be required. PGW will also reach out to local banks and credit unions, to put together a range of offers on loans for energy efficiency retrofits.

In the following example, the customer is presented a project that will cost a total of $910. PGW in this case would offer an incentive of $267, leaving $643 for the customer to contribute toward the investment. This is two years' worth of expected bill savings which last 15 years. In conjunction with the financial incentive offer, PGW would help the customer access financing for three years through a source such as Keystone HELP. At an interest rate of 6%, the annual payments on the loan total $235. As shown in the

table below, the customer puts no money down, and enjoys a net positive cash flow of $87, more than a third of the annual cost of servicing the loan.

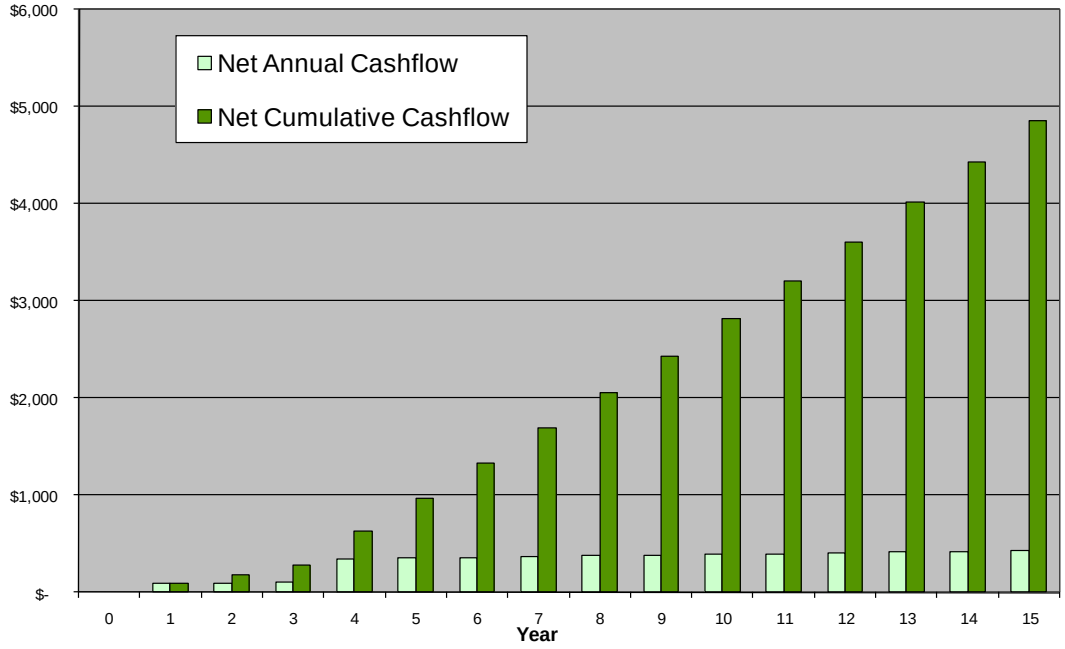
Table 16: Cash Flow from Typical Residential Retrofit Project

Year	Annual Payments (Principal & Interest)	Annual Electric Savings	Annual Natural Gas Savings/ (Costs)	Net Annual Cashflow	Net Cumulative Cashflow
0				**$ -**	**$ -**
1	$ (235)	$ 17	$ 305	**$ 87**	**$ 87**
2	$ (235)	$ 17	$ 311	**$ 93**	**$ 179**
3	$ (235)	$ 17	$ 317	**$ 100**	**$ 279**
4	0	$ 18	$ 323	**$ 341**	**$ 620**
5	0	$ 18	$ 330	**$ 348**	**$ 968**
6	0	$ 18	$ 336	**$ 355**	**$ 1,322**
7	0	$ 19	$ 343	**$ 362**	**$ 1,684**
8	0	$ 19	$ 350	**$ 369**	**$ 2,053**
9	0	$ 20	$ 357	**$ 376**	**$ 2,430**
10	0	$ 20	$ 364	**$ 384**	**$ 2,814**
11	0	$ 20	$ 371	**$ 392**	**$ 3,205**
12	0	$ 21	$ 379	**$ 399**	**$ 3,605**
13	0	$ 21	$ 386	**$ 407**	**$ 4,012**
14	0	$ 22	$ 394	**$ 416**	**$ 4,428**
15	0	$ 22	$ 402	**$ 424**	**$ 4,851**

The following figure is a graphical representation of the customer's cash flow over the lifetime of the installed measures.

Figure 6

Cash Flow



B. Enhanced Low-income Retrofit

The Enhanced Low-income Retrofit Program seeks to provide cost-effective energy savings to low-income customers who participate in PGW's Customer Responsibility Program (CRP). A secondary goal of the program is to reduce the overall long-term cost of the CRP as paid by all firm customers. In general, the program makes the customer's homes more energy efficient and comfortable by:

- Repairing or replacing older and less energy efficiency heating systems
- Providing comprehensive weatherization services
- Educating customers on ways to reduce their energy along with basic health and safety information
- Raising awareness of energy conservation and encouraging the incorporation of energy saving behavior
- Targeting high-use customers to maximize impact and increase cost-effectiveness
- Streamlining the delivery mechanism through implementation contractors

Enhanced Low-income Retrofit					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Customer Incentives	$ -	$ 6,019,695.67	$ 6,019,695.67	$ 6,019,695.67	$ 6,019,695.67
Administration and Management	$ 50,000.00	$ 150,000.00	$ 150,000.00	$ 150,000.00	$ 150,000.00
Marketing and Business Development	$ -	$ -	$ -	$ -	$ -
Contractor Costs	$ -	$ 529,158.24	$ 529,158.24	$ 529,158.24	$ 529,158.24
Inspection and Verification	$ -	$ 9,586.20	$ 9,586.20	$ 9,586.20	$ 9,586.20
On-site Technical Assessment	$ -	$ -	$ -	$ -	$ -
Evaluation	$ -	$ 75,000.00	$ -	$ 75,000.00	$ -
TOTAL:	**$ 50,000.00**	**$ 6,783,440.11**	**$ 6,708,440.11**	**$ 6,783,440.11**	**$ 6,708,440.11**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	101	101	101	101
Cumulative Annual:	-	101	201	302	402

1. Target Market

Any customer participating in PGW's Customer Responsibility Program (CRP) is eligible for participation in the Enhanced Low-income Retrofit Program. Started in 1990, the CRP is a low-income payment assistance program available to any residential customer with gross household income at or below 150% of the federal poverty level (FPL). Participants pay a fixed percentage of their income (between 8 and 10 percent) to maintain gas service[8]. To be considered for the Enhance Low-income Retrofit Program, customers must be 1) an owner occupied one to four residential dwelling units OR 2) renters who pay for their own natural gas heat and have a natural gas account in their name.

To effectively utilize the programs resources, PGW will specifically target customers that have been identified as heavier users of natural gas. In a previous pilot program, PGW has found that targeting high use customers produces larger savings at a lower marginal cost[9]. By targeting higher use customers PGW can increase the program cost-effectiveness and have a greater impact on reducing the cost of the CRP on ratepayers.

2. Delivery and Oversight

Customer eligibility requirements are met through participation in the CRP. PGW encourages enrollment in the program through direct mailing, telemarketing, bill inserts, public relations, and community outreach (please see the Marketing Strategies section for further detail). The low income retrofit program offers the same energy efficiency services that the Comprehensive Residential Heating Retrofit Program offers, but at no cost to the customer. This leads to a slight difference in procedure.

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[8] *Universal Service and Energy Conservation Plan – 2008 to 2010*. Philadelphia Gas Works. June 1, 2007.

[9] See conclusions from Blasnik, Michael. *Philadelphia Gas Works' Conservation Works Program Calender Year 2006 and Comprehensive Treatment Pilot*. M. Blasnik & Associates: November 19, 2008.

The subcontractor performs an energy audit and identifies all cost-effective measures. With the permission of the customer, the subcontractor oversees measure installation by certified contractors. The subcontractor then verifies installation and pays the contractor. PGW will process payments to the subcontractor and undertake a number of random inspections to (1) ensure that measures have been correctly installed and savings are being achieved, (2) guarantee that program guidelines have been met, and (3) collect customer feedback.

3. Target Measures

The measures offered through the Enhanced Low Income Program are identical to the options offered through the Comprehensive Residential Heating Retrofit Program. Available measures include comprehensive weatherization efforts such as air sealing and added insulation as well as heating system replacement and low-flow showerheads and aerators for faucets. Education is particularly import within the low income program, and Energy Auditors will have a "kitchen table" discussion on energy saving tips, proper care and maintenance, health and safety information, and the benefits from the various measures.

4. Marketing and Outreach

In marketing the Enhanced Low Income Program, PGW will determine a comprehensive marketing approach. Marketing efforts will focus on specific subgroups to drive participation. High use customers will be targeted since they provide the greatest potential for savings and net benefits. Efforts will be made to reach all participants in the CRP through direct mailings, bill inserts, and email blasts. The Marketing and Outreach section of the Comprehensive Residential Heating Retrofit Program contains a comprehensive list of marketing activities.

Strategies that are specifically designed for the Enhanced Low Income Program include 1) Targeted mailings of high usage customers 2) Bill inserts for all CRP participants 3) Outreach to organizations serving the same target market 4) Door-to-door canvassing in under-utilized neighborhoods and 5) Telemarketing efforts focused on the highest usage customers. Since eligibility for the program is achieved through participation in the CRP, participants who have online account access will be able to enroll in the program directly through their online customer portal. After submitting a request, the program administrator will contact the customer to schedule an energy audit.

5. Financial Strategies

All cost-effective efficiency measures are installed at no cost to the customer. This drives higher participation levels, which in turn leads to higher net-benefits and a reduction in the overall long-term cost of the CRP for rate payers.

C. Premium Efficiency Gas Appliances and Heating Equipment

This program works to promote the selection of residential-sized efficient gas appliances and heating equipment at the time of purchase and ultimately to transform the market to shift to the high-efficiency options.

Premium Efficiency Gas Appliances and Heating Equipment					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Customer Incentives	$ -	$ 472,953.66	$ 1,418,860.98	$ 1,418,860.98	$ 1,418,860.98
Administration and Management	$ 50,000.00	$ 100,000.00	$ 100,000.00	$ 100,000.00	$ 100,000.00
Marketing and Business Development	$ 50,000.00	$ 75,000.00	$ 75,000.00	$ 75,000.00	$ 75,000.00
Inspection and Verification	$ -	$ 11,317.60	$ 33,952.80	$ 33,952.80	$ 33,952.80
Evaluation	$ -	$ -	$ 75,000.00	$ -	$ 75,000.00
TOTAL:	**$ 100,000.00**	**$ 659,271.26**	**$ 1,702,813.78**	**$ 1,627,813.78**	**$ 1,702,813.78**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	38	115	115	115
Cumulative Annual:	-	38	154	269	385

1. Target Market

This program targets residential and small commercial customers making purchases of gas appliances and heating equipment.

2. Delivery and Oversight

As the program administrator PGW will provide retailer support and broad-based marketing as well as set up the system for providing rebates to customers purchasing the high-efficiency equipment. PGW will investigate opportunities to coordinate with other programs targeting this market. The program budget provides funding for outside technical assistance contractors to assist PGW management in working with other entities and market actors.

3. Target Measures

Measures in the program include high-efficiency furnaces, high-efficiency water heaters, and high-efficiency clothes washers. The following table shows a list of efficient measures and their incentives.

Table 17

Residential Efficienct Equipment Incentives		
Measure	**Minimum Efficiency**	**Rebate**
Tankless Water Heaters (w/ electronic ignition)	EF = 80	$ 150.00
Tankless Water Heaters (w/ electronic ignition)	EF = 82	$ 300.00
Storage Tank (min 40 gallons)	N/A	$ 50.00
Natural Gas Furnace	AFUE = 92	$ 200.00
Natural Gas Furnace	AFUE = 92 / ECM driving fan	$ 400.00
Natural Gas Water Boiler(w/ electronic ignition)	.82 AFUE	$ 200.00
Natural Gas Water Boiler(w/ electronic ignition)	.85 AFUE	$ 500.00
Natural Gas Water Boiler(w/ electronic ignition)	.90 AFUE	$ 1,000.00
Programmable Thermostat	N/A	$ 25.00

4. Marketing and Outreach

PGW will work with equipment manufacturers, distributors, and retailers/vendors to make the high-efficiency equipment available for purchase. Engineers and contractors will be encouraged to recommend or specify the choice of high-efficiency equipment to customers making purchases of gas appliances and heating equipment.

5. Financial Strategies

Financial incentives covering 80% of the incremental cost of premium-efficiency equipment will be offered to customers to help offset the barriers that the higher cost of the more efficient equipment often pose.

D. Commercial and Industrial Equipment Efficiency Upgrades

This program works to promote the selection of commercial and industrial efficient gas heating and process equipment at the time of new installation or scheduled replacement and ultimately to transform the market to shift to the high-efficiency options.

Commercial and industrial equipment efficiency upgrades					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Customer Incentives	$ -	$ -	$ 120,415.79	$ 270,935.52	$ 361,247.36
Customer Incentives	$ -	$ 75,000.00	$ 100,000.00	$ 100,000.00	$ 100,000.00
Direct Implementation:	$ -	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
Evaluation:	$ -	$ -	$ 4,324.67	$ 9,730.50	$ 12,974.00
	$ -	$ -	$ -	$ 75,000.00	$ -
TOTAL:	**$ -**	**$ 125,000.00**	**$ 274,740.45**	**$ 505,666.02**	**$ 524,221.36**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	-	4	9	12
Cumulative Annual:	-	-	4	13	25

1. Target Market

This program targets commercial and industrial customers planning on the installation or replacement of gas heating or process equipment.

2. Delivery and Oversight

As the program administrator, PGW will provide retailer support and broad-based marketing as well as set up the system for providing rebates to customers purchasing the high-efficiency equipment. PGW will investigate opportunities to coordinate with other programs targeting this market. As with the residential equipment program, PGW has budgeted funds for engaging outside technical assistance contractors to help work with other entities and market actors.

3. Target Measures

Measures in the program include high-efficiency furnaces, space heating boilers, water heaters, process boilers, pool heaters, cooking equipment and commercial clothes washers.

The following table shows a list of measures along with their incentives

Table 18

Commercial & Industrial Equipment and Efficiency Measure Incentives			
Measure	**Minimum Efficiency**	**Rebate**	**Limits**
Programmable Thermostat	N/A	$ 25.00	Limit 5
Boiler Reset Control (1 Stage)	N/A	$ 150.00	Limit 2
Boiler Reset Control (2 Stage)	N/A	$ 250.00	Limit 2
Roof Insulation	R-19	20% of installed cost	Maximum $10,000
Roof Insulation	R-30	20% of installed cost	Maximum $10,000
Wall Insulation	BCR greater than 1.0 using TRC	20% of installed cost	Maximum $10,000
Floor Insulation	BCR greater than 1.0 using TRC	20% of installed cost	Maximum $10,000
Pipe Insulation	BCR greater than 1.0 using TRC	$1.50/linear foot	Limit 500 linear feet
Duct Insulation	BCR greater than 1.0 using TRC	$1.50/linear foot	Limit 500 linear feet
Windows	BCR greater than 1.0 using TRC	$1.00/sq foot	Limit 2,500 sq feet
Natural Gas Furnace	AFUE = 90	$ 500.00	N/A
Natural Gas Furnace	AFUE = 92	$ 500.00	N/A
Natural Gas Furnace	AFUE = 92 / ECM driving fan	$ 700.00	N/A
Natural Gas Furnace	AFUE = 94 / ECM driving fan	$ 900.00	N/A
Natural Gas Furnace	AFUE = 95 / ECM driving fan	$ 900.00	N/A
Natural Gas Water Boiler(w/ electronic ignition)	AFUE = 85	$ 800.00	N/A
Natural Gas Water Boiler(w/ electronic ignition)	AFUE = 90	$ 1,200.00	N/A
Natarual Gas Steam Boiler	AFUE = 82	$ 800.00	N/A
Indirect Water Heater	N/A	$ 300.00	N/A

4. Marketing and Outreach

PGW will work with equipment manufacturers, distributors, and retailers/vendors to make the high-efficiency equipment available for purchase. Engineers and contractors will be encouraged to recommend or specify the choice of high-efficiency equipment to customers installing gas heating and process equipment.

5. Financial Strategies

Financial incentives covering 80% of the incremental cost of premium-efficiency equipment will be offered to customers to help offset the barriers that the higher cost of the more efficient equipment often poses.

E. Municipal Facilities Comprehensive Efficiency Retrofit

PGW plans a comprehensive retrofit program designed for municipal facilities. This program utilizes energy-service contractors to identify and install cost-effective energy-saving technologies.

Municipal Facilities Comprehensive Efficiency Retrofit					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Administration and Management	$ -	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
Inspection and Verification	$ -	$ -	$ 1,539.00	$ 1,539.00	$ 1,539.00
On-site Technical Assessment	$ -	$ -	$ 615,600.00	$ 615,600.00	$ 615,600.00
TOTAL:	**$ -**	**$ 50,000.00**	**$ 667,139.00**	**$ 667,139.00**	**$ 667,139.00**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	-	16	16	16
Cumulative Annual:	-	-	16	32	48

1. Target Market

This program targets facilities owned and/or operated by the City of Philadelphia. These include a wide range of buildings, including schools, office buildings, and public housing.

2. Delivery and Oversight

PGW will select energy-service contractors through competitive bid and provide random inspections to verify that work was done and savings are being achieved. PGW will also provide assistance with engineering and economic assessment of retrofit efficiency options and coordination with participation in other programs. PGW will investigate opportunities to coordinate with other programs targeting this market. In particular, PGW will help the City undertake the technical and economic assessments required to qualify for financial incentives offered by PECO's nonresidential electric DSM program.

3. Target Measures

Potential measures in the program include high-efficiency furnaces, space heating boilers, water heaters, HVAC controls and shell improvements. PGW will also actively seek to identify and quantify the costs and performance of electric efficiency measures qualifying for financial incentives under PECO's DSM program. These will include lighting, HVAC, and motors and drives.

4. Marketing and Outreach

Facility managers, department heads, and financial officers will be asked to allow private energy-service contractors to conduct audits of their facilities and identify cost-effective energy-saving retrofit opportunities.

5. Financial Strategies

Financing advice will be offered for cost-effective gas-saving measures. In particular, PGW will assist the City with analysis of efficiency investment financial performance in the order to qualify for federal funding or to access either traditional or nontraditional financing facilities.

F. High-efficiency Construction

A comprehensive program designed for new construction, remodeling, and renovation efficiency improvements for residential and commercial buildings. This program seeks to transform the market so that energy-efficient design and construction becomes standard practice.

High-efficiency Construction					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Customer Incentives	$ -	$ -	$ 208,502.83	$ 521,257.09	$ 1,042,514.17
Administration and Management	$ -	$ 75,000.00	$ 75,000.00	$ 75,000.00	$ 75,000.00
Marketing and Business Development	$ -	$ 50,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
Inspection and Verification	$ -	$ -	$ 8,497.56	$ 21,243.89	$ 42,487.78
Evaluation	$ -	$ -	$ -	$ -	$ 75,000.00
TOTAL:	**$ -**	**$ 125,000.00**	**$ 342,000.39**	**$ 667,500.98**	**$ 1,210,001.95**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	-	5	13	26
Cumulative Annual:	-	-	5	18	43

1. Target Market

This program targets residential and commercial customers engaged in new construction, remodeling, and renovation of their buildings.

2. Delivery and Oversight

PGW will provide support for and financial assistance to those involved with new construction, remodeling, and renovation projects. PGW will also provide assistance with engineering and economic assessment of the proposed efficiency options. PGW will investigate opportunities to coordinate with other programs targeting this market.

3. Target Measures

Potential measures in the program include high-efficiency furnaces, space heating boilers, water heaters, HVAC controls, insulation and window upgrades.

4. Market Actors and Technologies

This program seeks to affect the energy-efficiency decisions by the parties involved with new construction, remodeling, and renovation, such as property developers, property managers, home or building owners, real estate agents, architects, engineers, builders, and contractors.

5. Financial Strategies

Financial incentives covering 80% of the incremental cost of high-efficiency equipment will be offered to customers to help offset the barriers that the higher cost of the more

efficient equipment often pose. This also includes the costs for comprehensive design assistance from architects and engineers.

G. Commercial and Industrial Retrofit

A comprehensive retrofit program designed for commercial and industrial facilities, this program promotes the installation of a wide array of cost-effective energy-saving technologies.

Commercial and Industrial Retrofit					
	2010	2011	2012	2013	2014
COSTS (2009$)					
Customer Incentives	$ -	$ -	$ 107,036.26	$ 240,831.58	$ 321,108.77
Administration and Management	$ -	$ 50,000.00	$ 75,000.00	$ 75,000.00	$ 75,000.00
Marketing and Business Development	$ -	$ 25,000.00	$ 50,000.00	$ 50,000.00	$ 50,000.00
Inspection and Verification	$ -	$ -	$ 4,324.67	$ 9,730.50	$ 12,974.00
Evaluation	$ -	$ -	$ -	$ 75,000.00	$ -
TOTAL:	**$ -**	**$ 75,000.00**	**$ 236,360.92**	**$ 375,562.08**	**$ 459,082.77**
GAS SAVINGS (BBtu)					
Annual Incremental:	-	-	8	18	24
Cumulative Annual:	-	-	8	26	49

1. Target Market

This program targets commercial and industrial facilities.

2. Delivery and Oversight

PGW will provide support and financial assistance for customers engaged in comprehensive audits and retrofits of their facilities. PGW will provide random inspections to verify that work was done and savings are being achieved. PGW will also provide assistance with engineering and economic assessment of retrofit efficiency options. PGW will investigate opportunities to coordinate with other programs targeting this market.

3. Target Measures

Potential measures in the program include high-efficiency furnaces, space heating boilers, water heaters, HVAC and process controls, shell improvements, pool heaters, cooking equipment, process boilers, and process optimization.

4. Market Actors and Technologies

This program will seek to convince Facility managers, department heads, and financial officers to conduct audits of their facilities and identify cost-effective energy-saving retrofit opportunities.

5. Financial Strategies

Customized incentives will be offered based on payback buydown and customer cash flow, including electric and other resource savings.

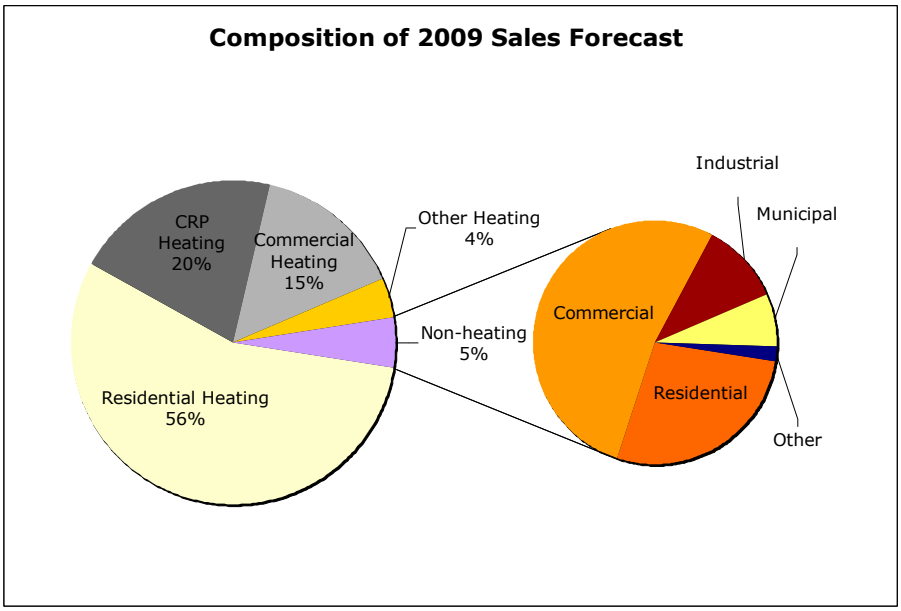
VII. ASSUMPTIONS AND CALCULATIONS

This section provides additional information on the assumptions and calculations PGW used to estimate energy, economic, and environmental impacts. A working electronic version of the cost-effectiveness calculator used to prepare these results is available.

A. Customers and Sales

PGW estimated the number of eligible customers in each market addressed by its DSM portfolios. Figure 7 summarizes the contributions of various customer groups to total gas energy requirements.

Figure 7



The PGW DSM programs are all directed at firm heating customers. Table 19 provides the sales and customer forecast for various heating customers in 2009.

Table 19
PHILADELPHIA GAS WORKS

	Forecast Budget 2009				
	Number of Customer Billings for February		Gas Sales		Gas Sales per Customer
Non-heating					
Residential	35,107		699,037		20
CRP	1,115		47,419		43
Commercial	5,158		1,339,896		260
Industrial	211		278,908		1,322
Municipal	106		177,030		1,670
NGV Firm	1		327		327
Total Firm Non-heating	**41,698**		**2,542,617**		61
Heating					
Residential	351,006	77.5%	28,409,135	58.5%	81
CRP	79,885	17.6%	10,472,516	21.6%	131
Housing Authority - GS	2,047	0.5%	222,184	0.5%	109
Commercial	18,582	4.1%	7,703,575	15.9%	415
Industrial	499	0.1%	477,416	1.0%	957
Municipal	380	0.1%	656,349	1.4%	1,727
Housing Authority - PHA	804	0.2%	636,815	1.3%	792
Total Firm Heating	**453,203**	100.0%	**48,577,990**	100.0%	107
Total Firm		**494,901**		**51,120,607**	**103**
Heating share of total firm		92%		95%	
Source	SR 12		SR11		

B. Program Inputs

PGW estimated program costs and savings based on a variety of sources. The two residential retrofit programs comprise the large majority of spending and savings. These estimates are grounded in PGW's experience with its low-income program. Based on evaluated results, PGW projected per-customer savings and costs assuming continued improvement in past performance, especially as the program is targeted to high-use customers in both the low-income and non-low income programs.

Savings projections for other programs are less robust compared to the residential retrofit programs. Costs and savings assumptions for efficiency measures in other markets are based on experience and plans of other utilities. PGW's estimated administration costs are based on judgment. The detailed work plans PGW plans to file prior to initiating any of its plans will contain updated estimates for these elements.

Table 20 presents detailed assumptions on customer acceptance rates and program costs and savings inputs.

Table 20

PHILADELPHIA GAS WORKS
Five Year Gas Demand-Side Management Plan
PROGRAM INPUTS

							Staging % of Maximum Customer Participation in Year								Per-customer Financial Incentive	
	5 years															
PROGRAM	Total Eligible Customers	Annual Pace	Annual Customers Eligible	Applicability/ Feasibility	Acceptance Rate	Maximum Annual Customer Participation	2010	2011	2012	2013	2014	Per-Customer Gas Savings	Per-Customer Gas Usage (MCF)	Installed or Incremental Cost per MCF/yr	%	$/MCF/yr
Comprehensive Residential Heating Retrofit	351,006	5%	17,550	80%	50%	7,020		50%	75%	100%	100%	20%	81	$ 56.22	33%	$ 18.74
Enhanced Low-income Retrofit	79,885	7%	5,326	90%	80%	3,834		100%	100%	100%	100%	20%	131	$ 56.22	100%	$ 56.22
Premium Efficiency Gas Appliances and Heating Equipment	452,704	5%	22,635	90%	67%	13,581		33%	100%	100%	100%	8%	106	$ 12.29	100%	$ 12.29
Commercial and industrial equipment efficiency upgrades	19,461	5%	973	80%	67%	519			33%	75%	100%	5%	454	$ 40.88	75%	$ 30.66
Municipal Facilities Comprehensive Efficiency Retrofit	380	20%	76	90%	90%	62			100%	100%	100%	15%	1,727	$ 40.88	0%	$ -
High-efficiency Construction	22,660	1%	4,532	50%	75%	1,700			20%	50%	100%	20%	75	$ 40.88	100%	$ 40.88
Commercial and Industrial Retrofit	19,461	7%	1,297	60%	67%	519			33%	75%	100%	10%	454	$ 40.88	33%	$ 13.63

C. Measure Inputs

Table 21 provides additional information used to characterize the efficiency measures analyzed.

Table 21

MEASURE INPUTS (Program Year 1, 2010)
24-Nov-09 14:16
Portfolio

					Electricity Savings							Operation and Maintenance Costs		Utility Customer Incentives	
					Natural Gas Savings		Energy	Capacity				Baseline Equipment Components/Maintenance			
					Usage				Coincidence Factors						
Measure Name	Program ID (e.g., A or B)	Measure Life (years)		Incremental Installed Cost or Full Cost for Retrofit (2009$)	1 = NG Base 2 = NG Space Heat 3 = NG DHW 4 = NG User Defined 5 = NG User Defined	Natural Gas Saved (MMBtu/yr)	Annual kWh Saved	Maximum Load Reduction (kW)	Summer GenerationCapacity (% of Maximum)	Winter Gener. Capacity (% of Maximum)	Transm. Capacity (% of Maximum)	Distribution Capacity (% of Maximum)	Component 1 Life (years)	Component 1 Replacement Cost (2009$)	Electric Utility Customer Incentive (2009$)	Gas Utility Customer Incentive (2009$)
[0]	[1]	[2]		[4]	[5]	[6]	[7]	[12]	[13]	[14]	[15]	[16]	[29]	[30]	[37]	[38]
Comprehensive Residential Heating Retrofit	A	15		$910	2	16.19	167	0.278	70%	0%	70%	70%				$303
CFL direct install	A	6.5		$9.59			63	0.054	8%	30%	8%	8%	0.86	$0.50		$9.59
Enhanced Low-income Retrofit	B	15		$1,474	2	26.22	134	0.223	70%	0%	70%	70%				$1,474
CFL direct install	B	6.48		$9.59			63	0.054	8%	30%	8%	8%	0.86	$0.50		$9.59
Premium Efficiency Gas Appliances and Heating Equipme	C	15		$104	3	8.50										$104
Commercial and Industrial Equipment Efficiency Upgrades	D	15		$928	3	22.71										$696
Municipal Facilities Comprehensive Efficiency Retrofit	E	15		$10,591	2	259.09										$0
High-Efficiency Construction	F	15		$613	2	15.01										$613
Commercial and Industrial Retrofit	G	15		$1,856	3	45.41										$619

D. Penetration

Table 22 indicates the annual number of measures installed in each program in each year. Note that the CFL direct install numbers refers to the number of CFL lamps.

Table 22

Program Year	1	2	3	4	5
Year	2010	2011	2012	2013	2014
In Program Penetration					
Comprehensive Residential Heating Retrofit	0	3,510	5,265	7,020	7,020
CFL direct install	0	35,101	52,651	70,201	70,201
Enhanced Low-income Retrofit	0	3,834	3,834	3,834	3,834
CFL direct install	0	38,345	38,345	38,345	38,345
Premium Efficiency Gas Appliances and Heating Equip	0	4,527	13,581	13,581	13,581
Commercial and Industrial Equipment Efficiency Upgrad	0	0	173	389	519
Municipal Facilities Comprehensive Efficiency Retrofit	0	0	62	62	62
High-Efficiency Construction	0	0	340	850	1,700
Commercial and Industrial Retrofit	0	0	173	389	519

E. Energy Savings

Table 23 provides a year-by-year breakdown of electricity and gas savings by program.

Table 23

Year:	Total	2010	2011	2012	2013	2014
Portfolio						
Incremental annual MWh Saved (Net at meter)		0	5,730	7,130	8,530	8,530
Incremental annual MWh Saved (In prog, at meter)		0	5,730	7,130	8,530	8,530
Cumulative annual MWh Saved (Net, at meter)		0	5,730	12,860	21,390	29,920
Cumulative annual MWh Saved (Net, at gen.)		0	6,647	14,918	24,812	34,707
Incremental annual Summer kW Saved (Net at meter)		0	1,598	2,016	2,433	2,433
Incremental annual Summer kW Saved (In prog, at meter)		0	1,598	2,016	2,433	2,433
Cumulative annual Summer kW Saved (Net, at meter)		0	1,598	3,614	6,048	8,481
Cumulative annual Summer kW Saved (Net, at gen.)		0	1,854	4,192	7,015	9,838
Incremental annual BBtu Gas Saved (Net)		0	196	334	385	406
Incremental annual BBtu Saved (In prog)		0	196	334	385	406
Cumulative annual BBtu Saved (Net)		0	196	530	915	1,321
Lifetime BBtu Saved (Net)	**19,817**	0	2,938	5,011	5,772	6,096
Comprehensive Residential Heating Retrofit Program Tot						
Incremental annual MWh Saved (Net at meter)		0	2800	4200	5599	5599
Incremental annual MWh Saved (In prog, at meter)		0	2800	4200	5599	5599
Cumulative annual MWh Saved (Net, at meter)		0	2800	6999	12599	18198
Cumulative annual MWh Saved (Net, at gen.)		0	3248	8119	14614	21110
Incremental annual Summer kW Saved (Net at meter)		0	835	1253	1670	1670
Incremental annual Summer kW Saved (In prog, at meter)		0	835	1253	1670	1670
Cumulative annual Summer kW Saved (Net, at meter)		0	835	2088	3758	5429
Cumulative annual Summer kW Saved (Net, at gen.)		0	969	2422	4360	6297
Incremental annual BBtu Gas Saved (Net)		0	57	85	114	114
Incremental annual BBtu Saved (In prog)		0	57	85	114	114
Cumulative annual BBtu Saved (Net)		0	57	142	256	369
Lifetime BBtu Saved (Net)	**5,540**	0	852	1278	1705	1705
Enhanced Low-income Retrofit Program Total						
Incremental annual MWh Saved (Net at meter)		0	2930	2930	2930	2930
Incremental annual MWh Saved (In prog, at meter)		0	2930	2930	2930	2930
Cumulative annual MWh Saved (Net, at meter)		0	2930	5861	8791	11722
Cumulative annual MWh Saved (Net, at gen.)		0	3399	6799	10198	13597
Incremental annual Summer kW Saved (Net at meter)		0	763	763	763	763
Incremental annual Summer kW Saved (In prog, at meter)		0	763	763	763	763
Cumulative annual Summer kW Saved (Net, at meter)		0	763	1526	2289	3052
Cumulative annual Summer kW Saved (Net, at gen.)		0	885	1770	2655	3541
Incremental annual BBtu Gas Saved (Net)		0	101	101	101	101
Incremental annual BBtu Saved (In prog)		0	101	101	101	101
Cumulative annual BBtu Saved (Net)		0	101	201	302	402
Lifetime BBtu Saved (Net)	**6,032**	0	1508	1508	1508	1508
Premium Efficiency Gas Appliances and Heating Equipm						
Incremental annual BBtu Gas Saved (Net)		0	38	115	115	115
Incremental annual BBtu Saved (In prog)		0	38	115	115	115
Cumulative annual BBtu Saved (Net)		0	38	154	269	385
Lifetime BBtu Saved (Net)	**5,772**	0	577	1732	1732	1732
Commercial and Industrial Equipment Efficiency Upgrade						
Incremental annual BBtu Saved (In prog)		0	0	4	9	12
Cumulative annual BBtu Saved (Net)		0	0	4	13	25
Lifetime BBtu Saved (Net)	**368**	0	0	59	133	177
Municipal Facilities Comprehensive Efficiency Retrofit Pr						
Incremental annual BBtu Gas Saved (Net)		0	0	16	16	16
Incremental annual BBtu Saved (In prog)		0	0	16	16	16
Cumulative annual BBtu Saved (Net)		0	0	16	32	48
Lifetime BBtu Saved (Net)	**718**	0	0	239	239	239
High-Efficiency Construction Program Total						
Incremental annual BBtu Gas Saved (Net)		0	0	5	13	26
Incremental annual BBtu Saved (In prog)		0	0	5	13	26
Cumulative annual BBtu Saved (Net)		0	0	5	18	43
Lifetime BBtu Saved (Net)	**650**	0	0	77	191	383
Commercial and Industrial Retrofit Program Total						
Incremental annual BBtu Gas Saved (Net)		0	0	8	18	24
Incremental annual BBtu Saved (In prog)		0	0	8	18	24
Cumulative annual BBtu Saved (Net)		0	0	8	26	49
Lifetime BBtu Saved (Net)	**736**	0	0	118	265	353

F. Avoided Costs

The economic evaluation of an energy-efficiency measure requires an estimate of the measure's benefits. The major benefit of gas energy-efficiency programs is the reduction of gas use and associated costs to customers. Those avoided costs may be passed on to customers by the utility, third-party suppliers, or both, but they are all eventually paid by customers.

Electric avoided costs are often computed for a number of cost drivers, such as summer and winter contribution to system peak load, and seasonal energy use for on- and off-peak periods. In the cost-benefit computation, analysts estimate the effect of a proposed measure or program on each of the cost drivers. The benefit of the energy-efficiency proposal is then estimated by multiplying the energy savings for each cost driver by the per-unit avoided cost for that driver, and adding up the benefits for all the drivers. This approach works well for evaluation of electric energy-efficiency programs, simplifying the costs of serving loads for 8,760 hours to a few cost drivers, which can be estimated for the wide variety of electric end uses (*e.g.*, residential and commercial space heating, space cooling, ventilation, water heating, refrigeration, indoor and outdoor lighting, clothes drying, cooking, computers and other plug loads, as well as a range of industrial loads).

Like most detailed analyses of avoided gas costs, this study's calculation of avoided costs is structured differently than that usually used to estimate electric avoided costs. Planning and procurement for natural gas is primarily concerned with daily loads, rather than annual loads, so there are fewer load shapes. There are also fewer end uses for gas than electricity, since very little gas is used for lighting, refrigeration, or residential air conditioning, and no gas is used for computers or ventilation. Hence, it is feasible to compute avoided costs for the load shapes of the few gas end uses. In the cost-benefit analysis, the benefit of each energy-efficiency measure can be estimated as the measure's annual savings times a single load-specific avoided cost.

This load-shape approach to defining avoided costs allows for distinctions between the costs of different end uses that impose different costs, even for similar seasonal usage levels. An end use that does not vary with weather, such as cooking or clothes drying, may use the same amount of gas in the winter as a heating boiler, but the gas to serve the boiler will be more expensive. The boiler will predictably use more gas on very cold days, when gas is most expensive, and less on mild days, when gas is relatively cheap. Serving the boiler requires the reservation of enough pipeline capacity to meet load on typical cold days, and the construction of local transmission-and-distribution capacity and supplemental gas supplied to meet load on extraordinarily cold days. The boiler will use more gas on cold days, when regional gas demand is high and prices are high. The development of avoided cost by load shape allows for the reflection of these differences between loads even within a season or a month.

This estimate of avoided gas costs comprises the following three parts:

- Commodity: The market prices of gas delivered to a utility's citygate in a normal year
- Peaking capacity: The costs of local capacity to cover the difference between normal and design-peak conditions
- Local transmission and distribution (T&D): The utility's cost of building, operating and maintaining the high-pressure transmission and lower-pressure distribution system in its service area

1. Commodity Cost

We forecast the monthly delivered gas price to the PGW citygate for gas delivered evenly over the month, as the sum of

- The NYMEX forward price for gas delivered to Henry hub for September 2009 through August 2020, plus
- The NYMEX forwards for the price basis from Henry Hub to Transco Zone 6, which includes the PGW citygate, through December 2012. After 2012, we escalate the basis at the same rate as the Henry Hub forward price.[10]

Beyond 2020, we escalate the delivered gas price at an assumed inflation rate of 2%. From these forwards, we computed annual commodity costs for the following three load shapes:

- Baseload, including industrial processes, cooking, and clothes drying, modeled as using the same amount of gas every day.
- Space heating, modeled as using gas each day in proportion to daily heating degree days (HDD).
- Water heating, modeled as a mix of baseload and space-heating load. This approximation reflects the observation that gas usage by water-heating customers rises in the winter months, probably as a combination of higher standby losses and warmer water temperatures for baths, showers and washing.

While gas utilities do not purchase a large portion of their supply in the daily spot market, the short-term market in which utilities can procure gas to meet higher-than-expected load, or sell off gas when their supplies exceed their needs determines the value of the gas. Every dekatherm of gas that a PGW consumer does not use is one more dekatherm that is available to someone in the spot market who is willing to pay the spot price for that gas. Depending on the gas-supply situation and contracts of the utility (or gas supplier), the utility may avoid buying gas from the spot market, or sell more gas into the spot market, or reduce its use of some longer-term contract.

[10] Forward prices are the closing values for April 14, 2009.

In the longer term, annual and multi-year contracts should average near the spot prices for the same time periods. Estimating the effect of specific load reductions on the supply portfolio and costs of any particular utility or gas supplier is complicated, since the calculation would have to model purchases, sales and usage of a variety of gas supplies, pipeline capacity, storage resources, and supplementary resources. This approach would also require non-public data from competitive gas suppliers. The spot-market price is a reasonable estimate of the resource benefit from reduced commodity use.

2. Baseload Commodity

For baseload end uses, where use of gas does not vary with weather or the season, the analysis weights the forecast monthly gas price by the number of days in the month.

3. Space-Heating Commodity

The cost of commodity for space heating varies from the cost of baseload in two ways. First, the amount of gas used varies among months, and is concentrated in the higher-cost winter months. Second, within each month, space heating uses more gas on the colder days, when gas tends to be more expensive than the average for the month.
For the first factor, the monthly percentage the study assumed that the monthly use of gas for space heating is proportional to the monthly sum of daily heating degree days (HDDs). Heating degree days are the difference between the days's average temperature and a base temperature, at which space-heating use is assumed to be zero. That base temperature, or balance point, is lower than the temperature maintained by the thermostat, since the building is warmed by sun shining in the windows and by interior gains (waste heat) from lights, appliances, equipment, and people.

We used the monthly average HDDs with a base of 65° F for 1978–2007 published by NOAA.[11]

The second factor, the effect of the intra-month correlation of price and load, reflects the fact that heating loads use more gas on colder days within each month, and that prices tend to be higher on cold days.[12] This correction was computed as the typical ratio of the heating-load-weighted market price to the average daily price for the month. Since the NYMEX prices are for gas delivered evenly over the month, multiplying that ratio by the NYMEX-based price forecast results in an estimate of the price of gas for heating load in the month.

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[11] "2007 Local Climatological Data: Annual Summary With Comparative Data, Philadelphia, Pennsylvania (KPHL)," National Oceanographic and Atmospheric Administration, ISSN 0198-4535.

[12] The utility or a gas supplier can meet load in those high-load high-priced days with spot purchases, by reserving storage and associated transportation to the citygate, or by reserving additional pipeline capacity directly to the citygate. All these approaches impose costs that would not be needed for a load that was constant across the days of the month.

Of course, gas prices vary due to factors other than the current day's temperature in Philadelphia, including the following:

- Wind and sunshine on that day, since heating load will be higher on a cloudy, windy 40°F day than a sunny calm day with the same air temperature.
- Weather in other parts of North America. A cold snap in California will drive up wellhead prices in Texas and Alberta, and hence prices for deliveries to Pennsylvania. Cold temperatures in New England or New York not only raise wellhead prices, but also market prices for delivery to New York citygates. Conversely, mild weather elsewhere can moderate prices in Philadelphia, even when it is cold in Philadelphia.
- Weather on other days. High gas demand in earlier days of the same month, or in earlier months, will tend to deplete storage and push prices higher. Forecasts of cold weather in coming days and weeks will tend to push up price before the cold front hits, as users scramble to put gas into storage.
- Gas in storage, which depends on the weather, other gas demands over the previous year or so, market participants' guesses regarding price tends, and other factors.
- Demand for gas for electric generation, which varies during the month with oil prices and outages of coal and nuclear plants and between years as load grows and supplies change.
- Gas production capacity, which changes within winter months primarily due to freeze-ups of gas wells in producing areas, but changes significantly between years due to depletion and new additions (and sometimes hurricanes).

For this study, the intra-month price ratio was computed for each calendar month using data for each of the last two gas years, 2006/07 and 2007/08. The analysis computes the ratio of load-weighted to average monthly price for each month.

Equation 1: Intra-Month Heating Price Ratio.

$$\text{intra - month heating price ratio} = \frac{\left[\dfrac{\sum_{month} HD_{day} \times P_{day}}{\sum_{month} HD_{day}}\right]}{\left[\dfrac{\sum_{month} P_{day}}{\#\,\text{days in the month}}\right]}$$

where HD_{day} = heating degree-days for the day

P_{day} = delivered price for the day

The ratios tend to be highest in the winter and close to 1.00 in the shoulder months.

The heating commodity cost for each year is the sum across months of the following product:

NYMEX monthly forward × monthly HDD % × intra-month price ratio

The annual heating commodity cost is significantly greater than the annual baseload commodity cost. The annual residential heating avoided cost, averaged over the period 2006–2025, is 12% greater than average annual baseload price. These differences can largely be explained by the fact that most of the heating usage is in the high-priced months of January, February, and December.

4. Water-Heating Commodity

Based on previous experience, the analysis assumed that water-heating load is similar in shape to 75% baseload and 25% space-heating load. The heating-like shape is probably attributable to a combination of higher standby losses and longer, hotter showers and baths in cold weather.

5. Commodity-Cost Summary

The attached spreadsheet shows avoided commodity costs for the three load shapes. The relationships among the prices for the various load shapes are as expected. The heating cost is higher than the water-heating cost, which is higher than the baseload cost. The average costs of utility gas supplies, which serve large amounts of heating load, tend to be much higher than the flat year-round gas supplies reflected in the baseload commodity costs. The average avoided commodity cost will similarly be more expensive than the avoided commodity cost for a flat year-round gas supply.

6. Peaking Capacity Cost

In addition to buying and delivering the gas required in a normal year, a gas utility must be prepared to meet much higher loads on an extremely cold (design-peak) day.[13] The prices for gas in a normal year do not include the costs of reserving capacity and supplies to meet design-day conditions. Those design loads are normally met by local storage (liquefied natural gas) and/or peaking off-system storage and associated transportation. Based on an estimated cost of capacity of $100/yr/Dth-day for NYSERDA's Seneca storage project, and $90/yr/Dth-day for propane capacity ("Natural Gas Energy Efficiency Resource Development Potential in New York," Mosenthal, et al, NYSERDA, October 31, 2006), we used a value of $100/ yr/Dth-day.

Since baseload has no increment of sendout on the design peak over average conditions, it would not have any peaking capacity charges.

While actual gas-system supply planning is quite complex, the problem was simplified by assuming that peaking capacity is required for the difference between sendout on a design peak day and on the average of the peak day in the two years. PGW's design day is 65

[13] Energy supplies must also be sufficient to meet colder-than-normal weather for days or weeks at a time.

degree days, which was actually experienced on January 17, 1982. The maximum HDDs were 50 in 2007/08 and 48 in 2006/07, for an average of 49 HDD in the two years from which our commodity-cost shapes were adjusted.

7. Avoided T&D Cost

As peak loads grow, local distribution companies need to expand their internal transmission and distribution systems by adding parallel mains, looping, and increasing operating pressures, and increasing the size of new and replacement lines. The expenditures vary across each utility's service area and over time. Typically relatively small increments of load require expensive upgrades, while other load areas have excess capacity for many years resulting in no expansion costs.
Marginal or avoided T&D costs are therefore generally estimated by comparing growth-related costs to peak load growth over a period of several years. Based on estimates from upstate New York utilities, discounted 50% to reflect the expected decline in PGW total load, we used an avoided T&D cost of $50/Dth-day.

G. Program Cost-effectiveness Analysis

The analysis used a discount rate of 5.9%. This is the same discount rate used in present worth calculations in PGW's most recent evaluation of its low-income retrofit program.

The following tables present more detailed information on annual program benefits and costs by year. Table 24 shows each program's incremental contribution to lifetime benefits and costs by year; Table 25 provides the running total of cumulative net benefits by program by year.

Table 24

NPV of Incremental Lifetime Costs and Benefits					
(2009$)					
Program Year:	**1**	**2**	**3**	**4**	**5**
Year:	**2010**	**2011**	**2012**	**2013**	**2014**
Total Resource Test					
Portfolio Total					
Benefits	0	18,904,520	29,075,847	32,416,368	32,760,826
Costs	350,000	10,961,350	14,903,502	16,688,091	16,706,493
Net Benefits	(350,000)	7,943,170	14,172,345	15,728,277	16,054,332
BCR	0.00	1.72	1.95	1.94	1.96
Comprehensive Residential Heating Retrofit Program					
Benefits	0	6,216,920	8,934,524	11,466,386	11,061,274
Costs	100,000	3,740,796	5,342,018	6,632,811	6,385,896
Net Benefits	(100,000)	2,476,123	3,592,506	4,833,575	4,675,378
BCR	0.00	1.66	1.67	1.73	1.73
Enhanced Low-income Retrofit Program					
Benefits	0	9,834,581	9,420,193	9,058,734	8,730,759
Costs	50,000	6,037,530	5,668,619	5,466,089	5,129,025
Net Benefits	(50,000)	3,797,052	3,751,573	3,592,646	3,601,734
BCR	0.00	1.63	1.66	1.66	1.70
Premium Efficiency Gas Appliances and Heating Equipment Program					
Benefits	0	2,853,019	8,201,463	7,879,345	7,585,836
Costs	100,000	608,024	1,478,567	1,336,991	1,349,125
Net Benefits	(100,000)	2,244,995	6,722,895	6,542,354	6,236,711
BCR	0.00	4.69	5.55	5.89	5.62
Commercial and Industrial Equipment Efficiency Upgrades Program					
Benefits	0	0	279,042	603,185	774,287
Costs	0	125,000	289,504	521,933	524,570
Net Benefits	0	(125,000)	(10,462)	81,251	249,718
BCR	n/a	0.00	0.96	1.16	1.48
Municipal Facilities Comprehensive Efficiency Retrofit Program					
Benefits	0	0	1,274,840	1,223,856	1,177,397
Costs	0	50,000	1,216,063	1,185,471	1,156,584
Net Benefits	0	(50,000)	58,777	38,384	20,812
BCR	n/a	0.00	1.05	1.03	1.02
High-Efficiency Construction Program					
Benefits	0	0	407,703	978,493	1,882,698
Costs	0	125,000	309,047	560,659	1,025,128
Net Benefits	0	(125,000)	98,655	417,834	857,570
BCR	n/a	0.00	1.32	1.75	1.84
Commercial and Industrial Retrofit Program					
Benefits	0	0	558,083	1,206,369	1,548,575
Costs	0	75,000	399,683	784,136	861,166
Net Benefits	0	(75,000)	158,400	422,233	687,409
BCR	n/a	0.00	1.40	1.54	1.80

Table 25

NPV of Cumulative Costs and Benefits					
(2009$)					
Program Year:	**1**	**2**	**3**	**4**	**5**
Year:	**2010**	**2011**	**2012**	**2013**	**2014**
Total Resource Test					
Portfolio Total					
Benefits	0	18,904,520	47,980,367	80,396,735	113,157,561
Costs	350,000	11,188,558	25,738,691	41,857,503	57,808,244
Net Benefits	(350,000)	7,715,962	22,241,676	38,539,233	55,349,317
BCR	0.00	1.69	1.86	1.92	1.96
Comprehensive Residential Heating Retrofit Program					
Benefits	0	6,216,920	15,151,444	26,617,829	37,679,103
Costs	100,000	3,802,996	9,036,200	15,483,871	21,617,885
Net Benefits	(100,000)	2,413,923	6,115,243	11,133,958	16,061,218
BCR	0.00	1.63	1.68	1.72	1.74
Enhanced Low-income Retrofit Program					
Benefits	0	9,834,581	19,254,774	28,313,509	37,044,268
Costs	50,000	6,044,966	11,638,956	16,984,338	21,972,192
Net Benefits	(50,000)	3,789,615	7,615,818	11,329,171	15,072,076
BCR	0.00	1.63	1.65	1.67	1.69
Premium Efficiency Gas Appliances and Heating Equipment Program					
Benefits	0	2,853,019	11,054,482	18,933,828	26,519,663
Costs	100,000	697,641	2,145,441	3,449,407	4,740,331
Net Benefits	(100,000)	2,155,379	8,909,042	15,484,420	21,779,332
BCR	0.00	4.09	5.15	5.49	5.59
Commercial and Industrial Equipment Efficiency Upgrades Program					
Benefits	0	0	279,042	882,226	1,656,514
Costs	0	118,034	390,816	875,651	1,366,816
Net Benefits	0	(118,034)	(111,774)	6,575	289,698
BCR	n/a	0.00	0.71	1.01	1.21
Municipal Facilities Comprehensive Efficiency Retrofit Program					
Benefits	0	0	1,274,840	2,498,696	3,676,093
Costs	0	47,213	1,190,989	2,271,021	3,290,862
Net Benefits	0	(47,213)	83,852	227,675	385,230
BCR	n/a	0.00	1.07	1.10	1.12
High-Efficiency Construction Program					
Benefits	0	0	407,703	1,386,196	3,268,894
Costs	0	118,034	412,616	950,162	1,925,587
Net Benefits	0	(118,034)	(4,913)	436,034	1,343,307
BCR	n/a	0.00	0.99	1.46	1.70
Commercial and Industrial Retrofit Program					
Benefits	0	0	558,083	1,764,452	3,313,027
Costs	0	70,820	456,490	1,207,479	2,040,365
Net Benefits	0	(70,820)	101,593	556,973	1,272,662
BCR	n/a	0.00	1.22	1.46	1.62

H. Job Creation

Table 26 presents the range of employment-impact projects for the proposed PGW programs, using a range of jobs created per trillion BTU saved.[14]

Table 26

	JOB CREATION IMPACTS OF GAS EFFICIENCY PORTFOLIO		
	30 Jobs/TBtu	40 Jobs/TBtu	50 Jobs/TBtu
RESIDENTIAL PROGRAMS			
2009	0	0	0
2010	88	118	147
2011	136	181	226
2012	148	198	247
2013	148	198	247
TOTAL	**520**	**694**	**867**
NON-RESIDENTIAL PROGRAMS			
2009	0	0	0
2010	0	0	0
2011	15	20	25
2012	25	33	41
2013	35	46	58
TOTAL	**74**	**99**	**124**
TOTAL PORTFOLIO			
2009	0	0	0
2010	88	118	147
2011	150	200	251
2012	173	231	289
2013	183	244	305
TOTAL	**595**	**793**	**991**

These values were derived based on an extensive review of research on job creation resulting from efficiency and renewable investment. That research is summarized below. Table 21 provides the list of studies reviewed.

What happens to the labor market and job creation when spending on energy efficiency (EE) increases? There are certainly jobs gained in implementing and administering the energy efficiency field. But there are also jobs that would have been created on the energy supply side that never came into existence due to energy efficiency. More importantly, the money that customers save on their energy bill has to go somewhere. To start, we will examine the dynamics of energy efficiency's effects on job creation. Then

[14] This does not include the additional jobs created from the electric savings resulting from PGW's programs.

we will look at some of the estimates that previous studies have provided for net jobs created due to energy efficiency.

The net effect of jobs lost in the energy supply sector and gained in the energy efficiency sector directly due to EE are slightly positive. National Grid's experience in Rhode Island from 1990 to 2005 found that "the jobs gained by increased spending on efficiency are offset by the jobs lost owing to lower spending on supply" (Goodman 2006). While this is good, it does not show the true benefits that come from EE.

The big gains in job creation come from the induced effects of re-spending savings on energy bills. Some studies estimate that the effects account for more than 90% of net job creation (Geller et. al. 1992). An examination of California's energy efficiency drive from 1976 to 2006 found that for every new job foregone in oil, gas, and electric power, 50 new jobs were created in California (Roland-Host 2008).

When customers save money on their energy bills, that money goes somewhere else. Most of it is re-spent in other areas of the economy, with the largest absolute rises in construction, retail trade, and the services industry (Geller et. al. 1992). The stimulation of aggregate demand from re-spending in turn increases aggregate output, a macro-economic "multiplier" effect.

In Michigan, Laitner and Kushler find a large difference in the labor-intensity of sectors with large job gains versus sectors where jobs are lost. They calculate that retail trade creates 19.1 jobs per million dollars of spending, while natural gas distribution creates 2.9 jobs (2007). Since energy supply chains are not that labor intensive, the shift of spending in these sectors to other sectors of the economy increases the multiplier effect on job creation:

> When consumers shift one dollar of demand from electricity to groceries, for example, one dollar is removed from a relatively simple, capital intensive supply chain dominated by electric power generation and carbon fuel delivery. When the dollar goes to groceries, it animates much more job intensive expenditure chains including retailers, wholesalers, food processors, transport, and farming. Moreover, a larger proportion of these supply chains (and particularly services that are the dominant part of expenditure) resides within the state, capturing more job creation from Californians for California. Moreover, the state reduced its energy import dependence, while directing a greater percent of its consumption to in-state economic activities. (Roland-Host 2008).

As Roland-Host points out, large chunk of the re-spending finds its way towards industries that require extensive local infrastructure and jobs, such as construction and retail. Because of this, leakage of labor from the area where EE originates is low. On a state level, Laitner and Kushler estimate that 80% of jobs created due to EE stay in Michigan, and they admit that this number could probably be higher (2007). Not only does EE contribute to a larger and more diverse economy and labor market, most of the benefits are localized.

There have been numerous studies over the past 30 years that examine the impacts of energy efficiency on job creation. If we focus on studies that look within the U.S., we find wide variances in time horizon, efficiency potential, and net job creation. Table 27 summarizes the findings of 48 such studies. Every state and region is unique, but we can develop a framework for comparing studies based on two key statistics.

Table 27: Summary of Past Energy Efficiency Studies

Key Indicator	Low	High	Average
Period of Analysis (Years)	5	26	12
Efficiency Potential (Savings over Reference Case)	6%	33%	23%
Benefit-Cost Ratio of Policy Scenario	1.1	4.8	1.95
Net Jobs Gained per TBtu of Efficiency Gains	9	95	49
Net Impact on GDP (as Percent Change in Ref. Case)	-0.01%	0.60%	0.15%

Source: ACEEE - *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments.* June 2008.

The number of net jobs gained per trillion BTus (TBtu) of efficiency gains gives us a basic rule of thumb for calculating how many jobs a given portfolio of EE programs might create. But how do we know that the portfolio of programs is comparable to these in past studies? The benefit-cost ratio gives an indication, which is independent of the size of spending, for comparing similar portfolios.

The following figure shows each study's net jobs/TBtu against their benefit-cost ratio. Most of the studies fall in the range 20 to 60 jobs/TBtu and a benefit-cost Ratio of 1.5 to 2.5. This cluster of estimates gives a good jumping off point for figuring out an appropriate number of jobs/TBtu to use.

Figure 7

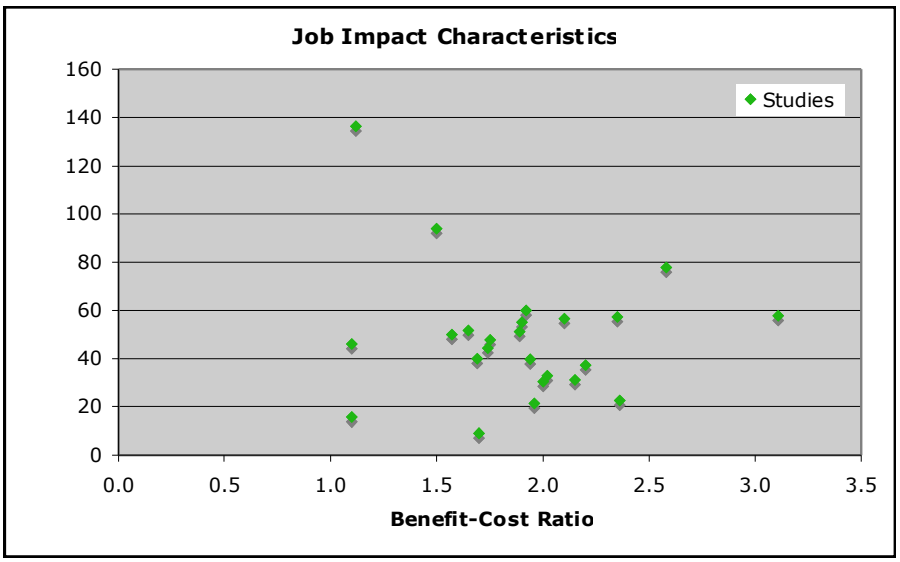

Table 28 gives a detailed breakdown of the findings from 25 studies. The most relevant numbers for Philadelphia come from the 1997 study of the Mid-Atlantic (which includes New York, New Jersey, and Pennsylvania). This study estimated approximately 57 net jobs/TBtu with a portfolio that has a benefit-cost ratio of 2.36, putting it solidly within the cluster of studies previously identified. Putting it another way, "the rise in employment, driven largely by the spending of energy bill savings, is equivalent to the number of jobs supported by the expansion or relocation of 1,095 small manufacturing plants in Mid-Atlantic region" (Nadel et al 1997).

Table 28: Summary Impacts by Region and Year of Analysis

Region	Year	Energy Saved (TBtu)	Benefit-Cost Ratio	Net Jobs	Net Jobs/TBtu
Florida	2007	1,567	1.70	14,264	9
Texas	2007	1,031	2.20	38,291	37
Midwest	1995	4,300	1.75	205,200	48
Michigan	2007	335	2.36	7,506	22
MidAtlantic	1997	2,868	2.35	164,320	57
Texas	1998	976	1.10	45,000	46
Arizona	1997	185	1.92	11,076	60
Colorado	2007	80	1.89	4,100	51
Maryland	1996	278	1.90	15,300	55
Missouri	1995	2	1.57	100	50
Mississippi	2000	49	1.50	4,600	94
Nevada	1997	131	2.02	4,300	33
U.S.	2005	13,737	1.10	215,308	16
Washington	1994	365	1.65	18,800	52
U.S.	2001	37,600	1.96	800,000	21
Wyoming	1997	87	2.15	2,700	31
Colorado	1996	212	1.94	8,400	40
Alabama	1994	266	1.69	10,590	40
Western States	1997	1,303	1.74	57,651	44
Maine	2008	68	2.00	2,070	30
Minnesota	1993	49	2.58	3,810	78
Southwestern States	2002	1,010	3.11	58,400	58
Southeastern States	1996	6,600	1.12	900,000	136
Connecticut	2004	11	2.10	622	57
Study Totals		73,109	1.72	2,592,408	35

Source: ACEEE - *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments.* June 2008.

Energy efficiency's impact on job creation stems mostly from the benefits of decreased energy bills. A customer who would have spent money on energy, instead divert that capital to a diverse range of economic sectors. Most of the sectors that benefit form this re-spending are much more job-intensive than the energy supply sector. Furthermore, the multiplying effect from stimulating aggregate demand adds even more jobs to the economy. For Pennsylvania, reasonable assumptions of 59 jobs per TBTu of efficiency

gains have been estimated. The benefits are clear in California, where energy efficiency "reduced its (California's) energy import dependence and directed a greater percentage of its consumption to instate, employment-intensive goods and services, whose supply chains also largely reside within the state … and facilitate(ed) the economy's transition to a low carbon future" (Roland-Host 2008).

References for Job Creation:

Geller, Howard, John DeCicco, and John A. "Skip" Laitner. 1992. *Energy Efficiency and Job Creation.* Washington, D.C.: American Council for an Energy Efficiency Economy (ACEEE).

Laitner, Skip, John DeCicco, Neal Elliot, Howard Geller, and Marshall Goldberg. 1994. *Energy Efficiency as an Investment in Ohio's Economic Future.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Laitner, Skip, John DeCicco, Neal Elliott, Howard Geller, and Marshall Goldberg, Robert Mowris, and Steven Nadel. 1995. *Energy Efficiency and Economic Development in the Midwest.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Goldberg, Marshall, Martin Kushler, Steven Nadel, Skip Laitner, Neal Elliott, and Martin Thomas. 1998. *Energy Efficiency and Economic Development in Illinois.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Nadel, Steven, Skip Laitner, Marshall Goldberg, Neal Elliott, John DeCicco, Howard Geller, and Robert Mowris. 1997. *Energy Efficiency and Economic Development in New York, New Jersey, and Pennsylvania.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Laitner, Skip, and Martin G. Kushler. December 2007. *More Jobs and Total Wage Income: The Economic Benefits of an Efficiency-Led Clean Energy Strategy to Meet Growing Electricity Needs in Michigan.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Laitner, Skip, and Vanessa McKinney. June 2008. *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Laitner, Skip, and Teresa Galluzo. July 2008. *Energy Efficiency Benefits the Iowa Economy.* Iowa: The Iowa Policy Project.

Ehrahardt-Martinex, Karen, and John A. "Skip" Laitner. May 2008. *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture.* Washington, D.C.: American Council for an Energy Efficiency Economy.

Bezdek, Roger. 2007. *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century*. Boulder, CO: American Solar Energy Society (ASES).

Bezdek, Roger. January 2009. *Green Collar Jobs in the U.S. and Colorado: Economic Drivers for the 21st Century*. Boulder, CO: American Solar Energy Society.

Goodman, Ian. July 2006. *National Grid's Energy Efficiency Programs: Benefits for Rhode Island's Economic Development and Environment*. National Grid USA.

Lehmer, Aaron. 2008. *Renewable Energy Development Creates More Jobs than Fossil Fuels: A Summary of Recent Research.* Oakland, CA: Green for All and the Ella Baker Center for Human Rights.

Roland-Holst, David. October 2008. *Energy Efficiency, Innovation, and Job Creation in California*. Berkeley, CA: Center for Energy, Resources, and Economic Sustainability (CERES) at the University of California Berkeley.

VIII. TECHNICAL APPENDIX

A functioning, self-documented MS Excel workbook containing the cost-effectiveness analysis and the rate and bill analysis is available upon request for easy review.