

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

Company: **Montana-Dakota Utilities Co.**  
Project: **Programmable Thermostats**  
Program Years: **2012 - 2014**

Input Data		First Year	Second Year	Third Year
1) Retail Rate (\$/Dk) =	\$7.713			
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) =	\$4.410			
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) =	\$0.02005			
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 =	2011			
15) Project Analysis Year 1 =	2012			
Project Analysis Year 2 =	2013			
Project Analysis Year 3 =	2014			
16) Utility Project Costs				
16a) Administrative & Operating Costs =		\$773	\$698	\$623
16b) Incentive Costs =		2,000	2,000	2,000
16c) Total Utility Project Costs =		\$2,773	\$2,698	\$2,623
17) Direct Participant Costs (\$/Part.) =		\$60	\$60	\$60
18) Participant Non-Energy Costs (Annual \$/Part.) =		\$0	\$0	\$0
Escalation Rate =		0.00%	0.00%	0.00%
19) Participant Non-Energy Savings (Annual \$/Part) =		\$0	\$0	\$0
Escalation Rate =		0.00%	0.00%	1.40%
20) Project Life (Years) =		15	15	15
21) Avg. Dk/Part. Saved =		2,900	2,900	2,900
22) Avg Non-Gas Fuel Units/Part. Saved =		216	216	216
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =		0	0	0
23) Number of Participants =		100	100	100
24) Total Annual Dk Saved =		290	290	290
25) Incentive/Participant =		\$20	\$20	\$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	\$31,970	2.78
Utility Cost Test	\$42,447	6.69
Societal Test	\$82,124	5.26
Participant Test	\$120,678	8.35
Total Resource Cost Test	\$46,339	3.50

**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)
1	2012	290	\$4,564	\$1,324	\$0.000	\$0	\$1,324	2.9	\$124	\$360	\$1,684	\$1,814	\$342	\$773	\$2,000	\$3,115	(\$1,431)
2	2013	580	4,724	2,740	0.000	0	2,740	5.8	126	731	3,471	1,878	708	698	2,000	3,406	65
3	2014	870	4,889	4,253	0.000	0	4,253	8.7	127	1,105	5,358	1,944	1,099	623	2,000	3,722	1,636
4	2015	870	5,061	4,403	0.000	0	4,403	8.7	128	1,114	5,517	2,012	1,138	0	0	1,138	4,379
5	2016	870	5,238	4,557	0.000	0	4,557	8.7	129	1,122	5,679	2,082	1,177	0	0	1,177	4,502
6	2017	870	5,421	4,716	0.000	0	4,716	8.7	131	1,140	5,856	2,155	1,219	0	0	1,219	4,637
7	2018	870	5,611	4,882	0.000	0	4,882	8.7	132	1,148	6,030	2,230	1,261	0	0	1,261	4,769
8	2019	870	5,807	5,052	0.000	0	5,052	8.7	133	1,157	6,209	2,308	1,305	0	0	1,305	4,904
9	2020	870	6,010	5,229	0.000	0	5,229	8.7	135	1,175	6,404	2,389	1,351	0	0	1,351	5,053
10	2021	870	6,221	5,412	0.000	0	5,412	8.7	136	1,183	6,595	2,473	1,398	0	0	1,398	5,197
11	2022	870	6,438	5,601	0.000	0	5,601	8.7	137	1,192	6,793	2,559	1,447	0	0	1,447	5,346
12	2023	870	6,664	5,798	0.000	0	5,798	8.7	139	1,209	7,007	2,649	1,498	0	0	1,498	5,509
13	2024	870	6,897	6,000	0.000	0	6,000	8.7	140	1,218	7,218	2,742	1,551	0	0	1,551	5,667
14	2025	870	7,138	6,210	0.000	0	6,210	8.7	142	1,235	7,445	2,838	1,605	0	0	1,605	5,840
15	2026	870	7,388	6,428	0.000	0	6,428	8.7	143	1,244	7,672	2,937	1,661	0	0	1,661	6,011
16	2027	580	7,647	4,435	0.000	0	4,435	5.8	144	835	5,270	3,040	1,146	0	0	1,146	4,124
17	2028	290	7,915	2,295	0.000	0	2,295	2.9	146	423	2,718	3,146	593	0	0	593	2,125
18	2029	0	8,192	0	0.000	0	0	0.0	147	0	0	3,256	0	0	0	0	0
19	2030	0	8,478	0	0.000	0	0	0.0	149	0	0	3,370	0	0	0	0	0
20	2031	0	8,775	0	0.000	0	0	0.0	150	0	0	3,488	0	0	0	0	0
21	2032	0	9,082	0	0.000	0	0	0.0	152	0	0	3,610	0	0	0	0	0
Total =		13,050									\$96,926					\$28,593	\$68,333
											NPV =	\$49,907				\$17,937	\$31,970
Total NPV =			\$31,970														
Benefit/Cost Ratio =			2.78														

**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	\$1,324	\$360	\$1,684	\$773	\$2,000	\$2,773	(\$1,089)
2013	2,740	731	3,471	698	2,000	2,698	773
2014	4,253	1,105	5,358	623	2,000	2,623	2,735
2015	4,403	1,114	5,517	0	0	0	5,517
2016	4,557	1,122	5,679	0	0	0	5,679
2017	4,716	1,140	5,856	0	0	0	5,856
2018	4,882	1,148	6,030	0	0	0	6,030
2019	5,052	1,157	6,209	0	0	0	6,209
2020	5,229	1,175	6,404	0	0	0	6,404
2021	5,412	1,183	6,595	0	0	0	6,595
2022	5,601	1,192	6,793	0	0	0	6,793
2023	5,798	1,209	7,007	0	0	0	7,007
2024	6,000	1,218	7,218	0	0	0	7,218
2025	6,210	1,235	7,445	0	0	0	7,445
2026	6,428	1,244	7,672	0	0	0	7,672
2027	4,435	835	5,270	0	0	0	5,270
2028	2,295	423	2,718	0	0	0	2,718
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 =			\$96,926			\$8,094	\$88,832
NPV =			\$49,907			\$7,460	\$42,447
Total NPV =			\$42,447				
Benefit/Cost Ratio =			<u>6.69</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: **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' Costs Net of Rebate (I)	Annual Total Costs (J)	
2012	\$1,324	\$360	\$0.022	\$475	\$1.041	\$302	\$2,461	\$2,773	\$4,000	\$6,773	(\$4,312)
2013	2,740	731	0.023	994	1.065	618	5,083	2,698	4,000	6,698	(1,615)
2014	4,253	1,105	0.024	1,555	1.090	948	7,861	2,623	4,000	6,623	1,238
2015	4,403	1,114	0.025	1,620	1.115	970	8,107	0	0	0	8,107
2016	4,557	1,122	0.026	1,685	1.141	993	8,357	0	0	0	8,357
2017	4,716	1,140	0.027	1,750	1.167	1,015	8,621	0	0	0	8,621
2018	4,882	1,148	0.028	1,814	1.194	1,039	8,883	0	0	0	8,883
2019	5,052	1,157	0.029	1,879	1.221	1,062	9,150	0	0	0	9,150
2020	5,229	1,175	0.030	1,944	1.249	1,087	9,435	0	0	0	9,435
2021	5,412	1,183	0.031	2,009	1.278	1,112	9,716	0	0	0	9,716
2022	5,601	1,192	0.032	2,074	1.307	1,137	10,004	0	0	0	10,004
2023	5,798	1,209	0.033	2,138	1.337	1,163	10,308	0	0	0	10,308
2024	6,000	1,218	0.034	2,203	1.368	1,190	10,611	0	0	0	10,611
2025	6,210	1,235	0.035	2,268	1.400	1,218	10,931	0	0	0	10,931
2026	6,428	1,244	0.036	2,333	1.432	1,246	11,251	0	0	0	11,251
2027	4,435	835	0.038	1,642	1.465	850	7,762	0	0	0	7,762
2028	2,295	423	0.039	842	1.498	434	3,994	0	0	0	3,994
2029	0	0	0.040	0	1.533	0	0	0	0	0	0
2030	0	0	0.042	0	1.568	0	0	0	0	0	0
2031	0	0	0.043	0	1.604	0	0	0	0	0	0
2032	0	0	0.045	0	1.641	0	0	0	0	0	0
Total =							\$142,535			\$20,094	\$122,441
NPV =							\$101,416			\$19,292	\$82,124
Total NPV =		\$82,124									
Benefit/Cost Ratio =		<u>5.26</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: **Programmable Thermostats**

Year	Benefits							Costs	
	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)	Annual Benefits Less Costs (I)
2012	\$2,000	290	\$7.983	\$2,315	\$0.106	\$2,290	\$6,605	\$6,000	\$605
2013	2,000	580	8.262	4,792	0.109	4,709	11,501	6,000	5,501
2014	2,000	870	8.552	7,440	0.113	7,322	16,762	6,000	10,762
2015	0	870	8.851	7,700	0.117	7,582	15,282	0	15,282
2016	0	870	9.161	7,970	0.121	7,841	15,811	0	15,811
2017	0	870	9.481	8,248	0.125	8,100	16,348	0	16,348
2018	0	870	9.813	8,537	0.130	8,424	16,961	0	16,961
2019	0	870	10.157	8,837	0.134	8,683	17,520	0	17,520
2020	0	870	10.512	9,145	0.139	9,007	18,152	0	18,152
2021	0	870	10.880	9,466	0.144	9,331	18,797	0	18,797
2022	0	870	11.261	9,797	0.149	9,655	19,452	0	19,452
2023	0	870	11.655	10,140	0.154	9,979	20,119	0	20,119
2024	0	870	12.063	10,495	0.160	10,368	20,863	0	20,863
2025	0	870	12.485	10,862	0.165	10,692	21,554	0	21,554
2026	0	870	12.922	11,242	0.171	11,081	22,323	0	22,323
2027	0	580	13.374	7,757	0.177	7,646	15,403	0	15,403
2028	0	290	13.842	4,014	0.183	3,953	7,967	0	7,967
2029	0	0	14.327	0	0.189	0	0	0	0
2030	0	0	14.828	0	0.196	0	0	0	0
2031	0	0	15.347	0	0.203	0	0	0	0
2032	0	0	15.884	0	0.210	0	0	0	0
<b>Total =</b>		<b>13,050</b>					<b>\$281,420</b>	<b>\$18,000</b>	<b>\$263,420</b>
							<b>NPV = \$137,091</b>	<b>\$16,413</b>	<b>120,678</b>
<b>Total NPV =</b>		<b>\$120,678</b>							
<b>Benefit/Cost Ratio =</b>		<b>8.35</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)

**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	\$1,324	\$360	\$475	\$2,159	\$2,773	\$4,000	\$6,773	(\$4,614)
2013	2,740	731	994	4,465	2,698	4,000	6,698	(2,233)
2014	4,253	1,105	1,555	6,913	2,623	4,000	6,623	290
2015	4,403	1,114	1,620	7,137	0	0	0	7,137
2016	4,557	1,122	1,685	7,364	0	0	0	7,364
2017	4,716	1,140	1,750	7,606	0	0	0	7,606
2018	4,882	1,148	1,814	7,844	0	0	0	7,844
2019	5,052	1,157	1,879	8,088	0	0	0	8,088
2020	5,229	1,175	1,944	8,348	0	0	0	8,348
2021	5,412	1,183	2,009	8,604	0	0	0	8,604
2022	5,601	1,192	2,074	8,867	0	0	0	8,867
2023	5,798	1,209	2,138	9,145	0	0	0	9,145
2024	6,000	1,218	2,203	9,421	0	0	0	9,421
2025	6,210	1,235	2,268	9,713	0	0	0	9,713
2026	6,428	1,244	2,333	10,005	0	0	0	10,005
2027	4,435	835	1,642	6,912	0	0	0	6,912
2028	2,295	423	842	3,560	0	0	0	3,560
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 =	\$126,151			\$20,094	\$106,057
			NPV =	\$64,841			\$18,502	46,339

Total NPV = \$46,339  
Benefit/Cost Ratio = 3.50

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)