

Response No. 1-3  
Attachment A

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Montana-Dakota Utilities Co.  
 South Dakota Gas DSM Program Summary  
 2012  
 Benefit/Cost Ratios

Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		1.10	1.62	1.91	3.17	1.17
Furnace (92-94%)	Residential	1.62	3.03	1.81	1.90	1.05
Furnace (95+%)- New	Residential	0.70	0.89	1.24	2.50	0.77
Furnace (95+%)- Replacement	Residential	1.11	1.65	1.95	3.16	1.18
Water Heating (.62 EF)	Residential	0.43	0.52	0.83	2.29	0.52
Water Heating (.67 EF)	Residential	0.72	0.91	1.36	2.67	0.91
Programmable Thermostats	Residential	2.01	4.88	4.27	7.00	2.77
Furnace (92-94%)	Commercial	N/A	N/A	N/A	N/A	N/A
Furnace (95+%)- New	Commercial	N/A	N/A	N/A	N/A	N/A
Furnace (95+%)- Replacement	Commercial	1.73	2.88	3.09	4.09	1.84
Custom Efficiency	Commercial	N/A	N/A	N/A	N/A	N/A

**Montana-Dakota Utilities Co.  
Gas Utility - South Dakota  
Conservation Portfolio Summary  
2012 Program Years**

<b>Programs</b>	<b>2012</b>			Lifetime
	<b>Participants</b>	<b>Cost</b>	<b>Dk Savings</b>	<b>Dk Savings</b>
<b>Residential Program</b>				
Furnaces - 92-94% AFUE	4	\$745	47.2	850
Furnaces - 95+% AFUE - New	26	9,696	184.6	3,323
Furnaces - 95+% AFUE - Repl.	80	29,835	1,048.0	18,864
Water Heating (.62 EF)	3	186	4.2	42
Water Heating (.67 EF)	9	1,119	32.4	324
Programmable Thermostats	53	1,318	153.7	2,306
<b>Total Residential</b>	<b>175</b>	<b>42,899</b>	<b>1,470.1</b>	<b>25,709</b>
<b>Commercial Program</b>				
Furnaces - 92-94% AFUE	0	\$0	0.0	0
Furnaces - 95+% AFUE - New	0	0	0.0	0
Furnaces - 95+% AFUE - Repl.	4	1,492	92.0	1,656
Custom Efficiency	0	0	0.0	0
<b>Total Commercial</b>	<b>4</b>	<b>\$1,492</b>	<b>92.0</b>	<b>1,656</b>
<b>Energy Audit Program Costs</b>		<b>\$500</b>		
<b>Total Programs</b>	<b>179</b>	<b>\$44,891</b>	<b>1,562.1</b>	<b>27,365</b>

**Montana-Dakota Utilities Co.  
Gas Utility - South Dakota  
Conservation Portfolio Summary  
2012 Program Years**

<b>Programs</b>	<b>Total Participants</b>	<b>Total Energy Reduction</b>	<b>Total Cost</b>	<b>Lifetime Cost/Dk</b>
<b>Conservation Programs</b>				
<b>Residential Program</b>				
Furnaces - 92-94% AFUE	4	850	\$745	\$0.88
Furnaces - 95+% AFUE - New	26	3,323	9,696	2.92
Furnaces - 95+% AFUE - Replacement	80	18,864	29,835	1.58
Water Heating (.62 EF)	3	42	186	4.43
Water Heating (.67 EF)	9	324	1,119	3.45
Programmable Thermostats	53	2,306	1,318	0.57
	<u>175</u>	<u>25,709</u>	<u>\$42,899</u>	1.67
<b>Commercial Program</b>				
Furnaces - 92-94% AFUE	0	0	\$0	
Furnaces - 95+% AFUE - New	0	0	0	
Furnaces - 95+% AFUE - Replacement	4	1,656	1,492	0.90
Custom Efficiency	0	0	0	
	<u>4</u>	<u>1,656</u>	<u>\$1,492</u>	0.90
<b>Energy Audit Program Costs</b>			\$500	
<b>Total Programs</b>	<u><u>179</u></u>	<u><u>27,365</u></u>	<u><u>\$44,891</u></u>	\$1.64

**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Total South Dakota Program**  
Program Years: **2012**

Input Data	First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) = Escalation Rate =			
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) = Escalation Rate = Non-Gas Fuel Units (ie. kWh,Gallons, etc) =			
3) Commodity Cost (\$/Dk) = Escalation Rate =			
4) Demand Cost (\$/Unit/Yr) = Escalation Rate =			
5) Peak Reduction Factor =			
6) Variable O&M (\$/Dk) = Escalation Rate =			
7) Non-Gas Fuel Cost (\$/Fuel Unit) = Escalation Rate =			
8) Non-Gas Fuel Loss Factor			
9) Gas Environmental Damage Factor = Escalation Rate =			
10) Non Gas Fuel Environmental Damage Factor = Escalation Rate =			
11) Participant Discount Rate =	10.00%		
12) Utility Discount Rate =	8.94%		
13) Societal Discount Rate =	4.25%		
14) General Input Data Year =	2011		
15) Project Analysis Year 1 = Project Analysis Year 2 = Project Analysis Year 3 =	2012 2013 2014		
16) Utility Project Costs			
16a) Administrative & Operating Costs = 1/		\$9,181	
16b) Incentive Costs =		35,710	
16c) Total Utility Project Costs =		\$44,891	
17) Direct Participant Costs (\$/Part.) =			
18) Participant Non-Energy Costs (Annual \$/Part.) = Escalation Rate =			
19) Participant Non-Energy Savings (Annual \$/Part) = Escalation Rate =			
20) Project Life (Years) =			
21) Avg. Dk/Part. Saved =			
22) Avg Non-Gas Fuel Units/Part. Saved = 22a) Avg Additional Non-Gas Fuel Units/ Part. Used =			
23) Number of Participants =		179	
24) Total Annual Dk Saved =		\$1,562.1	
25) Incentive/Participant =			
26) Distribution Delivery Charge			
27) Effective Income Tax Rate = (Federal & State Taxes)			
	<b>Test Results</b>		
		<b>NPV</b>	<b>B/C</b>
	Ratepayer Impact Measure Test	\$6,813	1.10
	Utility Cost Test	\$27,606	1.62
	Societal Test	\$75,871	1.91
	Participant Test	\$161,340	3.17
	Total Resource Cost Test	\$14,252	1.17

1/ Energy Audit program costs of \$500 included with Total Program tests only.

**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Total South Dakota Program**

t	Year	Benefits								Costs						Annual Benefits Less Costs (P)
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Dmd Savings / Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	
1	2012	1,562		4,461		0	4,461	16	1,908	\$6,369		1,757	8,681	35,710	\$46,148	(\$39,779)
2	2013	1,562		4,615		0	4,615	16	1,922	6,537		1,819	0	0	\$1,819	\$4,718
3	2014	1,562		4,777		0	4,777	16	1,953	6,730		1,883	0	0	\$1,883	\$4,847
4	2015	1,562		4,943		0	4,943	16	1,970	6,913		1,948	0	0	\$1,948	\$4,965
5	2016	1,562		5,118		0	5,118	16	1,983	7,101		2,016	0	0	\$2,016	\$5,085
6	2017	1,562		5,297		0	5,297	16	2,001	7,298		2,087	0	0	\$2,087	\$5,211
7	2018	1,562		5,483		0	5,483	16	2,032	7,515		2,160	0	0	\$2,160	\$5,355
8	2019	1,562		5,672		0	5,672	16	2,047	7,719		2,235	0	0	\$2,235	\$5,484
9	2020	1,562		5,872		0	5,872	16	2,063	7,935		2,314	0	0	\$2,314	\$5,621
10	2021	1,562		6,078		0	6,078	16	2,095	8,173		2,394	0	0	\$2,394	\$5,779
11	2022	1,526		6,142		0	6,142	15	2,067	8,209		2,420	0	0	\$2,420	\$5,789
12	2023	1,526		6,358		0	6,358	15	2,084	8,442		2,504	0	0	\$2,504	\$5,938
13	2024	1,526		6,581		0	6,581	15	2,114	8,695		2,592	0	0	\$2,592	\$6,103
14	2025	1,526		6,811		0	6,811	15	2,128	8,939		2,683	0	0	\$2,683	\$6,256
15	2026	1,526		7,049		0	7,049	15	2,159	9,208		2,777	0	0	\$2,777	\$6,431
16	2027	1,372		6,562		0	6,562	14	1,960	8,522		2,580	0	0	\$2,580	\$5,942
17	2028	1,372		6,792		0	6,792	14	1,973	8,765		2,671	0	0	\$2,671	\$6,094
18	2029	1,372		7,029		0	7,029	14	2,000	9,029		2,764	0	0	\$2,764	\$6,265
19	2030	0		0		0	0	0	0	0		0	0	0	\$0	\$0
20	2031	0		0		0	0	0	0	0		0	0	0	\$0	\$0
21	2032	0		0		0	0	0	0	0		0	0	0	\$0	\$0
22	2033	0		0		0	0	0	0	0		0	0	0	\$0	\$0
Total =		27,366								\$142,099					\$85,995	\$56,104
									NPV =	\$71,997					\$65,185	\$6,813
Total NPV =															\$6,813	
Benefit/Cost Ratio =															1.10	

Worksheet Calculations	
(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27))
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Total South Dakota Program**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$4,461	\$1,908	\$6,369	\$8,681	\$35,710	\$44,391	(\$38,022)
2013	4,615	1,922	6,537	0	0	0	6,537
2014	4,777	1,953	6,730	0	0	0	6,730
2015	4,943	1,970	6,913	0	0	0	6,913
2016	5,118	1,983	7,101	0	0	0	7,101
2017	5,297	2,001	7,298	0	0	0	7,298
2018	5,483	2,032	7,515	0	0	0	7,515
2019	5,672	2,047	7,719	0	0	0	7,719
2020	5,872	2,063	7,935	0	0	0	7,935
2021	6,078	2,095	8,173	0	0	0	8,173
2022	6,142	2,067	8,209	0	0	0	8,209
2023	6,358	2,084	8,442	0	0	0	8,442
2024	6,581	2,114	8,695	0	0	0	8,695
2025	6,811	2,128	8,939	0	0	0	8,939
2026	7,049	2,159	9,208	0	0	0	9,208
2027	6,562	1,960	8,522	0	0	0	8,522
2028	6,792	1,973	8,765	0	0	0	8,765
2029	7,029	2,000	9,029	0	0	0	9,029
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0
Total =			\$142,099			\$44,391	\$97,708
		NPV =	\$71,997			\$44,391	\$27,606
Total NPV =			\$27,606				
Benefit/Cost Ratio =			<u>1.62</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

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**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Total South Dakota Program**

Year	Benefits						Costs			Annual Benefits Less Costs (K)	
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)		Annual Total Costs (J)
2012	\$4,461	\$1,908		2,126		1,590	\$10,085	44,391	38,720	\$83,111	(\$73,026)
2013	4,615	1,922		2,212		1,626	10,375	0	0	0	10,375
2014	4,777	1,953		2,296		1,664	10,690	0	0	0	10,690
2015	4,943	1,970		2,382		1,702	10,997	0	0	0	10,997
2016	5,118	1,983		2,466		1,743	11,310	0	0	0	11,310
2017	5,297	2,001		2,551		1,783	11,632	0	0	0	11,632
2018	5,483	2,032		2,636		1,822	11,973	0	0	0	11,973
2019	5,672	2,047		2,722		1,865	12,306	0	0	0	12,306
2020	5,872	2,063		2,806		1,908	12,649	0	0	0	12,649
2021	6,078	2,095		2,891		1,951	13,015	0	0	0	13,015
2022	6,142	2,067		2,977		1,949	13,135	0	0	0	13,135
2023	6,358	2,084		3,147		1,994	13,583	0	0	0	13,583
2024	6,581	2,114		3,232		2,039	13,966	0	0	0	13,966
2025	6,811	2,128		3,315		2,088	14,342	0	0	0	14,342
2026	7,049	2,159		3,402		2,135	14,745	0	0	0	14,745
2027	6,562	1,960		3,091		1,965	13,578	0	0	0	13,578
2028	6,792	1,973		3,164		2,009	13,938	0	0	0	13,938
2029	7,029	2,000		3,311		2,056	14,396	0	0	0	14,396
2030	0	0		0		0	0	0	0	0	0
2031	0	0		0		0	0	0	0	0	0
2032	0	0		0		0	0	0	0	0	0
2033	0	0		0		0	0	0	0	0	0
Total =							\$226,715			\$83,111	\$143,604
							NPV = \$158,982			\$83,111	\$75,871
Total NPV =		\$75,871									
Benefit/Cost Ratio =		<u>1.91</u>									

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated..	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	



**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Total South Dakota Program**

Year	Benefits						Costs	Annual Benefits Less Costs (I)	
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)	Total Annual Benefits (G)		Direct Participant Costs (H)
2012	35,710	1,562		9,356		8,677	\$53,743	74,430	(\$20,687)
2013	0	1,562		9,683		9,016	18,699	0	\$18,699
2014	0	1,562		10,021		9,275	19,296	0	\$19,296
2015	0	1,562		10,374		9,616	19,990	0	\$19,990
2016	0	1,562		10,736		9,954	20,690	0	\$20,690
2017	0	1,562		11,110		10,295	21,405	0	\$21,405
2018	0	1,562		11,499		10,635	22,134	0	\$22,134
2019	0	1,562		11,902		11,060	22,962	0	\$22,962
2020	0	1,562		12,319		11,401	23,720	0	\$23,720
2021	0	1,562		12,749		11,825	24,574	0	\$24,574
2022	0	1,526		12,887		12,252	25,139	0	\$25,139
2023	0	1,526		13,335		12,676	26,011	0	\$26,011
2024	0	1,526		13,804		13,101	26,905	0	\$26,905
2025	0	1,526		14,287		13,612	27,899	0	\$27,899
2026	0	1,526		14,787		14,037	28,824	0	\$28,824
2027	0	1,372		13,754		12,589	26,343	0	\$26,343
2028	0	1,372		14,237		13,031	27,268	0	\$27,268
2029	0	1,372		14,736		13,475	28,211	0	\$28,211
2030	0	0		0		0	0	0	\$0
2031	0	0		0		0	0	0	\$0
2032	0	0		0		0	0	0	\$0
2033	0	0		0		0	0	0	\$0
Total =		27,366					\$463,813	\$74,430	\$389,383
							NPV = \$235,770	\$74,430	161,340
Total NPV =		\$161,340							
Benefit/Cost Ratio =		<u>3.17</u>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)



**Table 5**  
**Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Total South Dakota Program**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$4,461	\$1,908	\$2,126	\$8,495	\$44,391	\$38,720	\$83,111	(\$74,616)
2013	4,615	1,922	2,212	8,749	0	0	0	8,749
2014	4,777	1,953	2,296	9,026	0	0	0	9,026
2015	4,943	1,970	2,382	9,295	0	0	0	9,295
2016	5,118	1,983	2,466	9,567	0	0	0	9,567
2017	5,297	2,001	2,551	9,849	0	0	0	9,849
2018	5,483	2,032	2,636	10,151	0	0	0	10,151
2019	5,672	2,047	2,722	10,441	0	0	0	10,441
2020	5,872	2,063	2,806	10,741	0	0	0	10,741
2021	6,078	2,095	2,891	11,064	0	0	0	11,064
2022	6,142	2,067	2,977	11,186	0	0	0	11,186
2023	6,358	2,084	3,147	11,589	0	0	0	11,589
2024	6,581	2,114	3,232	11,927	0	0	0	11,927
2025	6,811	2,128	3,315	12,254	0	0	0	12,254
2026	7,049	2,159	3,402	12,610	0	0	0	12,610
2027	6,562	1,960	3,091	11,613	0	0	0	11,613
2028	6,792	1,973	3,164	11,929	0	0	0	11,929
2029	7,029	2,000	3,311	12,340	0	0	0	12,340
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
			Total =	\$192,826			\$83,111	\$109,715
			NPV =	\$97,363			\$83,111	14,252

Total NPV = \$14,252  
Benefit/Cost Ratio = 1.17

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)



**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 92-94% AFUE Furnace**

t	Year	Benefits										Costs				Annual Benefits Less Costs (P)	
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)		Total Program Costs (O)
0	2012	47	\$2.855	\$135	\$0.000	\$0	\$135	0.5	\$123	\$62	\$197	\$1,753	\$54	\$145	\$600	\$799	(\$602)
1	2013	47	2.955	139	0.000	0	139	0.5	124	62	201	1.814	56	0	0	56	145
2	2014	47	3.058	144	0.000	0	144	0.5	126	63	207	1.878	58	0	0	58	149
3	2015	47	3.165	149	0.000	0	149	0.5	127	64	213	1.944	60	0	0	60	153
4	2016	47	3.276	155	0.000	0	155	0.5	128	64	219	2.012	62	0	0	62	157
5	2017	47	3.391	160	0.000	0	160	0.5	129	65	225	2.082	64	0	0	64	161
6	2018	47	3.510	166	0.000	0	166	0.5	131	66	232	2.155	66	0	0	66	166
7	2019	47	3.632	171	0.000	0	171	0.5	132	66	237	2.230	68	0	0	68	169
8	2020	47	3.759	177	0.000	0	177	0.5	133	67	244	2.308	71	0	0	71	173
9	2021	47	3.891	184	0.000	0	184	0.5	135	68	252	2.389	73	0	0	73	179
10	2022	47	4.027	190	0.000	0	190	0.5	136	68	258	2.473	76	0	0	76	182
11	2023	47	4.168	197	0.000	0	197	0.5	137	69	266	2.559	79	0	0	79	187
12	2024	47	4.314	204	0.000	0	204	0.5	139	70	274	2.649	81	0	0	81	193
13	2025	47	4.465	211	0.000	0	211	0.5	140	70	281	2.742	84	0	0	84	197
14	2026	47	4.621	218	0.000	0	218	0.5	142	71	289	2.838	87	0	0	87	202
15	2027	47	4.783	226	0.000	0	226	0.5	143	72	298	2.937	90	0	0	90	208
16	2028	47	4.951	234	0.000	0	234	0.5	144	72	306	3.040	93	0	0	93	213
17	2029	47	5.124	242	0.000	0	242	0.5	146	73	315	3.146	97	0	0	97	218
18	2030	0	5.303	0	0.000	0	0	0.0	147	0	0	3.256	0	0	0	0	0
19	2031	0	5.489	0	0.000	0	0	0.0	149	0	0	3.370	0	0	0	0	0
20	2032	0	5.681	0	0.000	0	0	0.0	150	0	0	3.488	0	0	0	0	0
Total =		850									\$4,514					\$2,064	\$2,450
																\$1,395	\$861
Total NPV =			\$861														
Benefit/Cost Ratio =			1.62														

**Worksheet Calculations**

(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27))
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 92-94% AFUE Furnace**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$135	\$62	\$197	\$145	\$600	\$745	(\$548)
2013	139	62	201	0	0	0	201
2014	144	63	207	0	0	0	207
2015	149	64	213	0	0	0	213
2016	155	64	219	0	0	0	219
2017	160	65	225	0	0	0	225
2018	166	66	232	0	0	0	232
2019	171	66	237	0	0	0	237
2020	177	67	244	0	0	0	244
2021	184	68	252	0	0	0	252
2022	190	68	258	0	0	0	258
2023	197	69	266	0	0	0	266
2024	204	70	274	0	0	0	274
2025	211	70	281	0	0	0	281
2026	218	71	289	0	0	0	289
2027	226	72	298	0	0	0	298
2028	234	72	306	0	0	0	306
2029	242	73	315	0	0	0	315
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$4,514			\$745	\$3,769
		NPV =	\$2,256			\$745	\$1,511
Total NPV =			\$1,511				
Benefit/Cost Ratio =			<u>3.03</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 92-94% AFUE Furnace**

Year	Benefits						Costs			Annual Benefits Less Costs (K)	
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)		Annual Total Costs (J)
2012	\$135	\$62	\$0.025	\$0	\$1.018	\$48	\$245	\$745	\$1,400	\$2,145	(\$1,900)
2013	139	62	0.026	0	1.041	49	250	0	0	0	250
2014	144	63	0.027	0	1.065	50	257	0	0	0	257
2015	149	64	0.028	0	1.090	51	264	0	0	0	264
2016	155	64	0.029	0	1.115	53	272	0	0	0	272
2017	160	65	0.030	0	1.141	54	279	0	0	0	279
2018	166	66	0.031	0	1.167	55	287	0	0	0	287
2019	171	66	0.032	0	1.194	56	293	0	0	0	293
2020	177	67	0.033	0	1.221	58	302	0	0	0	302
2021	184	68	0.034	0	1.249	59	311	0	0	0	311
2022	190	68	0.035	0	1.278	60	318	0	0	0	318
2023	197	69	0.037	0	1.307	62	328	0	0	0	328
2024	204	70	0.038	0	1.337	63	337	0	0	0	337
2025	211	70	0.039	0	1.368	65	346	0	0	0	346
2026	218	71	0.040	0	1.400	66	355	0	0	0	355
2027	226	72	0.042	0	1.432	68	366	0	0	0	366
2028	234	72	0.043	0	1.465	69	375	0	0	0	375
2029	242	73	0.045	0	1.498	71	386	0	0	0	386
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0

Total = \$5,571 \$2,145 \$3,426  
 NPV = \$3,884 \$2,145 \$1,739

Total NPV = \$1,739  
 Benefit/Cost Ratio = 1.81

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated.	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

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**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 92-94% AFUE Furnace**

Year	Benefits						Total Annual Benefits (G)	Direct Participant Costs (H)	Annual Benefits Less Costs (I)
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)			
2012	\$600	47	\$6.012	\$284	\$0.102	\$0	\$884	\$2,000	(\$1,116)
2013	0	47	6.222	294	0.106	0	294	0	294
2014	0	47	6.440	304	0.109	0	304	0	304
2015	0	47	6.666	315	0.113	0	315	0	315
2016	0	47	6.899	326	0.117	0	326	0	326
2017	0	47	7.140	337	0.121	0	337	0	337
2018	0	47	7.390	349	0.125	0	349	0	349
2019	0	47	7.649	361	0.130	0	361	0	361
2020	0	47	7.917	374	0.134	0	374	0	374
2021	0	47	8.194	387	0.139	0	387	0	387
2022	0	47	8.481	400	0.144	0	400	0	400
2023	0	47	8.777	414	0.149	0	414	0	414
2024	0	47	9.085	429	0.154	0	429	0	429
2025	0	47	9.403	444	0.160	0	444	0	444
2026	0	47	9.732	459	0.165	0	459	0	459
2027	0	47	10.072	475	0.171	0	475	0	475
2028	0	47	10.425	492	0.177	0	492	0	492
2029	0	47	10.790	509	0.183	0	509	0	509
2030	0	0	11.167	0	0.189	0	0	0	0
2031	0	0	11.558	0	0.196	0	0	0	0
2032	0	0	11.963	0	0.203	0	0	0	0
Total =		850					\$7,553	\$2,000	\$5,553
							NPV = \$3,799	\$2,000	1,799
Total NPV =		\$1,799							
Benefit/Cost Ratio =		<u>1.90</u>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

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**Table 5**  
**Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Residential 92-94% AFUE Furnace**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$135	\$62	\$0	\$197	\$745	\$1,400	\$2,145	(\$1,948)
2013	139	62	0	201	0	0	0	201
2014	144	63	0	207	0	0	0	207
2015	149	64	0	213	0	0	0	213
2016	155	64	0	219	0	0	0	219
2017	160	65	0	225	0	0	0	225
2018	166	66	0	232	0	0	0	232
2019	171	66	0	237	0	0	0	237
2020	177	67	0	244	0	0	0	244
2021	184	68	0	252	0	0	0	252
2022	190	68	0	258	0	0	0	258
2023	197	69	0	266	0	0	0	266
2024	204	70	0	274	0	0	0	274
2025	211	70	0	281	0	0	0	281
2026	218	71	0	289	0	0	0	289
2027	226	72	0	298	0	0	0	298
2028	234	72	0	306	0	0	0	306
2029	242	73	0	315	0	0	0	315
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
			Total =	\$4,514			\$2,145	\$2,369
			NPV =	\$2,256			\$2,145	111

Total NPV = \$111  
Benefit/Cost Ratio = 1.05

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)



**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - New**  
Program Years: **2012**

Input Data			First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$6.012	16) Utility Project Costs			
Escalation Rate =	3.50%	16a) Administrative & Operating Costs =	\$1,896		
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) =	\$0.10200	16b) Incentive Costs =	7,800		
Escalation Rate =	3.50%	16c) Total Utility Project Costs =	\$9,696		
Non-Gas Fuel Units (ie. kWh, Gallons, etc) =	Kwh	17) Direct Participant Costs (\$/Part.) =	\$620		
3) Commodity Cost (\$/Dk) =	\$2.855	18) Participant Non-Energy Costs (Annual \$/Part.) =	\$0		
Escalation Rate =	3.50%	Escalation Rate =	0.00%		
4) Demand Cost (\$/Unit/Yr) =	\$123.18	19) Participant Non-Energy Savings (Annual \$/Part) =	\$0		
Escalation Rate =	1.00%	Escalation Rate =	0.00%		
5) Peak Reduction Factor =	1.000%	20) Project Life (Years) =	18		
6) Variable O&M (\$/Dk) =	\$0.000	21) Avg. Dk/Part. Saved =	7.100		
Escalation Rate =	0.00%	22) Avg Non-Gas Fuel Units/Part. Saved =	669		
7) Non-Gas Fuel Cost (\$/Fuel Unit) =	\$0.02314	22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0		
Escalation Rate =	3.50%	23) Number of Participants =	26		
8) Non-Gas Fuel Loss Factor	7.48%	24) Total Annual Dk Saved =	184.6		
9) Gas Environmental Damage Factor =	\$1.018	25) Incentive/Participant =	\$300		
Escalation Rate =	2.30%	26) Distribution Delivery Charge			\$1.753
10) Non Gas Fuel Environmental Damage Factor :	\$0.000	27) Effective Income Tax Rate =			35.000%
Escalation Rate =	0.00%	(Federal & State Taxes)			
11) Participant Discount Rate =	10.00%				
12) Utility Discount Rate =	8.94%				
13) Societal Discount Rate =	4.25%				
14) General Input Data Year =	2012				
15) Project Analysis Year 1 =	2012				
Project Analysis Year 2 =	0				
Project Analysis Year 3 =	0				

Test Results	NPV	B/C
Ratepayer Impact Measure Test	(\$3,616)	0.70
Utility Cost Test	(\$1,079)	0.89
Societal Test	\$4,285	1.24
Participant Test	\$24,181	2.50
Total Resource Cost Test	(\$4,133)	0.77

**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - New**

t	Year	Benefits										Costs				Annual Benefits Less Costs (P)		
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)		Total Program Costs (O)	
0	2012	185	\$2,855	\$527	\$0.000	\$0	\$527	1.8	\$123	\$221	\$748	\$1,753	\$210	\$1,896	\$7,800	\$9,906	(\$9,158)	
1	2013	185	2,955	545	0.000	0	545	1.8	124	223	768	1,814	218	0	0	218	550	
2	2014	185	3,058	565	0.000	0	565	1.8	126	227	792	1,878	225	0	0	225	567	
3	2015	185	3,165	584	0.000	0	584	1.8	127	229	813	1,944	233	0	0	233	580	
4	2016	185	3,276	605	0.000	0	605	1.8	128	230	835	2,012	241	0	0	241	594	
5	2017	185	3,391	626	0.000	0	626	1.8	129	232	858	2,082	250	0	0	250	608	
6	2018	185	3,510	648	0.000	0	648	1.8	131	236	884	2,155	259	0	0	259	625	
7	2019	185	3,632	670	0.000	0	670	1.8	132	238	908	2,230	268	0	0	268	640	
8	2020	185	3,759	694	0.000	0	694	1.8	133	239	933	2,308	277	0	0	277	656	
9	2021	185	3,891	718	0.000	0	718	1.8	135	243	961	2,389	287	0	0	287	674	
10	2022	185	4,027	743	0.000	0	743	1.8	136	245	988	2,473	297	0	0	297	691	
11	2023	185	4,168	769	0.000	0	769	1.8	137	247	1,016	2,559	307	0	0	307	709	
12	2024	185	4,314	796	0.000	0	796	1.8	139	250	1,046	2,649	318	0	0	318	728	
13	2025	185	4,465	824	0.000	0	824	1.8	140	252	1,076	2,742	329	0	0	329	747	
14	2026	185	4,621	853	0.000	0	853	1.8	142	256	1,109	2,838	341	0	0	341	768	
15	2027	185	4,783	883	0.000	0	883	1.8	143	257	1,140	2,937	352	0	0	352	788	
16	2028	185	4,951	914	0.000	0	914	1.8	144	259	1,173	3,040	365	0	0	365	808	
17	2029	185	5,124	946	0.000	0	946	1.8	146	263	1,209	3,146	377	0	0	377	832	
18	2030	0	5,303	0	0.000	0	0	0.0	147	0	0	3,256	0	0	0	0	0	
19	2031	0	5,489	0	0.000	0	0	0.0	149	0	0	3,370	0	0	0	0	0	
20	2032	0	5,681	0	0.000	0	0	0.0	150	0	0	3,488	0	0	0	0	0	
Total =		3,323									\$17,257					\$14,850	\$2,407	
																	\$12,233	(\$3,616)
Total NPV =																		(\$3,616)
Benefit/Cost Ratio =																		0.70

**Worksheet Calculations**

(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27))
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

**Table 2**  
**Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - New**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$527	\$221	\$748	\$1,896	\$7,800	\$9,696	(\$8,948)
2013	545	223	768	0	0	0	768
2014	565	227	792	0	0	0	792
2015	584	229	813	0	0	0	813
2016	605	230	835	0	0	0	835
2017	626	232	858	0	0	0	858
2018	648	236	884	0	0	0	884
2019	670	238	908	0	0	0	908
2020	694	239	933	0	0	0	933
2021	718	243	961	0	0	0	961
2022	743	245	988	0	0	0	988
2023	769	247	1,016	0	0	0	1,016
2024	796	250	1,046	0	0	0	1,046
2025	824	252	1,076	0	0	0	1,076
2026	853	256	1,109	0	0	0	1,109
2027	883	257	1,140	0	0	0	1,140
2028	914	259	1,173	0	0	0	1,173
2029	946	263	1,209	0	0	0	1,209
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$17,257			\$9,696	\$7,561
NPV =			\$8,617			\$9,696	(\$1,079)
Total NPV =			(\$1,079)				
Benefit/Cost Ratio =			<u>0.89</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - New**

Year	Benefits						Costs			Annual Benefits Less Costs (K)	
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)		Annual Total Costs (J)
2012	\$527	\$221	\$0.025	\$435	\$1.018	\$188	\$1,371	\$9,696	\$8,320	\$18,016	(\$16,645)
2013	545	223	0.026	452	1.041	192	1,412	0	0	0	1,412
2014	565	227	0.027	470	1.065	197	1,459	0	0	0	1,459
2015	584	229	0.028	487	1.090	201	1,501	0	0	0	1,501
2016	605	230	0.029	504	1.115	206	1,545	0	0	0	1,545
2017	626	232	0.030	522	1.141	211	1,591	0	0	0	1,591
2018	648	236	0.031	539	1.167	215	1,638	0	0	0	1,638
2019	670	238	0.032	557	1.194	220	1,685	0	0	0	1,685
2020	694	239	0.033	574	1.221	225	1,732	0	0	0	1,732
2021	718	243	0.034	591	1.249	231	1,783	0	0	0	1,783
2022	743	245	0.035	609	1.278	236	1,833	0	0	0	1,833
2023	769	247	0.037	644	1.307	241	1,901	0	0	0	1,901
2024	796	250	0.038	661	1.337	247	1,954	0	0	0	1,954
2025	824	252	0.039	678	1.368	253	2,007	0	0	0	2,007
2026	853	256	0.040	696	1.400	258	2,063	0	0	0	2,063
2027	883	257	0.042	731	1.432	264	2,135	0	0	0	2,135
2028	914	259	0.043	748	1.465	270	2,191	0	0	0	2,191
2029	946	263	0.045	783	1.498	277	2,269	0	0	0	2,269
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0

Total = NPV = \$32,070 \$18,016 \$14,054  
\$22,301 \$18,016 \$4,285

Total NPV = \$4,285  
Benefit/Cost Ratio = 1.24

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated..	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - New**

Year	Benefits						Costs	Annual Benefits Less Costs (I)	
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)	Total Annual Benefits (G)		Direct Participant Costs (H)
2012	\$7,800	185	\$6.012	\$1,110	\$0.102	\$1,774	\$10,684	\$16,120	(\$5,436)
2013	0	185	6.222	1,149	0.106	1,844	2,993	0	2,993
2014	0	185	6.440	1,189	0.109	1,896	3,085	0	3,085
2015	0	185	6.666	1,231	0.113	1,966	3,197	0	3,197
2016	0	185	6.899	1,274	0.117	2,035	3,309	0	3,309
2017	0	185	7.140	1,318	0.121	2,105	3,423	0	3,423
2018	0	185	7.390	1,364	0.125	2,174	3,538	0	3,538
2019	0	185	7.649	1,412	0.130	2,261	3,673	0	3,673
2020	0	185	7.917	1,461	0.134	2,331	3,792	0	3,792
2021	0	185	8.194	1,513	0.139	2,418	3,931	0	3,931
2022	0	185	8.481	1,566	0.144	2,505	4,071	0	4,071
2023	0	185	8.777	1,620	0.149	2,592	4,212	0	4,212
2024	0	185	9.085	1,677	0.154	2,679	4,356	0	4,356
2025	0	185	9.403	1,736	0.160	2,783	4,519	0	4,519
2026	0	185	9.732	1,797	0.165	2,870	4,667	0	4,667
2027	0	185	10.072	1,859	0.171	2,974	4,833	0	4,833
2028	0	185	10.425	1,924	0.177	3,079	5,003	0	5,003
2029	0	185	10.790	1,992	0.183	3,183	5,175	0	5,175
2030	0	0	11.167	0	0.189	0	0	0	0
2031	0	0	11.558	0	0.196	0	0	0	0
2032	0	0	11.963	0	0.203	0	0	0	0
<b>Total =</b>		<b>3,323</b>					<b>\$78,461</b>	<b>\$16,120</b>	<b>\$62,341</b>
						<b>NPV =</b>	<b>\$40,301</b>	<b>\$16,120</b>	<b>24,181</b>
<b>Total NPV =</b>		<b>\$24,181</b>							
<b>Benefit/Cost Ratio =</b>		<b>2.50</b>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

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**Table 5**  
**Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Residential 95+% AFUE Furnace - New**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$527	\$221	\$435	\$1,183	\$9,696	\$8,320	\$18,016	(\$16,833)
2013	545	223	452	1,220	0	0	0	1,220
2014	565	227	470	1,262	0	0	0	1,262
2015	584	229	487	1,300	0	0	0	1,300
2016	605	230	504	1,339	0	0	0	1,339
2017	626	232	522	1,380	0	0	0	1,380
2018	648	236	539	1,423	0	0	0	1,423
2019	670	238	557	1,465	0	0	0	1,465
2020	694	239	574	1,507	0	0	0	1,507
2021	718	243	591	1,552	0	0	0	1,552
2022	743	245	609	1,597	0	0	0	1,597
2023	769	247	644	1,660	0	0	0	1,660
2024	796	250	661	1,707	0	0	0	1,707
2025	824	252	678	1,754	0	0	0	1,754
2026	853	256	696	1,805	0	0	0	1,805
2027	883	257	731	1,871	0	0	0	1,871
2028	914	259	748	1,921	0	0	0	1,921
2029	946	263	783	1,992	0	0	0	1,992
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
			Total =	\$27,938			\$18,016	\$9,922
			NPV =	\$13,883			\$18,016	(4,133)

Total NPV = (\$4,133)  
Benefit/Cost Ratio = 0.77

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)

**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - Replacement**  
Program Years: **2012**

Input Data			First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$6.012	16) Utility Project Costs			
Escalation Rate =	3.50%	16a) Administrative & Operating Costs =	\$5,835		
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) =	\$0.10200	16b) Incentive Costs =	24,000		
Escalation Rate =	3.50%	16c) Total Utility Project Costs =	\$29,835		
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh	17) Direct Participant Costs (\$/Part.) =	\$620		
3) Commodity Cost (\$/Dk) =	\$2.855	18) Participant Non-Energy Costs (Annual \$/Part.) =	\$0		
Escalation Rate =	3.50%	Escalation Rate =	0.00%		
4) Demand Cost (\$/Unit/Yr) =	\$123.18	19) Participant Non-Energy Savings (Annual \$/Part) =	\$0		
Escalation Rate =	1.00%	Escalation Rate =	0.00%		
5) Peak Reduction Factor =	1.000%	20) Project Life (Years) =	18		
6) Variable O&M (\$/Dk) =	\$0.000	21) Avg. Dk/Part. Saved =	13.100		
Escalation Rate =	0.00%	22) Avg Non-Gas Fuel Units/Part. Saved =	669		
7) Non-Gas Fuel Cost (\$/Fuel Unit) =	\$0.02314	22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0		
Escalation Rate =	3.50%	23) Number of Participants =	80		
8) Non-Gas Fuel Loss Factor	7.48%	24) Total Annual Dk Saved =	1,048.0		
9) Gas Environmental Damage Factor =	\$1.018	25) Incentive/Participant =	\$300		
Escalation Rate =	2.30%	26) Distribution Delivery Charge			\$1.753
10) Non Gas Fuel Environmental Damage Factor =	\$0.000	27) Effective Income Tax Rate =			35.000%
Escalation Rate =	0.00%	(Federal & State Taxes)			
11) Participant Discount Rate =	10.00%				
12) Utility Discount Rate =	8.94%				
13) Societal Discount Rate =	4.25%				
14) General Input Data Year =	2012				
15) Project Analysis Year 1 =	2012				
Project Analysis Year 2 =	0				
Project Analysis Year 3 =	0				

  

Test Results	NPV	B/C
Ratepayer Impact Measure Test	\$5,045	1.11
Utility Cost Test	\$19,448	1.65
Societal Test	\$52,445	1.95
Participant Test	\$106,919	3.16
Total Resource Cost Test	\$10,050	1.18

**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - Replacement**

t	Year	Benefits								Costs						Annual Benefits Less Costs (P)	
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)		Total Program Costs (O)
0	2012	1,048	\$2,855	\$2,992	\$0.000	\$0	\$2,992	10.5	\$123	\$1,292	\$4,284	\$1,753	\$1,194	\$5,835	\$24,000	\$31,029	(\$26,745)
1	2013	1,048	2,955	3,097	0.000	0	3,097	10.5	124	1,302	4,399	1,814	1,236	0	0	1,236	3,163
2	2014	1,048	3,058	3,205	0.000	0	3,205	10.5	126	1,323	4,528	1,878	1,279	0	0	1,279	3,249
3	2015	1,048	3,165	3,317	0.000	0	3,317	10.5	127	1,334	4,651	1,944	1,324	0	0	1,324	3,327
4	2016	1,048	3,276	3,433	0.000	0	3,433	10.5	128	1,344	4,777	2,012	1,371	0	0	1,371	3,406
5	2017	1,048	3,391	3,554	0.000	0	3,554	10.5	129	1,355	4,909	2,082	1,418	0	0	1,418	3,491
6	2018	1,048	3,510	3,678	0.000	0	3,678	10.5	131	1,376	5,054	2,155	1,468	0	0	1,468	3,586
7	2019	1,048	3,632	3,806	0.000	0	3,806	10.5	132	1,386	5,192	2,230	1,519	0	0	1,519	3,673
8	2020	1,048	3,759	3,939	0.000	0	3,939	10.5	133	1,397	5,336	2,308	1,572	0	0	1,572	3,764
9	2021	1,048	3,891	4,078	0.000	0	4,078	10.5	135	1,418	5,496	2,389	1,627	0	0	1,627	3,869
10	2022	1,048	4,027	4,220	0.000	0	4,220	10.5	136	1,428	5,648	2,473	1,685	0	0	1,685	3,963
11	2023	1,048	4,168	4,368	0.000	0	4,368	10.5	137	1,439	5,807	2,559	1,743	0	0	1,743	4,064
12	2024	1,048	4,314	4,521	0.000	0	4,521	10.5	139	1,460	5,981	2,649	1,804	0	0	1,804	4,177
13	2025	1,048	4,465	4,679	0.000	0	4,679	10.5	140	1,470	6,149	2,742	1,868	0	0	1,868	4,281
14	2026	1,048	4,621	4,843	0.000	0	4,843	10.5	142	1,491	6,334	2,838	1,933	0	0	1,933	4,401
15	2027	1,048	4,783	5,013	0.000	0	5,013	10.5	143	1,502	6,515	2,937	2,001	0	0	2,001	4,514
16	2028	1,048	4,951	5,189	0.000	0	5,189	10.5	144	1,512	6,701	3,040	2,071	0	0	2,071	4,630
17	2029	1,048	5,124	5,370	0.000	0	5,370	10.5	146	1,533	6,903	3,146	2,143	0	0	2,143	4,760
18	2030	0	5,303	0	0.000	0	0	0.0	147	0	0	3,256	0	0	0	0	0
19	2031	0	5,489	0	0.000	0	0	0.0	149	0	0	3,370	0	0	0	0	0
20	2032	0	5,681	0	0.000	0	0	0.0	150	0	0	3,488	0	0	0	0	0
Total =		18,864									\$98,664					\$59,091	\$39,573
																\$44,238	\$5,045
Total NPV =			\$5,045														
Benefit/Cost Ratio =			1.11														

**Worksheet Calculations**

(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27))
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

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**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - Replacement**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$2,992	\$1,292	\$4,284	\$5,835	\$24,000	\$29,835	(\$25,551)
2013	3,097	1,302	4,399	0	0	0	4,399
2014	3,205	1,323	4,528	0	0	0	4,528
2015	3,317	1,334	4,651	0	0	0	4,651
2016	3,433	1,344	4,777	0	0	0	4,777
2017	3,554	1,355	4,909	0	0	0	4,909
2018	3,678	1,376	5,054	0	0	0	5,054
2019	3,806	1,386	5,192	0	0	0	5,192
2020	3,939	1,397	5,336	0	0	0	5,336
2021	4,078	1,418	5,496	0	0	0	5,496
2022	4,220	1,428	5,648	0	0	0	5,648
2023	4,368	1,439	5,807	0	0	0	5,807
2024	4,521	1,460	5,981	0	0	0	5,981
2025	4,679	1,470	6,149	0	0	0	6,149
2026	4,843	1,491	6,334	0	0	0	6,334
2027	5,013	1,502	6,515	0	0	0	6,515
2028	5,189	1,512	6,701	0	0	0	6,701
2029	5,370	1,533	6,903	0	0	0	6,903
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$98,664		\$29,835	\$68,829	
NPV =			\$49,283		\$29,835	\$19,448	
Total NPV =			\$19,448				
Benefit/Cost Ratio =			<u>1.65</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

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**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - Replacement**

Year	Benefits							Costs			Annual Benefits Less Costs (K)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)	Annual Total Costs (J)	
2012	\$2,992	\$1,292	\$0.025	\$1,338	\$1.018	\$1,067	\$6,689	\$29,835	\$25,600	\$55,435	(\$48,746)
2013	3,097	1,302	0.026	1,392	1.041	1,091	6,882	0	0	0	6,882
2014	3,205	1,323	0.027	1,445	1.065	1,116	7,089	0	0	0	7,089
2015	3,317	1,334	0.028	1,499	1.090	1,142	7,292	0	0	0	7,292
2016	3,433	1,344	0.029	1,552	1.115	1,169	7,498	0	0	0	7,498
2017	3,554	1,355	0.030	1,606	1.141	1,196	7,711	0	0	0	7,711
2018	3,678	1,376	0.031	1,659	1.167	1,223	7,936	0	0	0	7,936
2019	3,806	1,386	0.032	1,713	1.194	1,251	8,156	0	0	0	8,156
2020	3,939	1,397	0.033	1,766	1.221	1,280	8,382	0	0	0	8,382
2021	4,078	1,418	0.034	1,820	1.249	1,309	8,625	0	0	0	8,625
2022	4,220	1,428	0.035	1,873	1.278	1,339	8,860	0	0	0	8,860
2023	4,368	1,439	0.037	1,980	1.307	1,370	9,157	0	0	0	9,157
2024	4,521	1,460	0.038	2,034	1.337	1,401	9,416	0	0	0	9,416
2025	4,679	1,470	0.039	2,087	1.368	1,434	9,670	0	0	0	9,670
2026	4,843	1,491	0.040	2,141	1.400	1,467	9,942	0	0	0	9,942
2027	5,013	1,502	0.042	2,248	1.432	1,501	10,264	0	0	0	10,264
2028	5,189	1,512	0.043	2,301	1.465	1,535	10,537	0	0	0	10,537
2029	5,370	1,533	0.045	2,408	1.498	1,570	10,881	0	0	0	10,881
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0
Total =							\$154,987			\$55,435	\$99,552
							NPV =	\$107,880		\$55,435	\$52,445

Total NPV = \$52,445  
Benefit/Cost Ratio = 1.95

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated..	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

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**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential 95+% AFUE Furnace - Replacement**

Year	Benefits						Costs		Annual Benefits Less Costs (I)
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)	Total Annual Benefits (G)	Direct Participant Costs (H)	
2012	\$24,000	1,048	\$6.012	\$6,301	\$0.102	\$5,459	\$35,760	\$49,600	(\$13,840)
2013	0	1,048	6.222	6,521	0.106	5,673	12,194	0	12,194
2014	0	1,048	6.440	6,749	0.109	5,834	12,583	0	12,583
2015	0	1,048	6.666	6,986	0.113	6,048	13,034	0	13,034
2016	0	1,048	6.899	7,230	0.117	6,262	13,492	0	13,492
2017	0	1,048	7.140	7,483	0.121	6,476	13,959	0	13,959
2018	0	1,048	7.390	7,745	0.125	6,690	14,435	0	14,435
2019	0	1,048	7.649	8,016	0.130	6,958	14,974	0	14,974
2020	0	1,048	7.917	8,297	0.134	7,172	15,469	0	15,469
2021	0	1,048	8.194	8,587	0.139	7,439	16,026	0	16,026
2022	0	1,048	8.481	8,888	0.144	7,707	16,595	0	16,595
2023	0	1,048	8.777	9,198	0.149	7,974	17,172	0	17,172
2024	0	1,048	9.085	9,521	0.154	8,242	17,763	0	17,763
2025	0	1,048	9.403	9,854	0.160	8,563	18,417	0	18,417
2026	0	1,048	9.732	10,199	0.165	8,831	19,030	0	19,030
2027	0	1,048	10.072	10,555	0.171	9,152	19,707	0	19,707
2028	0	1,048	10.425	10,925	0.177	9,473	20,398	0	20,398
2029	0	1,048	10.790	11,308	0.183	9,794	21,102	0	21,102
2030	0	0	11.167	0	0.189	0	0	0	0
2031	0	0	11.558	0	0.196	0	0	0	0
2032	0	0	11.963	0	0.203	0	0	0	0
Total =		18,864					\$312,110	\$49,600	\$262,510
					NPV =		\$156,519	\$49,600	106,919
Total NPV =		\$106,919							
Benefit/Cost Ratio =		<u>3.16</u>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

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**Table 5  
Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Residential 95+% AFUE Furnace - Replacement**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$2,992	\$1,292	\$1,338	\$5,622	\$29,835	\$25,600	\$55,435	(\$49,813)
2013	3,097	1,302	1,392	5,791	0	0	0	5,791
2014	3,205	1,323	1,445	5,973	0	0	0	5,973
2015	3,317	1,334	1,499	6,150	0	0	0	6,150
2016	3,433	1,344	1,552	6,329	0	0	0	6,329
2017	3,554	1,355	1,606	6,515	0	0	0	6,515
2018	3,678	1,376	1,659	6,713	0	0	0	6,713
2019	3,806	1,386	1,713	6,905	0	0	0	6,905
2020	3,939	1,397	1,766	7,102	0	0	0	7,102
2021	4,078	1,418	1,820	7,316	0	0	0	7,316
2022	4,220	1,428	1,873	7,521	0	0	0	7,521
2023	4,368	1,439	1,980	7,787	0	0	0	7,787
2024	4,521	1,460	2,034	8,015	0	0	0	8,015
2025	4,679	1,470	2,087	8,236	0	0	0	8,236
2026	4,843	1,491	2,141	8,475	0	0	0	8,475
2027	5,013	1,502	2,248	8,763	0	0	0	8,763
2028	5,189	1,512	2,301	9,002	0	0	0	9,002
2029	5,370	1,533	2,408	9,311	0	0	0	9,311
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
			Total =	\$131,526			\$55,435	\$76,091
			NPV =	\$65,485			\$55,435	10,050

Total NPV = \$10,050  
Benefit/Cost Ratio = 1.18

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)

**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .62 EF**  
Program Years: **2012**

Input Data		First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$6.012			
Escalation Rate =	3.50%			
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) =	\$0.10200			
Escalation Rate =	3.50%			
Non-Gas Fuel Units (ie. kWh, Gallons, etc) =	Kwh			
3) Commodity Cost (\$/Dk) =	\$2.855			
Escalation Rate =	3.50%			
4) Demand Cost (\$/Unit/Yr) =	\$123.18			
Escalation Rate =	1.00%			
5) Peak Reduction Factor =	1.000%			
6) Variable O&M (\$/Dk) =	\$0.000			
Escalation Rate =	0.00%			
7) Non-Gas Fuel Cost (\$/Fuel Unit) =	\$0.02314			
Escalation Rate =	3.50%			
8) Non-Gas Fuel Loss Factor	7.48%			
9) Gas Environmental Damage Factor =	\$1.018			
Escalation Rate =	2.30%			
10) Non Gas Fuel Environmental Damage Factor =	\$0.000			
Escalation Rate =	0.00%			
11) Participant Discount Rate =	10.00%			
12) Utility Discount Rate =	8.94%			
13) Societal Discount Rate =	4.25%			
14) General Input Data Year =	2012			
15) Project Analysis Year 1 =	2012			
Project Analysis Year 2 =	0			
Project Analysis Year 3 =	0			
16) Utility Project Costs				
16a) Administrative & Operating Costs =		\$36		
16b) Incentive Costs =		150		
16c) Total Utility Project Costs =		\$186		
17) Direct Participant Costs (\$/Part.) =		\$50		
18) Participant Non-Energy Costs (Annual \$/Part.) =		\$0		
Escalation Rate =		0.00%		
19) Participant Non-Energy Savings (Annual \$/Part) =		\$0		
Escalation Rate =		0.00%		
20) Project Life (Years) =		10		
21) Avg. Dk/Part. Saved =		1.400		
22) Avg Non-Gas Fuel Units/Part. Saved =		0		
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =		0		
23) Number of Participants =		3		
24) Total Annual Dk Saved =		4.2		
25) Incentive/Participant =		\$50		
26) Distribution Delivery Charge				\$1.753
27) Effective Income Tax Rate = (Federal & State Taxes)				35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	(\$129)	0.43
Utility Cost Test	(\$90)	0.52
Societal Test	(\$32)	0.83
Participant Test	\$194	2.29
Total Resource Cost Test	(\$90)	0.52

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**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .62 EF**

t	Year	Benefits									Costs					Annual Benefits Less Costs (P)	
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)		Total Program Costs (O)
0	2012	4	\$2.855	\$12	\$0.000	\$0	\$12	0.0	\$123	\$0	\$12	\$1.753	\$5	\$36	\$150	\$191	(\$179)
1	2013	4	2.955	12	0.000	0	12	0.0	124	0	12	1.814	5	0	0	5	7
2	2014	4	3.058	13	0.000	0	13	0.0	126	0	13	1.878	5	0	0	5	8
3	2015	4	3.165	13	0.000	0	13	0.0	127	0	13	1.944	5	0	0	5	8
4	2016	4	3.276	14	0.000	0	14	0.0	128	0	14	2.012	5	0	0	5	9
5	2017	4	3.391	14	0.000	0	14	0.0	129	0	14	2.082	6	0	0	6	8
6	2018	4	3.510	15	0.000	0	15	0.0	131	0	15	2.155	6	0	0	6	9
7	2019	4	3.632	15	0.000	0	15	0.0	132	0	15	2.230	6	0	0	6	9
8	2020	4	3.759	16	0.000	0	16	0.0	133	0	16	2.308	6	0	0	6	10
9	2021	4	3.891	16	0.000	0	16	0.0	135	0	16	2.389	7	0	0	7	9
10	2022	0	4.027	0	0.000	0	0	0.0	136	0	0	2.473	0	0	0	0	0
11	2023	0	4.168	0	0.000	0	0	0.0	137	0	0	2.559	0	0	0	0	0
12	2024	0	4.314	0	0.000	0	0	0.0	139	0	0	2.649	0	0	0	0	0
13	2025	0	4.465	0	0.000	0	0	0.0	140	0	0	2.742	0	0	0	0	0
14	2026	0	4.621	0	0.000	0	0	0.0	142	0	0	2.838	0	0	0	0	0
15	2027	0	4.783	0	0.000	0	0	0.0	143	0	0	2.937	0	0	0	0	0
16	2028	0	4.951	0	0.000	0	0	0.0	144	0	0	3.040	0	0	0	0	0
17	2029	0	5.124	0	0.000	0	0	0.0	146	0	0	3.146	0	0	0	0	0
18	2030	0	5.303	0	0.000	0	0	0.0	147	0	0	3.256	0	0	0	0	0
19	2031	0	5.489	0	0.000	0	0	0.0	149	0	0	3.370	0	0	0	0	0
20	2032	0	5.681	0	0.000	0	0	0.0	150	0	0	3.488	0	0	0	0	0
Total =		42									\$140					\$242	(\$102)
											NPV =	\$96				\$224	(\$129)
Total NPV =																	(\$129)
Benefit/Cost Ratio =																	0.43

**Worksheet Calculations**

(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27))
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

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**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .62 EF**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$12	\$0	\$12	\$36	\$150	\$186	(\$174)
2013	12	0	12	0	0	0	12
2014	13	0	13	0	0	0	13
2015	13	0	13	0	0	0	13
2016	14	0	14	0	0	0	14
2017	14	0	14	0	0	0	14
2018	15	0	15	0	0	0	15
2019	15	0	15	0	0	0	15
2020	16	0	16	0	0	0	16
2021	16	0	16	0	0	0	16
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$140			\$186	(\$46)
		NPV =	\$96			\$186	(\$90)
Total NPV =			(\$90)				
Benefit/Cost Ratio =			<u>0.52</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .62 EF**

Year	Benefits						Costs			Annual Benefits Less Costs (K)	
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)		Annual Total Costs (J)
2012	\$12	\$0	\$0.025	\$0	\$1.018	\$4	\$16	\$186	\$0	\$186	(\$170)
2013	12	0	0.026	0	1.041	4	16	0	0	0	16
2014	13	0	0.027	0	1.065	4	17	0	0	0	17
2015	13	0	0.028	0	1.090	5	18	0	0	0	18
2016	14	0	0.029	0	1.115	5	19	0	0	0	19
2017	14	0	0.030	0	1.141	5	19	0	0	0	19
2018	15	0	0.031	0	1.167	5	20	0	0	0	20
2019	15	0	0.032	0	1.194	5	20	0	0	0	20
2020	16	0	0.033	0	1.221	5	21	0	0	0	21
2021	16	0	0.034	0	1.249	5	21	0	0	0	21
2022	0	0	0.035	0	1.278	0	0	0	0	0	0
2023	0	0	0.037	0	1.307	0	0	0	0	0	0
2024	0	0	0.038	0	1.337	0	0	0	0	0	0
2025	0	0	0.039	0	1.368	0	0	0	0	0	0
2026	0	0	0.040	0	1.400	0	0	0	0	0	0
2027	0	0	0.042	0	1.432	0	0	0	0	0	0
2028	0	0	0.043	0	1.465	0	0	0	0	0	0
2029	0	0	0.045	0	1.498	0	0	0	0	0	0
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0

Total = \$187 \$186 \$1  
 NPV = \$154 \$186 (\$32)

Total NPV = (\$32)  
 Benefit/Cost Ratio = 0.83

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated..	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

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**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .62 EF**

Year	Benefits						Costs	Annual Benefits Less Costs (I)	
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)	Total Annual Benefits (G)		Direct Participant Costs (H)
2012	\$150	4	\$6.012	\$25	\$0.102	\$0	\$175	\$150	\$25
2013	0	4	6.222	26	0.106	0	26	0	26
2014	0	4	6.440	27	0.109	0	27	0	27
2015	0	4	6.666	28	0.113	0	28	0	28
2016	0	4	6.899	29	0.117	0	29	0	29
2017	0	4	7.140	30	0.121	0	30	0	30
2018	0	4	7.390	31	0.125	0	31	0	31
2019	0	4	7.649	32	0.130	0	32	0	32
2020	0	4	7.917	33	0.134	0	33	0	33
2021	0	4	8.194	34	0.139	0	34	0	34
2022	0	0	8.481	0	0.144	0	0	0	0
2023	0	0	8.777	0	0.149	0	0	0	0
2024	0	0	9.085	0	0.154	0	0	0	0
2025	0	0	9.403	0	0.160	0	0	0	0
2026	0	0	9.732	0	0.165	0	0	0	0
2027	0	0	10.072	0	0.171	0	0	0	0
2028	0	0	10.425	0	0.177	0	0	0	0
2029	0	0	10.790	0	0.183	0	0	0	0
2030	0	0	11.167	0	0.189	0	0	0	0
2031	0	0	11.558	0	0.196	0	0	0	0
2032	0	0	11.963	0	0.203	0	0	0	0
<b>Total =</b>		<b>42</b>					<b>\$445</b>	<b>\$150</b>	<b>\$295</b>
					<b>NPV =</b>		<b>\$344</b>	<b>\$150</b>	<b>194</b>
<b>Total NPV =</b>		<b>\$194</b>							
<b>Benefit/Cost Ratio =</b>		<b>2.29</b>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

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**Table 5**  
**Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Residential Water Heating .62 EF**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$12	\$0	\$0	\$12	\$186	\$0	\$186	(\$174)
2013	12	0	0	12	0	0	0	12
2014	13	0	0	13	0	0	0	13
2015	13	0	0	13	0	0	0	13
2016	14	0	0	14	0	0	0	14
2017	14	0	0	14	0	0	0	14
2018	15	0	0	15	0	0	0	15
2019	15	0	0	15	0	0	0	15
2020	16	0	0	16	0	0	0	16
2021	16	0	0	16	0	0	0	16
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
			Total =	\$140			\$186	(\$46)
			NPV =	\$96			\$186	(90)

Total NPV = (\$90)  
Benefit/Cost Ratio = 0.52

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)

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**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .67 EF**  
Program Years: **2012**

Input Data			First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$6.012	16) Utility Project Costs			
Escalation Rate =	3.50%	16a) Administrative & Operating Costs =	\$219		
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) =	\$0.10200	16b) Incentive Costs =	900		
Escalation Rate =	3.50%	16c) Total Utility Project Costs =	\$1,119		
Non-Gas Fuel Units (ie. kWh, Gallons, etc) =	Kwh	17) Direct Participant Costs (\$/Part.) =	\$100		
3) Commodity Cost (\$/Dk) =	\$2.855	18) Participant Non-Energy Costs (Annual \$/Part.) =	\$0		
Escalation Rate =	3.50%	Escalation Rate =	0.00%		
4) Demand Cost (\$/Unit/Yr) =	\$123.18	19) Participant Non-Energy Savings (Annual \$/Part) =	\$0		
Escalation Rate =	1.00%	Escalation Rate =	0.00%		
5) Peak Reduction Factor =	1.000%	20) Project Life (Years) =	10		
6) Variable O&M (\$/Dk) =	\$0.000	21) Avg. Dk/Part. Saved =	3.600		
Escalation Rate =	0.00%	22) Avg Non-Gas Fuel Units/Part. Saved =	0		
7) Non-Gas Fuel Cost (\$/Fuel Unit) =	\$0.02314	22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0		
Escalation Rate =	3.50%	23) Number of Participants =	9		
8) Non-Gas Fuel Loss Factor	7.48%	24) Total Annual Dk Saved =	32.4		
9) Gas Environmental Damage Factor =	\$1.018	25) Incentive/Participant =	\$100		
Escalation Rate =	2.30%	26) Distribution Delivery Charge			\$1.753
10) Non Gas Fuel Environmental Damage Factor :	\$0.000	27) Effective Income Tax Rate =			35.000%
Escalation Rate =	0.00%	(Federal & State Taxes)			
11) Participant Discount Rate =	10.00%				
12) Utility Discount Rate =	8.94%				
13) Societal Discount Rate =	4.25%				
14) General Input Data Year =	2012				
15) Project Analysis Year 1 =	2012				
Project Analysis Year 2 =	0				
Project Analysis Year 3 =	0				

  

Test Results	NPV	B/C
Ratepayer Impact Measure Test	(\$402)	0.72
Utility Cost Test	(\$106)	0.91
Societal Test	\$404	1.36
Participant Test	\$1,505	2.67
Total Resource Cost Test	(\$106)	0.91

**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .67 EF**

t	Year	Benefits										Costs				Annual Benefits Less Costs (P)		
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)		Total Program Costs (O)	
0	2012	32	\$2.855	\$93	\$0.000	\$0	\$93	0.3	\$123	\$37	\$130	\$1.753	\$37	\$219	\$900	\$1,156	(\$1,026)	
1	2013	32	2.955	96	0.000	0	96	0.3	124	37	133	1.814	38	0	0	38	95	
2	2014	32	3.058	99	0.000	0	99	0.3	126	38	137	1.878	40	0	0	40	97	
3	2015	32	3.165	103	0.000	0	103	0.3	127	38	141	1.944	41	0	0	41	100	
4	2016	32	3.276	106	0.000	0	106	0.3	128	38	144	2.012	42	0	0	42	102	
5	2017	32	3.391	110	0.000	0	110	0.3	129	39	149	2.082	44	0	0	44	105	
6	2018	32	3.510	114	0.000	0	114	0.3	131	39	153	2.155	45	0	0	45	108	
7	2019	32	3.632	118	0.000	0	118	0.3	132	40	158	2.230	47	0	0	47	111	
8	2020	32	3.759	122	0.000	0	122	0.3	133	40	162	2.308	49	0	0	49	113	
9	2021	32	3.891	126	0.000	0	126	0.3	135	41	167	2.389	50	0	0	50	117	
10	2022	0	4.027	0	0.000	0	0	0.0	136	0	0	2.473	0	0	0	0	0	
11	2023	0	4.168	0	0.000	0	0	0.0	137	0	0	2.559	0	0	0	0	0	
12	2024	0	4.314	0	0.000	0	0	0.0	139	0	0	2.649	0	0	0	0	0	
13	2025	0	4.465	0	0.000	0	0	0.0	140	0	0	2.742	0	0	0	0	0	
14	2026	0	4.621	0	0.000	0	0	0.0	142	0	0	2.838	0	0	0	0	0	
15	2027	0	4.783	0	0.000	0	0	0.0	143	0	0	2.937	0	0	0	0	0	
16	2028	0	4.951	0	0.000	0	0	0.0	144	0	0	3.040	0	0	0	0	0	
17	2029	0	5.124	0	0.000	0	0	0.0	146	0	0	3.146	0	0	0	0	0	
18	2030	0	5.303	0	0.000	0	0	0.0	147	0	0	3.256	0	0	0	0	0	
19	2031	0	5.489	0	0.000	0	0	0.0	149	0	0	3.370	0	0	0	0	0	
20	2032	0	5.681	0	0.000	0	0	0.0	150	0	0	3.488	0	0	0	0	0	
Total =		324										\$1,474				\$1,552	(\$78)	
																	\$1,415	(\$402)
Total NPV =																		(\$402)
Benefit/Cost Ratio =																		0.72

**Worksheet Calculations**

(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27))
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

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**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .67 EF**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$93	\$37	\$130	\$219	\$900	\$1,119	(\$989)
2013	96	37	133	0	0	0	133
2014	99	38	137	0	0	0	137
2015	103	38	141	0	0	0	141
2016	106	38	144	0	0	0	144
2017	110	39	149	0	0	0	149
2018	114	39	153	0	0	0	153
2019	118	40	158	0	0	0	158
2020	122	40	162	0	0	0	162
2021	126	41	167	0	0	0	167
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$1,474			\$1,119	\$355
		NPV =	\$1,013			\$1,119	(\$106)
Total NPV =			(\$106)				
Benefit/Cost Ratio =			<u>0.91</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .67 EF**

Year	Benefits							Costs			Annual Benefits Less Costs (K)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)	Annual Total Costs (J)	
2012	\$93	\$37	\$0.025	\$0	\$1.018	\$33	\$163	\$1,119	\$0	\$1,119	(\$956)
2013	96	37	0.026	0	1.041	34	167	0	0	0	167
2014	99	38	0.027	0	1.065	35	172	0	0	0	172
2015	103	38	0.028	0	1.090	35	176	0	0	0	176
2016	106	38	0.029	0	1.115	36	180	0	0	0	180
2017	110	39	0.030	0	1.141	37	186	0	0	0	186
2018	114	39	0.031	0	1.167	38	191	0	0	0	191
2019	118	40	0.032	0	1.194	39	197	0	0	0	197
2020	122	40	0.033	0	1.221	40	202	0	0	0	202
2021	126	41	0.034	0	1.249	40	207	0	0	0	207
2022	0	0	0.035	0	1.278	0	0	0	0	0	0
2023	0	0	0.037	0	1.307	0	0	0	0	0	0
2024	0	0	0.038	0	1.337	0	0	0	0	0	0
2025	0	0	0.039	0	1.368	0	0	0	0	0	0
2026	0	0	0.040	0	1.400	0	0	0	0	0	0
2027	0	0	0.042	0	1.432	0	0	0	0	0	0
2028	0	0	0.043	0	1.465	0	0	0	0	0	0
2029	0	0	0.045	0	1.498	0	0	0	0	0	0
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0

Total = \$1,841 \$1,119 \$722

NPV = \$1,523 \$1,119 \$404

Total NPV = \$404  
Benefit/Cost Ratio = 1.36

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated.	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Residential Water Heating .67 EF**

Year	Benefits						Costs	Annual Benefits Less Costs (I)	
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)	Total Annual Benefits (G)		Direct Participant Costs (H)
2012	\$900	32	\$6.012	\$195	\$0.102	\$0	\$1,095	\$900	\$195
2013	0	32	6.222	202	0.106	0	202	0	202
2014	0	32	6.440	209	0.109	0	209	0	209
2015	0	32	6.666	216	0.113	0	216	0	216
2016	0	32	6.899	224	0.117	0	224	0	224
2017	0	32	7.140	231	0.121	0	231	0	231
2018	0	32	7.390	239	0.125	0	239	0	239
2019	0	32	7.649	248	0.130	0	248	0	248
2020	0	32	7.917	257	0.134	0	257	0	257
2021	0	32	8.194	265	0.139	0	265	0	265
2022	0	0	8.481	0	0.144	0	0	0	0
2023	0	0	8.777	0	0.149	0	0	0	0
2024	0	0	9.085	0	0.154	0	0	0	0
2025	0	0	9.403	0	0.160	0	0	0	0
2026	0	0	9.732	0	0.165	0	0	0	0
2027	0	0	10.072	0	0.171	0	0	0	0
2028	0	0	10.425	0	0.177	0	0	0	0
2029	0	0	10.790	0	0.183	0	0	0	0
2030	0	0	11.167	0	0.189	0	0	0	0
2031	0	0	11.558	0	0.196	0	0	0	0
2032	0	0	11.963	0	0.203	0	0	0	0
Total =		324					\$3,186	\$900	\$2,286
							NPV = \$2,405	\$900	1,505
Total NPV =		\$1,505							
Benefit/Cost Ratio =		<u>2.67</u>							

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Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

**Table 5**  
**Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Residential Water Heating .67 EF**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$93	\$37	\$0	\$130	\$1,119	\$0	\$1,119	(\$989)
2013	96	37	0	133	0	0	0	133
2014	99	38	0	137	0	0	0	137
2015	103	38	0	141	0	0	0	141
2016	106	38	0	144	0	0	0	144
2017	110	39	0	149	0	0	0	149
2018	114	39	0	153	0	0	0	153
2019	118	40	0	158	0	0	0	158
2020	122	40	0	162	0	0	0	162
2021	126	41	0	167	0	0	0	167
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
			Total =	\$1,474			\$1,119	\$355
			NPV =	\$1,013			\$1,119	(106)

Total NPV = (\$106)  
Benefit/Cost Ratio = 0.91

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)

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**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Programmable Thermostats**  
Program Years: **2012**

Input Data	First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$6.012		
Escalation Rate =	3.50%		
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) =	\$0.10200		
Escalation Rate =	3.50%		
Non-Gas Fuel Units (ie. kWh, Gallons, etc) =	Kwh		
3) Commodity Cost (\$/Dk) =	\$2.855		
Escalation Rate =	3.50%		
4) Demand Cost (\$/Unit/Yr) =	\$123.18		
Escalation Rate =	1.00%		
5) Peak Reduction Factor =	1.000%		
6) Variable O&M (\$/Dk) =	\$0.000		
Escalation Rate =	0.00%		
7) Non-Gas Fuel Cost (\$/Fuel Unit) =	\$0.02314		
Escalation Rate =	3.50%		
8) Non-Gas Fuel Loss Factor	7.48%		
9) Gas Environmental Damage Factor =	\$1.018		
Escalation Rate =	2.30%		
10) Non Gas Fuel Environmental Damage Factor :	\$0.000		
Escalation Rate =	0.00%		
11) Participant Discount Rate =	10.00%		
12) Utility Discount Rate =	8.94%		
13) Societal Discount Rate =	4.25%		
14) General Input Data Year =	2012		
15) Project Analysis Year 1 =	2012		
Project Analysis Year 2 =	0		
Project Analysis Year 3 =	0		
16) Utility Project Costs			
16a) Administrative & Operating Costs =	\$258		
16b) Incentive Costs =	1,060		
16c) Total Utility Project Costs =	\$1,318		
17) Direct Participant Costs (\$/Part.) =	\$60		
18) Participant Non-Energy Costs (Annual \$/Part.) =	\$0		
Escalation Rate =	0.00%		
19) Participant Non-Energy Savings (Annual \$/Part.) =	\$0		
Escalation Rate =	0.00%		
20) Project Life (Years) =	15		
21) Avg. Dk/Part. Saved =	2.900		
22) Avg Non-Gas Fuel Units/Part. Saved =	216		
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0		
23) Number of Participants =	53		
24) Total Annual Dk Saved =	153.7		
25) Incentive/Participant =	\$20		
26) Distribution Delivery Charge			\$1.753
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	\$3,234	2.01
Utility Cost Test	\$5,115	4.88
Societal Test	\$11,227	4.27
Participant Test	\$19,080	7.00
Total Resource Cost Test	\$6,083	2.77

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**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Programmable Thermostats**

t	Year	Benefits										Costs					Annual Benefits Less Costs (P)
		Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Program Costs (O)	
0	2012	154	\$2,855	\$439	\$0.000	\$0	\$439	1.5	\$123	\$185	\$624	\$1,753	\$175	\$258	\$1,060	\$1,493	(\$869)
1	2013	154	2,955	454	0.000	0	454	1.5	124	186	640	1,814	181	0	0	181	459
2	2014	154	3,058	470	0.000	0	470	1.5	126	189	659	1,878	188	0	0	188	471
3	2015	154	3,165	486	0.000	0	486	1.5	127	191	677	1,944	194	0	0	194	483
4	2016	154	3,276	504	0.000	0	504	1.5	128	192	696	2,012	201	0	0	201	495
5	2017	154	3,391	521	0.000	0	521	1.5	129	194	715	2,082	208	0	0	208	507
6	2018	154	3,510	539	0.000	0	539	1.5	131	197	736	2,155	215	0	0	215	521
7	2019	154	3,632	558	0.000	0	558	1.5	132	198	756	2,230	223	0	0	223	533
8	2020	154	3,759	578	0.000	0	578	1.5	133	200	778	2,308	231	0	0	231	547
9	2021	154	3,891	598	0.000	0	598	1.5	135	203	801	2,389	239	0	0	239	562
10	2022	154	4,027	619	0.000	0	619	1.5	136	204	823	2,473	247	0	0	247	576
11	2023	154	4,168	641	0.000	0	641	1.5	137	206	847	2,559	256	0	0	256	591
12	2024	154	4,314	663	0.000	0	663	1.5	139	209	872	2,649	265	0	0	265	607
13	2025	154	4,465	686	0.000	0	686	1.5	140	210	896	2,742	274	0	0	274	622
14	2026	154	4,621	710	0.000	0	710	1.5	142	213	923	2,838	284	0	0	284	639
15	2027	0	4,783	0	0.000	0	0	0.0	143	0	0	2,937	0	0	0	0	0
16	2028	0	4,951	0	0.000	0	0	0.0	144	0	0	3,040	0	0	0	0	0
17	2029	0	5,124	0	0.000	0	0	0.0	146	0	0	3,146	0	0	0	0	0
18	2030	0	5,303	0	0.000	0	0	0.0	147	0	0	3,256	0	0	0	0	0
19	2031	0	5,489	0	0.000	0	0	0.0	149	0	0	3,370	0	0	0	0	0
20	2032	0	5,681	0	0.000	0	0	0.0	150	0	0	3,488	0	0	0	0	0
Total =		2,306									\$11,443					\$4,699	\$6,744
																\$3,199	\$3,234
Total NPV =			\$3,234														
Benefit/Cost Ratio =			2.01														

Worksheet Calculations	
(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27)
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)

**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Programmable Thermostats**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$439	\$185	\$624	\$258	\$1,060	\$1,318	(\$694)
2013	454	186	640	0	0	0	640
2014	470	189	659	0	0	0	659
2015	486	191	677	0	0	0	677
2016	504	192	696	0	0	0	696
2017	521	194	715	0	0	0	715
2018	539	197	736	0	0	0	736
2019	558	198	756	0	0	0	756
2020	578	200	778	0	0	0	778
2021	598	203	801	0	0	0	801
2022	619	204	823	0	0	0	823
2023	641	206	847	0	0	0	847
2024	663	209	872	0	0	0	872
2025	686	210	896	0	0	0	896
2026	710	213	923	0	0	0	923
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$11,443			\$1,318	\$10,125
		NPV =	\$6,433			\$1,318	\$5,115
Total NPV =			\$5,115				
Benefit/Cost Ratio =			<u>4.88</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

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**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Programmable Thermostats**

Year	Benefits						Costs			Annual Benefits Less Costs (K)	
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Net Costs of Rebate (I)		Annual Total Costs (J)
2012	\$439	\$185	\$0.025	\$286	\$1.018	\$156	\$1,066	\$1,318	\$2,120	\$3,438	(\$2,372)
2013	454	186	0.026	298	1.041	160	1,098	0	0	0	1,098
2014	470	189	0.027	309	1.065	164	1,132	0	0	0	1,132
2015	486	191	0.028	321	1.090	168	1,166	0	0	0	1,166
2016	504	192	0.029	332	1.115	171	1,199	0	0	0	1,199
2017	521	194	0.030	343	1.141	175	1,233	0	0	0	1,233
2018	539	197	0.031	355	1.167	179	1,270	0	0	0	1,270
2019	558	198	0.032	366	1.194	184	1,306	0	0	0	1,306
2020	578	200	0.033	378	1.221	188	1,344	0	0	0	1,344
2021	598	203	0.034	389	1.249	192	1,382	0	0	0	1,382
2022	619	204	0.035	401	1.278	196	1,420	0	0	0	1,420
2023	641	206	0.037	424	1.307	201	1,472	0	0	0	1,472
2024	663	209	0.038	435	1.337	205	1,512	0	0	0	1,512
2025	686	210	0.039	446	1.368	210	1,552	0	0	0	1,552
2026	710	213	0.040	458	1.400	215	1,596	0	0	0	1,596
2027	0	0	0.042	0	1.432	0	0	0	0	0	0
2028	0	0	0.043	0	1.465	0	0	0	0	0	0
2029	0	0	0.045	0	1.498	0	0	0	0	0	0
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0

Total = \$19,748 \$3,438 \$16,310

NPV = \$14,665 \$3,438 \$11,227

Total NPV = \$11,227  
Benefit/Cost Ratio = 4.27

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated..	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

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**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Programmable Thermostats**

Year	Benefits						Total Annual Benefits (G)	Direct Participant Costs (H)	Annual Benefits Less Costs (I)
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)			
2012	\$1,060	154	\$6.012	\$924	\$0.102	\$1,168	\$3,152	\$3,180	(\$28)
2013	0	154	6.222	956	0.106	1,213	2,169	0	2,169
2014	0	154	6.440	990	0.109	1,248	2,238	0	2,238
2015	0	154	6.666	1,025	0.113	1,294	2,319	0	2,319
2016	0	154	6.899	1,060	0.117	1,339	2,399	0	2,399
2017	0	154	7.140	1,097	0.121	1,385	2,482	0	2,482
2018	0	154	7.390	1,136	0.125	1,431	2,567	0	2,567
2019	0	154	7.649	1,176	0.130	1,488	2,664	0	2,664
2020	0	154	7.917	1,217	0.134	1,534	2,751	0	2,751
2021	0	154	8.194	1,259	0.139	1,591	2,850	0	2,850
2022	0	154	8.481	1,304	0.144	1,649	2,953	0	2,953
2023	0	154	8.777	1,349	0.149	1,706	3,055	0	3,055
2024	0	154	9.085	1,396	0.154	1,763	3,159	0	3,159
2025	0	154	9.403	1,445	0.160	1,832	3,277	0	3,277
2026	0	154	9.732	1,496	0.165	1,889	3,385	0	3,385
2027	0	0	10.072	0	0.171	0	0	0	0
2028	0	0	10.425	0	0.177	0	0	0	0
2029	0	0	10.790	0	0.183	0	0	0	0
2030	0	0	11.167	0	0.189	0	0	0	0
2031	0	0	11.558	0	0.196	0	0	0	0
2032	0	0	11.963	0	0.203	0	0	0	0
Total =		2,306					\$41,420	\$3,180	\$38,240
							NPV = \$22,260	\$3,180	19,080
Total NPV =		\$19,080							
Benefit/Cost Ratio =		<u>7.00</u>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

HH

**Table 5  
Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Programmable Thermostats**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$439	\$185	\$286	\$910	\$1,318	\$2,120	\$3,438	(\$2,528)
2013	454	186	298	938	0	0	0	938
2014	470	189	309	968	0	0	0	968
2015	486	191	321	998	0	0	0	998
2016	504	192	332	1,028	0	0	0	1,028
2017	521	194	343	1,058	0	0	0	1,058
2018	539	197	355	1,091	0	0	0	1,091
2019	558	198	366	1,122	0	0	0	1,122
2020	578	200	378	1,156	0	0	0	1,156
2021	598	203	389	1,190	0	0	0	1,190
2022	619	204	401	1,224	0	0	0	1,224
2023	641	206	424	1,271	0	0	0	1,271
2024	663	209	435	1,307	0	0	0	1,307
2025	686	210	446	1,342	0	0	0	1,342
2026	710	213	458	1,381	0	0	0	1,381
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
			Total =	\$16,984			\$3,438	\$13,546
			NPV =	\$9,521			\$3,438	6,083

Total NPV = \$6,083  
Benefit/Cost Ratio = 2.77

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)

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**NATURAL GAS CONSERVATION PROGRAMS/DEMAND-SIDE MANAGEMENT  
BEN/COST ANALYSIS FOR GAS CONSERVATION**

Company: **Montana-Dakota Utilities Co.**  
Project: **Commercial 95+% AFUE Furnace - Replacement**  
Program Years: **2012**

Input Data			First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$5.615	16) Utility Project Costs			
Escalation Rate =	3.50%	16a) Administrative & Operating Costs =	\$292		
2) Non-Gas Fuel Retail Rate (\$/Fuel Unit) =	\$0.10340	16b) Incentive Costs =	1,200		
Escalation Rate =	3.50%	16c) Total Utility Project Costs =	\$1,492		
Non-Gas Fuel Units (ie. kWh, Gallons, etc) =	Kwh	17) Direct Participant Costs (\$/Part.) =	\$620		
3) Commodity Cost (\$/Dk) =	\$2.855	18) Participant Non-Energy Costs (Annual \$/Part.) =	\$0		
Escalation Rate =	3.50%	Escalation Rate =	0.00%		
4) Demand Cost (\$/Unit/Yr) =	\$123.18	19) Participant Non-Energy Savings (Annual \$/Part) =	\$0		
Escalation Rate =	1.00%	Escalation Rate =	0.00%		
5) Peak Reduction Factor =	1.000%	20) Project Life (Years) =	18		
6) Variable O&M (\$/Dk) =	\$0.000	21) Avg. Dk/Part. Saved =	23.000		
Escalation Rate =	0.00%	22) Avg Non-Gas Fuel Units/Part. Saved =	669		
7) Non-Gas Fuel Cost (\$/Fuel Unit) =	\$0.02314	22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0		
Escalation Rate =	3.50%	23) Number of Participants =	4		
8) Non-Gas Fuel Loss Factor	7.48%	24) Total Annual Dk Saved =	92.0		
9) Gas Environmental Damage Factor =	\$1.018	25) Incentive/Participant =	\$300		
Escalation Rate =	2.30%	26) Distribution Delivery Charge			\$1.368
10) Non Gas Fuel Environmental Damage Factor :	\$0.000	27) Effective Income Tax Rate =			35.000%
Escalation Rate =	0.00%	(Federal & State Taxes)			
11) Participant Discount Rate =	10.00%				
12) Utility Discount Rate =	8.94%				
13) Societal Discount Rate =	4.25%				
14) General Input Data Year =	2012				
15) Project Analysis Year 1 =	2012				
Project Analysis Year 2 =	0				
Project Analysis Year 3 =	0				

  

Test Results	NPV	B/C
Ratepayer Impact Measure Test	\$1,819	1.73
Utility Cost Test	\$2,806	2.88
Societal Test	\$5,802	3.09
Participant Test	\$7,662	4.09
Total Resource Cost Test	\$2,337	1.84

**Table 1**  
**Ratepayer Impact Measure Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Commercial 95+% AFUE Furnace - Replacement**

Year	Benefits										Costs					Annual Benefits Less Costs (P)		
	Total Energy Reduction (A)	Gas Commodity Cost/Dk (B)	Gas Commodity Savings (C)	Variable O & M Cost/Dk (D)	Variable O & M Savings (E)	Total Energy Savings (F)	Peak Dk Demand Reduction (G)	Demand Savings Per Unit (H)	Total Demand Savings (I)	Total Savings (J)	Distribution Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Program Costs (O)			
0	2012	92	\$2,855	\$263	\$0.000	\$0	\$263	0.9	\$123	\$111	\$374	\$1,368	\$82	\$292	\$1,200	\$1,574	(\$1,200)	
1	2013	92	2,955	272	0.000	0	272	0.9	124	112	384	1,416	85	0	0	85	299	
2	2014	92	3,058	281	0.000	0	281	0.9	126	113	394	1,465	88	0	0	88	306	
3	2015	92	3,165	291	0.000	0	291	0.9	127	114	405	1,517	91	0	0	91	314	
4	2016	92	3,276	301	0.000	0	301	0.9	128	115	416	1,570	94	0	0	94	322	
5	2017	92	3,391	312	0.000	0	312	0.9	129	116	428	1,625	97	0	0	97	331	
6	2018	92	3,510	323	0.000	0	323	0.9	131	118	441	1,682	101	0	0	101	340	
7	2019	92	3,632	334	0.000	0	334	0.9	132	119	453	1,740	104	0	0	104	349	
8	2020	92	3,759	346	0.000	0	346	0.9	133	120	466	1,801	108	0	0	108	358	
9	2021	92	3,891	358	0.000	0	358	0.9	135	122	480	1,864	111	0	0	111	369	
10	2022	92	4,027	370	0.000	0	370	0.9	136	122	492	1,930	115	0	0	115	377	
11	2023	92	4,168	383	0.000	0	383	0.9	137	123	506	1,997	119	0	0	119	387	
12	2024	92	4,314	397	0.000	0	397	0.9	139	125	522	2,067	124	0	0	124	398	
13	2025	92	4,465	411	0.000	0	411	0.9	140	126	537	2,139	128	0	0	128	409	
14	2026	92	4,621	425	0.000	0	425	0.9	142	128	553	2,214	132	0	0	132	421	
15	2027	92	4,783	440	0.000	0	440	0.9	143	129	569	2,292	137	0	0	137	432	
16	2028	92	4,951	455	0.000	0	455	0.9	144	130	585	2,372	142	0	0	142	443	
17	2029	92	5,124	471	0.000	0	471	0.9	146	131	602	2,455	147	0	0	147	455	
18	2030	0	5,303	0	0.000	0	0	0.0	147	0	0	2,541	0	0	0	0	0	
19	2031	0	5,489	0	0.000	0	0	0.0	149	0	0	2,630	0	0	0	0	0	
20	2032	0	5,681	0	0.000	0	0	0.0	150	0	0	2,722	0	0	0	0	0	
Total =		1,656									\$8,607					\$3,497	\$5,110	
																	\$2,480	\$1,819
Total NPV =																		\$1,819
Benefit/Cost Ratio =																		1.73

**Worksheet Calculations**

(A) = Average Dk/Participant Saved (21) x Number of Participants (23) for Project Life (20)	(I) = (G) x (H)
(B) = Commodity Cost (3) escalated	(J) = (F) + (I)
(C) = (A) x (B)	(K) = Distribution Delivery Charge (26) escalated.
(D) = Variable O&M Cost (6), escalated	(L) = (A) x (K) x (1-Inverse of Tax Rate (27)
(E) = (A) x (D)	(M) = Admin & Operating Costs (16a)
(F) = (C) + (E)	(N) = Incentive Costs (16b)
(G) = (A) x Peak Reduction Factor (5)	(O) = (L) + (M) + (N)
(H) = Demand Cost (4) escalated.	(P) = (J) - (O)



**Table 2  
Utility Cost Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Commercial 95+% AFUE Furnace - Replacement**

Year	Benefits			Costs			Annual Benefits Less Costs (G)
	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	
2012	\$263	\$111	\$374	\$292	\$1,200	\$1,492	(\$1,118)
2013	272	112	384	0	0	0	384
2014	281	113	394	0	0	0	394
2015	291	114	405	0	0	0	405
2016	301	115	416	0	0	0	416
2017	312	116	428	0	0	0	428
2018	323	118	441	0	0	0	441
2019	334	119	453	0	0	0	453
2020	346	120	466	0	0	0	466
2021	358	122	480	0	0	0	480
2022	370	122	492	0	0	0	492
2023	383	123	506	0	0	0	506
2024	397	125	522	0	0	0	522
2025	411	126	537	0	0	0	537
2026	425	128	553	0	0	0	553
2027	440	129	569	0	0	0	569
2028	455	130	585	0	0	0	585
2029	471	131	602	0	0	0	602
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
Total =			\$8,607			\$1,492	\$7,115
		NPV =	\$4,298			\$1,492	\$2,806
Total NPV =			\$2,806				
Benefit/Cost Ratio =			<u>2.88</u>				

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(C) = Table 1 (J)
(D) = Table 1 (M)
(E) = Table 1 (N)
(F) = (D) + (E)
(G) = (C) - (F)

**Table 3  
Societal Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Commercial 95+% AFUE Furnace - Replacement**

Year	Benefits							Costs			Annual Benefits Less Costs (K)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (\$/Part.) (C)	Non-Gas Energy Savings (D)	Environmental Damage Savings/Dk (E)	Environmental Damage Savings (F)	Annual Total Savings (G)	Utility Program Costs (H)	Participants' Costs Net of Rebate (I)	Annual Total Costs (J)	
2012	\$263	\$111	\$0.025	\$67	\$1.018	\$94	\$535	\$1,492	\$1,280	\$2,772	(\$2,237)
2013	272	112	0.026	70	1.041	96	550	0	0	0	550
2014	281	113	0.027	72	1.065	98	564	0	0	0	564
2015	291	114	0.028	75	1.090	100	580	0	0	0	580
2016	301	115	0.029	78	1.115	103	597	0	0	0	597
2017	312	116	0.030	80	1.141	105	613	0	0	0	613
2018	323	118	0.031	83	1.167	107	631	0	0	0	631
2019	334	119	0.032	86	1.194	110	649	0	0	0	649
2020	346	120	0.033	88	1.221	112	666	0	0	0	666
2021	358	122	0.034	91	1.249	115	686	0	0	0	686
2022	370	122	0.035	94	1.278	118	704	0	0	0	704
2023	383	123	0.037	99	1.307	120	725	0	0	0	725
2024	397	125	0.038	102	1.337	123	747	0	0	0	747
2025	411	126	0.039	104	1.368	126	767	0	0	0	767
2026	425	128	0.040	107	1.400	129	789	0	0	0	789
2027	440	129	0.042	112	1.432	132	813	0	0	0	813
2028	455	130	0.043	115	1.465	135	835	0	0	0	835
2029	471	131	0.045	120	1.498	138	860	0	0	0	860
2030	0	0	0.046	0	1.533	0	0	0	0	0	0
2031	0	0	0.048	0	1.568	0	0	0	0	0	0
2032	0	0	0.050	0	1.604	0	0	0	0	0	0

Total = NPV = \$12,311 \$2,772 \$9,539  
\$8,574 \$2,772 \$5,802

Total NPV = \$5,802  
Benefit/Cost Ratio = 3.09

Worksheet Calculations	
(A) = Table 1 (F)	(H) = Table 2 (F)
(G) = Table 1 (I)	(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(C) = Non-Gas Fuel Cost (7), adjusted for losses (8), escalated..	(J) = (H) + (I)
(D) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]	(K) = (G) - (J)
(E) = Gas Environmental Damage Factor (9), escalated	
(F) = Table 1 (A) x (E)	
(G) = (A) + (B) + (D) + (F)	

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**Table 4  
Participant Test**

Company: **Montana-Dakota Utilities Co.**  
Project: **Commercial 95+% AFUE Furnace - Replacement**

Year	Benefits							Costs	Annual Benefits Less Costs (I)
	Incentives Received (A)	Total Energy Reduction (B)	Retail Rate (C)	Gas Bill Savings (D)	Non-Gas Fuel Retail Rate (E)	Non-Gas Energy Savings (F)	Total Annual Benefits (G)	Direct Participant Costs (H)	
2012	\$1,200	92	\$5.615	\$517	\$0.103	\$276	\$1,993	\$2,480	(\$487)
2013	0	92	5.812	535	0.107	286	821	0	821
2014	0	92	6.015	553	0.111	297	850	0	850
2015	0	92	6.225	573	0.115	308	881	0	881
2016	0	92	6.443	593	0.119	318	911	0	911
2017	0	92	6.669	614	0.123	329	943	0	943
2018	0	92	6.902	635	0.127	340	975	0	975
2019	0	92	7.144	657	0.132	353	1,010	0	1,010
2020	0	92	7.394	680	0.136	364	1,044	0	1,044
2021	0	92	7.653	704	0.141	377	1,081	0	1,081
2022	0	92	7.921	729	0.146	391	1,120	0	1,120
2023	0	92	8.198	754	0.151	404	1,158	0	1,158
2024	0	92	8.485	781	0.156	417	1,198	0	1,198
2025	0	92	8.782	808	0.162	434	1,242	0	1,242
2026	0	92	9.089	836	0.167	447	1,283	0	1,283
2027	0	92	9.407	865	0.173	463	1,328	0	1,328
2028	0	92	9.736	896	0.179	479	1,375	0	1,375
2029	0	92	10.077	927	0.186	498	1,425	0	1,425
2030	0	0	10.430	0	0.192	0	0	0	0
2031	0	0	10.795	0	0.199	0	0	0	0
2032	0	0	11.173	0	0.206	0	0	0	0
Total =		1,656					\$20,638	\$2,480	\$18,158
							NPV = \$10,142	\$2,480	7,662
Total NPV =		\$7,662							
Benefit/Cost Ratio =		<u>4.09</u>							

Worksheet Calculations
(A) = Table 1 (N)
(B) = Table 1 (A)
(C) = Retail Rate (1) escalated.
(D) = (B) x (C)
(E) = Non-Gas Fuel Retail Rate (2), escalated.
(F) = (C) x [Avg. Non-Gas Fuel Units/Part.Saved (22) x No. of Part. (23)]
(G) = (A) + (D) + (F)
(H) = Direct Participant Costs (17) x Number of Participants (23)
(I) = (G) - (H)

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**Table 5**  
**Total Resource Cost Test**

Compa **Montana-Dakota Utilities Co.**  
Project **Commercial 95+% AFUE Furnace - Replacement**

Year	Benefits				Costs			Annual Benefits Less Costs (H)
	Total Energy Savings (A)	Total Demand Savings (B)	Non-Gas Energy Savings (C)	Total Annual Benefits (D)	Utility Program Costs (E)	Participants' Costs Net of Rebate (F)	Total Costs (G)	
2012	\$263	\$111	\$67	\$441	\$1,492	\$1,280	\$2,772	(\$2,331)
2013	272	112	70	454	0	0	0	454
2014	281	113	72	466	0	0	0	466
2015	291	114	75	480	0	0	0	480
2016	301	115	78	494	0	0	0	494
2017	312	116	80	508	0	0	0	508
2018	323	118	83	524	0	0	0	524
2019	334	119	86	539	0	0	0	539
2020	346	120	88	554	0	0	0	554
2021	358	122	91	571	0	0	0	571
2022	370	122	94	586	0	0	0	586
2023	383	123	99	605	0	0	0	605
2024	397	125	102	624	0	0	0	624
2025	411	126	104	641	0	0	0	641
2026	425	128	107	660	0	0	0	660
2027	440	129	112	681	0	0	0	681
2028	455	130	115	700	0	0	0	700
2029	471	131	120	722	0	0	0	722
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0

Total = \$10,250  
NPV = \$5,109

\$2,772 \$7,478  
\$2,772 2,337

Total NPV = \$2,337  
Benefit/Cost Ratio = 1.84

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (T)
(C) = Table 3 (D)
(D) = (A) + (B) + (C)
(E) = Table 3 (H)
(F) = Table 3 (I)
(G) = (E) + (F)
(H) = (D) - (G)

**Montana-Dakota Utilities Co.  
Gas Utility - South Dakota  
DSM Summary  
April 1, 2012 through October 31, 2012**

	<u>Participants</u>	<u>Dk Savings</u>	<u>Incentive Expense</u>	<u>Admin Allocation</u>	<u>Admin Expense 1/</u>	<u>Total Expense</u>
<b>Residential</b>						
High Efficiency Furnace - 92-94%	4	47.2	\$600	1.68%	\$145	\$745
High Efficiency Furnace - 95%+ (new)	26	184.6	7,800	21.84%	1,896	9,696
High Efficiency Furnace - 95%+	80	1,048.0	24,000	67.21%	5,835	29,835
High Efficiency Water Heater (.62 EF)	3	4.2	150	0.42%	36	186
High Efficiency Water Heater (.67+ EF)	9	32.4	900	2.52%	219	1,119
Programmable Thermostats	53	153.7	1,060	2.97%	258	1,318
Total Residential	<u>175</u>	<u>1,470.1</u>	<u>34,510</u>		<u>\$8,389</u>	<u>\$42,899</u>
<b>Commercial &amp; Industrial</b>						
High Efficiency Furnace - 92-94%	0	0.0	0	0.00%	\$0	\$0
High Efficiency Furnace - 95%+ (new)	0	0.0	0	0.00%	0	0
High Efficiency Furnace - 95%+ (replacement)	4	92.0	1,200	3.36%	292	1,492
Custom	0	0.0	0	0.00%	0	0
Total Commercial and Industrial	<u>4</u>	<u>92.0</u>	<u>1,200</u>		<u>\$292</u>	<u>\$1,492</u>
Energy Audit 2/						\$500
Total South Dakota	<u><u>179</u></u>	<u><u>1,562.1</u></u>	<u><u>35,710</u></u>	100.00%	<u><u>\$8,681</u></u>	<u><u>\$44,891</u></u>

1/ Administration expense allocated on incentive costs.

Total Administration expense April 1, 2012 through November 30, 2012: \$8,681

2/ Reflects direct program expense.

Administration	\$3,900
Advertising	4,781
Total Administration	<u>\$8,681</u>

**Montana-Dakota Utilities Co.  
2012 Input Data Summary  
South Dakota Natural Gas Conservation Model**

Input No.	Input Data Description	Information Source	SD Res.	SD Comm.
1	Retail Rate (\$/dk)	Weighted Commodity SD Retail gas costs April - November 2012	6.012	5.615
	Escalation Rate		3.50%	3.50%
2	Non-Gas Fuel Retail (\$/fuel/unit)	Average retail cost of non gas fuel if measures also saves kWh, gallons of water, etc. (for analysis purposes, used electric as Non-Gas Fuel Retail Rate)	0.102	0.1034
	Escalation Rate		3.50%	3.50%
	Non-Gas Fuel Units (ie. kWh, Gallons, etc)		Kwh	Kwh
3	Commodity Cost (\$/dk)	Weighted Commodity Gas costs April - November 2012	2.855	2.855
	Escalation Rate		3.50%	3.50%
4	Demand Cost (\$/dk/Yr)	Annual cost of firm capacity on pipeline	\$123.18	\$123.18
	Escalation Rate		1.00%	1.00%
5	Peak Reduction Factor	Estimated average peak day reduction factor caused by implementing the measure (s)	1.000%	1.000%
6	Variable O&M (\$/dk)	Estimated variable O&M that will be avoided due the implementing the measure	\$0	\$0
	Escalation Rate		0.00%	0.00%
7	Non-Gas Fuel Cost (\$/Fuel Unit)	Average commodity cost of non gas fuel if measures also saves kWh, gallons of water, etc. (for analysis purposes, used electric as Non-Gas Fuel Cost)	\$0.02314	\$0.02314
	Escalation Rate		3.50%	3.50%
8	Non-Gas Fuel Loss Factor	Non-Gas fuel loss factor (for analysis purposes, used electric line loss factor for Black Hills)	7.48%	7.48%
9	Gas Environmental Damage Factor	EPA's Unit Conversions, Emissions Factors and Other Reference Data, November 2004	1.018	1.018
	Escalation Rate		2.30%	2.30%
10	Non Gas Fuel Environmental Damage Factor	Not Applicable	\$0	\$0
	Escalation Rate		0.00%	0.00%
11	Participant Discount Rate		10.00%	10.00%
12	Utility Discount Rate	Montana-Dakota's authorized average cost of capital	8.94%	8.94%
13	Societal Discount Rate	Equal to the 30 year T-Bill rate average for Twelve Months Ending July 31, 2011	4.25%	4.25%
14	General Input Data Year =	Year data was input	2012	2012
15	Project Analysis Year	Year(s) program will be implemented	2012	2012

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**Montana-Dakota Utilities Co.  
2012 Input Data Summary  
South Dakota Natural Gas Conservation Model**

Input No.	Input Data Description	Information Source	SD Res.	SD Comm.
16	Utility Project Costs	Total direct cost to the utility caused by implementing the program(s)		
17	Direct Participant Costs (\$/Part.)	Direct costs that the participant would have to participate in the program		
18	Participant Non-Energy Costs (Annual \$/Part.)	Annual participant non-energy costs if applicable caused by implementing the measure (Not Applicable)	\$0	\$0
	Yr. 1		\$0	\$0
	Yr. 2		\$0	\$0
	Yr. 3		\$0	\$0
	Escalation Rate Yr. 1		0.00%	0.00%
	Escalation Rate Yr. 2		0.00%	0.00%
	Escalation Rate Yr. 3		0.00%	0.00%
19	Participant Non-Energy Savings (Annual \$/Part) Yr. 1	Participant non energy savings if applicable caused by implementing the measure (Not Applicable)	\$0	\$0
	Yr. 2		\$0	\$0
	Yr. 3		\$0	\$0
	Escalation Rate Yr. 1		0.00%	0.00%
	Escalation Rate Yr. 2		0.00%	0.00%
	Escalation Rate Yr. 3		1.40%	1.40%
20	Project Life (Years)	Based on the estimated useful life of the energy saving equipment (20 years maximum)		
21	Avg. Dk/Part. Saved	Avg energy reduction (Dk) caused by the program(s)		
22	Avg Non-Gas Fuel Units/Part. Saved Yr. 1	Average non-gas fuel units saved or added due to implementing the measure (for analysis purposes, used Kwh)		
	Yr. 2		0	0
	Yr. 3		0	0
22a	Avg Additional Non-Gas Fuel Units/ Part. Used Yr. 1		0	0
	Yr. 2		0	0
	Yr. 3		0	0
23	Number of Participants	Total number of expected participants is the program(s)		
24	Total Annual Dk Saved	Total Dk saved from the program in the year implemented		
25	Incentive/Participant	Incentive provided to the participant		
26	Distribution Delivery Charge	Weighted Average of Montana-Dakota's Distribution Delivery Charge	1.753	1.368
27	Effective Fed & State Income Tax Rate	Montana-Dakota's effective tax rate	35%	35%

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