Montana-Dakota Utilities Co.
Gas Utility - South Dakota
Conservation Portfolio Summary
2021 - 2023 Program Years

Programs	Total Participants	Total Energy Reduction	Total Cost	Lifetime Cost/Dk
Conservation Programs				
Residential Program				
Furnaces - 95+% AFUE - New	510	48,960	$84,305	$1.72
Furnaces - 95+% AFUE - Replacement	810	315,900	267,769	0.85
Programmable Thermostats - Tier 1	255	5,870	4,218	0.72
Programmable Thermostats - Tier 2	520	30,368	34,381	1.13
	2,095	401,098	$390,673	$0.97
Commercial Program				
Furnaces - 95+% AFUE - New	22	2,720	$3,633	$1.34
Furnaces - 95+% AFUE - Replacement	52	21,740	17,184	0.79
Custom Efficiency	18	135,000	59,435	0.44
	92	159,460	$80,252	$0.50
Total Programs	2,187	560,558	$470,925	$0.84

Montana-Dakota Utilities Co.
Gas Utility - South Dakota
Conservation Portfolio Summary
2021 - 2023 Program Years

	2021			2022			2023			Lifetime
Programs	Participants	Cost	Dk Savings	Participants	Cost	Dk Savings	Participants	Cost	Dk Savings	Dk Savings
Residential Program										
Furnaces - 95+% AFUE - New	160	26,642	768	170	28,096	816	180	29,567	864	48,960
Furnaces - 95+% AFUE - Repl.	250	83,253	4,875	270	89,246	5,265	290	95,270	5,655	315,900
Programmable Thermostats - Tier 1	90	1,499	207	85	1,405	196	80	1,314	184	5,870
Programmable Thermostats - Tier 2	160	10,657	934	175	11,569	1,022	185	12,155	1,080	30,368
Total Residential	660	122,051	6,784	700	130,316	7,299	735	138,306	7,783	401,098
Commercial Program										
Furnaces - 95+% AFUE - New	5	833	31	7	1,157	43	10	1,643	62	2,720
Furnaces - 95+% AFUE - Repl.	15	4,995	314	17	5,619	355	20	6,570	418	21,740
Custom Efficiency	4	13,321	2,000	6	19,833	3,000	8	26,281	4,000	135,000
Total Commercial	24	$19,149	2,345	30	$26,609	3,398	38	$34,494	4,480	159,460
Total Programs	684	$141,200	9,129	730	$156,925	10,697	773	$172,800	12,263	560,558

Montana-Dakota Utilities Co.
South Dakota Gas DSM Program Summary

Benefit/Cost Ratios

Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		1.56	3.33	3.20	3.15	1.48
Furnace (95+%) - New	Residential	0.96	1.56	3.29	2.99	1.43
Furnace (95+%) - Replacement	Residential	1.40	3.17	3.34	3.76	1.50
Programmable Thermostats - Tier 1	Residential	1.65	4.60	4.52	4.15	2.41
Programmable Thermostats - Tier 2	Residential	1.36	2.92	2.27	2.44	1.22
Furnace (95+%) - New	Commercial	1.44	2.04	4.28	3.20	1.87
Furnace (95+%) - Replacement	Commercial	2.01	3.41	3.57	3.55	1.60
Custom Efficiency	Commercial	2.87	6.78	3.04	1.96	1.46

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: **2021 - 2023**

Input Data	
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 =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs = 1/	$14,000	$14,500	$15,000
16b) Incentive Costs =	127,200	142,425	157,800
16c) Total Utility Project Costs =	$141,200	$156,925	$172,800
17) Direct Participant Costs ($/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 =	684	730	773
24) Total Annual Dk Saved =	9,129	10,697	12,263
25) Incentive/Participant =			
26) Distribution Delivery Charge			
27) Effective Income Tax Rate =			
(Federal & State Taxes)			

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$522,897	1.56
Utility Cost Test	$1,020,418	3.33
Societal Test	$2,415,437	3.20
Participant Test	$2,091,444	3.15
Total Resource Cost Test	$498,262	1.48

Table 1
Ratepayer Impact Measure Test

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

			Benefits									Costs				
t	Year	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)	Total Program Costs (O)	Annual Benefits Less Costs (P)
1	2021	9,129		$22,577		$0	$22,577	91.0		$13,604	$36,181		$11,909	$14,000	$127,200	$153,109	($116,928)
2	2022	19,826		50,496		0	50,496	198.0		29,730	80,226		26,152	14,500	142,425	183,077	(102,851)
3	2023	32,090		84,204		0	84,204	321.0		48,808	133,012		42,858	15,000	157,800	215,658	(82,646)
4	2024	32,090		86,706		0	86,706	321.0		49,129	135,835		44,145	0	0	44,145	91,690
5	2025	32,090		89,306		0	89,306	321.0		49,772	139,078		45,468	0	0	45,468	93,610
6	2026	32,090		92,001		0	92,001	321.0		50,090	142,091		46,830	0	0	46,830	95,261
7	2027	32,090		94,762		0	94,762	321.0		50,733	145,495		48,245	0	0	48,245	97,250
8	2028	32,090		97,619		0	97,619	321.0		51,376	148,995		49,697	0	0	49,697	99,298
9	2029	32,090		100,539		0	100,539	321.0		51,697	152,236		51,187	0	0	51,187	101,049
10	2030	32,090		103,554		0	103,554	321.0		52,340	155,894		52,712	0	0	52,712	103,182
11	2031	30,948		102,871		0	102,871	310.0		50,775	153,646		51,998	0	0	51,998	101,648
12	2032	29,730		101,767		0	101,767	297.0		49,368	151,135		51,055	0	0	51,055	100,080
13	2033	28,466		100,372		0	100,372	285.0		47,846	148,218		49,887	0	0	49,887	98,331
14	2034	28,466		103,388		0	103,388	285.0		48,132	151,520		51,385	0	0	51,385	100,135
15	2035	28,466		106,491		0	106,491	285.0		48,701	155,192		52,920	0	0	52,920	102,272
16	2036	26,466		101,973		0	101,973	265.0		45,811	147,784		52,149	0	0	52,149	95,635
17	2037	23,466		93,114		0	93,114	235.0		41,091	134,205		50,082	0	0	50,082	84,123
18	2038	19,466		79,577		0	79,577	195.0		34,284	113,861		46,580	0	0	46,580	67,281
19	2039	19,466		81,952		0	81,952	195.0		34,674	116,626		47,968	0	0	47,968	68,658
20	2040	19,466		84,405		0	84,405	195.0		35,064	119,469		49,413	0	0	49,413	70,056
21	2041	13,478		60,207		0	60,207	135.0		24,533	84,740		35,203	0	0	35,203	49,537
22	2042	6,999		32,202		0	32,202	70.0		12,811	45,013		18,792	0	0	18,792	26,221
23	2043	0		0		0	0	0.0		0	0		0	0	0	0	0
	Total =	560,558									$2,790,452					$1,447,560	$1,342,892
									NPV =		$1,458,304					$935,407	$522,897

Total NPV = $522,897
Benefit/Cost Ratio = 1.56

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**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$22,577	$13,604	$36,181	$14,000	$127,200	$141,200	($105,019)
2022	50,496	29,730	80,226	14,500	142,425	156,925	(76,699)
2023	84,204	48,808	133,012	15,000	157,800	172,800	(39,788)
2024	86,706	49,129	135,835	0	0	0	135,835
2025	89,306	49,772	139,078	0	0	0	139,078
2026	92,001	50,090	142,091	0	0	0	142,091
2027	94,762	50,733	145,495	0	0	0	145,495
2028	97,619	51,376	148,995	0	0	0	148,995
2029	100,539	51,697	152,236	0	0	0	152,236
2030	103,554	52,340	155,894	0	0	0	155,894
2031	102,871	50,775	153,646	0	0	0	153,646
2032	101,767	49,368	151,135	0	0	0	151,135
2033	100,372	47,846	148,218	0	0	0	148,218
2034	103,388	48,132	151,520	0	0	0	151,520
2035	106,491	48,701	155,192	0	0	0	155,192
2036	101,973	45,811	147,784	0	0	0	147,784
2037	93,114	41,091	134,205	0	0	0	134,205
2038	79,577	34,284	113,861	0	0	0	113,861
2039	81,952	34,674	116,626	0	0	0	116,626
2040	84,405	35,064	119,469	0	0	0	119,469
2041	60,207	24,533	84,740	0	0	0	84,740
2042	32,202	12,811	45,013	0	0	0	45,013
2043	0	0	0	0	0	0	0
Total =			$2,790,452			$470,925	$2,319,527
		NPV =	$1,458,304			$437,886	$1,020,418

Total NPV = $1,020,418
Benefit/Cost Ratio = 3.33

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: **Total South Dakota Program**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$22,577	$13,604		$1,974		$19,335	$57,490	$141,200	$182,565	$323,765	($266,275)
2022	50,496	29,730		4,111		42,943	127,280	156,925	217,687	374,612	(247,332)
2023	84,204	48,808		6,419		71,112	210,543	172,800	252,785	425,585	(215,042)
2024	86,706	49,129		7,062		72,748	215,645	0	0	0	215,645
2025	89,306	49,772		7,062		74,417	220,557	0	0	0	220,557
2026	92,001	50,090		7,062		76,150	225,303	0	0	0	225,303
2027	94,762	50,733		7,703		77,882	231,080	0	0	0	231,080
2028	97,619	51,376		7,703		79,680	236,378	0	0	0	236,378
2029	100,539	51,697		7,703		81,508	241,447	0	0	0	241,447
2030	103,554	52,340		8,346		83,401	247,641	0	0	0	247,641
2031	102,871	50,775		8,261		82,259	244,166	0	0	0	244,166
2032	101,767	49,368		8,795		80,837	240,767	0	0	0	240,767
2033	100,372	47,846		8,689		79,192	236,099	0	0	0	236,099
2034	103,388	48,132		8,689		81,015	241,224	0	0	0	241,224
2035	106,491	48,701		9,310		82,864	247,366	0	0	0	247,366
2036	101,973	45,811		9,310		78,816	235,910	0	0	0	235,910
2037	93,114	41,091		9,930		71,500	215,635	0	0	0	215,635
2038	79,577	34,284		9,930		60,675	184,466	0	0	0	184,466
2039	81,952	34,674		10,550		62,077	189,253	0	0	0	189,253
2040	84,405	35,064		10,550		63,498	193,517	0	0	0	193,517
2041	60,207	24,533		7,738		44,976	137,454	0	0	0	137,454
2042	32,202	12,811		4,017		23,895	72,925	0	0	0	72,925
2043	0	0		0		0	0	0	0	0	0
Total =							$4,452,146			$1,123,962	$3,328,184
						NPV =	$3,511,019			$1,095,582	$2,415,437

Total NPV = $2,415,437
Benefit/Cost Ratio = 3.20

Worksheet Calculations

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

(H) = Table 2 (F)
(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(J) = (H) + (I)
(K) = (G) - (J)

Table 4
Participant Test

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

	Benefits							Costs	
Year	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)
2021	$127,200	9,129		$54,275		$25,219	$206,694	$309,765	($103,071)
2022	142,425	19,826		120,793		54,183	317,401	360,112	(42,711)
2023	157,800	32,090		200,455		87,157	445,412	410,585	34,827
2024	0	32,090		206,469		89,725	296,194	0	296,194
2025	0	32,090		212,645		92,293	304,938	0	304,938
2026	0	32,090		219,024		94,860	313,884	0	313,884
2027	0	32,090		225,596		98,033	323,629	0	323,629
2028	0	32,090		232,372		100,637	333,009	0	333,009
2029	0	32,090		239,342		103,810	343,152	0	343,152
2030	0	32,090		246,525		107,019	353,544	0	353,544
2031	0	30,948		244,421		109,101	353,522	0	353,522
2032	0	29,730		241,340		111,009	352,349	0	352,349
2033	0	28,466		237,434		112,769	350,203	0	350,203
2034	0	28,466		244,551		116,456	361,007	0	361,007
2035	0	28,466		251,892		120,180	372,072	0	372,072
2036	0	26,466		243,071		123,283	366,354	0	366,354
2037	0	23,466		225,080		127,007	352,087	0	352,087
2038	0	19,466		197,115		130,730	327,845	0	327,845
2039	0	19,466		203,033		135,038	338,071	0	338,071
2040	0	19,466		209,126		138,799	347,925	0	347,925
2041	0	13,478		149,083		99,106	248,189	0	248,189
2042	10	6,999		79,697		53,020	132,727	0	132,727
2043	0	0		0		0	0	0	0
Total =		560,558					$7,140,208	$1,080,462	$6,059,746
						NPV =	$3,064,995	$973,551	2,091,444

Total NPV =	$2,091,444
Benefit/Cost Ratio =	3.15

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) = (E) 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**

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$22,577	$13,604	$1,974	$38,155	$141,200	$182,565	$323,765	($285,610)
2022	50,496	29,730	4,111	84,337	156,925	217,687	374,612	(290,275)
2023	84,204	48,808	6,419	139,431	172,800	252,785	425,585	(286,154)
2024	86,706	49,129	7,062	142,897	0	0	0	142,897
2025	89,306	49,772	7,062	146,140	0	0	0	146,140
2026	92,001	50,090	7,062	149,153	0	0	0	149,153
2027	94,762	50,733	7,703	153,198	0	0	0	153,198
2028	97,619	51,376	7,703	156,698	0	0	0	156,698
2029	100,539	51,697	7,703	159,939	0	0	0	159,939
2030	103,554	52,340	8,346	164,240	0	0	0	164,240
2031	102,871	50,775	8,261	161,907	0	0	0	161,907
2032	101,767	49,368	8,795	159,930	0	0	0	159,930
2033	100,372	47,846	8,689	156,907	0	0	0	156,907
2034	103,388	48,132	8,689	160,209	0	0	0	160,209
2035	106,491	48,701	9,310	164,502	0	0	0	164,502
2036	101,973	45,811	9,310	157,094	0	0	0	157,094
2037	93,114	41,091	9,930	144,135	0	0	0	144,135
2038	79,577	34,284	9,930	123,791	0	0	0	123,791
2039	81,952	34,674	10,550	127,176	0	0	0	127,176
2040	84,405	35,064	10,550	130,019	0	0	0	130,019
2041	60,207	24,533	7,738	92,478	0	0	0	92,478
2042	32,202	12,811	4,017	49,030	0	0	0	49,030
2043	0	0	0	0	0	0	0	0
			Total =	$2,961,366			$1,123,962	$1,837,404
			NPV =	$1,541,653			$1,043,391	498,262

Total NPV =	$498,262
Benefit/Cost Ratio =	1.48

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: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$6.005
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12423
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$2,642	$2,596	$2,567
16b) Incentive Costs =	24,000	25,500	27,000
16c) Total Utility Project Costs =	$26,642	$28,096	$29,567
17) Direct Participant Costs ($/Part.) =	$165	$165	$165
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%	0.00%
20) Project Life (Years) =	20	20	20
21) Avg. Dk/Part. Saved =	4.800	4.800	4.800
22) Avg Non-Gas Fuel Units/Part. Saved =	0	0	0
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	160	170	180
24) Total Annual Dk Saved =	768	816	864
25) Incentive/Participant =	$150	$150	$150
26) Distribution Delivery Charge			$1.836
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($5,045)	0.96
Utility Cost Test	$44,195	1.56
Societal Test	$205,283	3.29
Participant Test	$151,975	2.99
Total Resource Cost Test	$37,068	1.43

Table 1
Ratepayer Impact Measure Test

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

		Benefits											Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	768	$2.473	$1,899	$0.000	$0	$1,899	7.7	$149	$1,147	$3,046	$1.891	$1,147	$2,642	$24,000	$27,789	($24,743)
2	2022	1,584	2.547	4,034	0.000	0	4,034	15.8	150	2,370	6,404	1.948	2,438	2,596	25,500	30,534	(24,130)
3	2023	2,448	2.624	6,424	0.000	0	6,424	24.5	152	3,724	10,148	2.006	3,879	2,567	27,000	33,446	(23,298)
4	2024	2,448	2.702	6,614	0.000	0	6,614	24.5	153	3,749	10,363	2.066	3,995	0	0	3,995	6,368
5	2025	2,448	2.783	6,813	0.000	0	6,813	24.5	155	3,798	10,611	2.128	4,115	0	0	4,115	6,496
6	2026	2,448	2.867	7,018	0.000	0	7,018	24.5	156	3,822	10,840	2.192	4,239	0	0	4,239	6,601
7	2027	2,448	2.953	7,229	0.000	0	7,229	24.5	158	3,871	11,100	2.258	4,367	0	0	4,367	6,733
8	2028	2,448	3.042	7,447	0.000	0	7,447	24.5	160	3,920	11,367	2.326	4,498	0	0	4,498	6,869
9	2029	2,448	3.133	7,670	0.000	0	7,670	24.5	161	3,945	11,615	2.396	4,634	0	0	4,634	6,981
10	2030	2,448	3.227	7,900	0.000	0	7,900	24.5	163	3,994	11,894	2.467	4,771	0	0	4,771	7,123
11	2031	2,448	3.324	8,137	0.000	0	8,137	24.5	164	4,018	12,155	2.541	4,914	0	0	4,914	7,241
12	2032	2,448	3.423	8,380	0.000	0	8,380	24.5	166	4,067	12,447	2.618	5,063	0	0	5,063	7,384
13	2033	2,448	3.526	8,632	0.000	0	8,632	24.5	168	4,116	12,748	2.696	5,214	0	0	5,214	7,534
14	2034	2,448	3.632	8,891	0.000	0	8,891	24.5	169	4,141	13,032	2.777	5,370	0	0	5,370	7,662
15	2035	2,448	3.741	9,158	0.000	0	9,158	24.5	171	4,190	13,348	2.860	5,531	0	0	5,531	7,817
16	2036	2,448	3.853	9,432	0.000	0	9,432	24.5	173	4,239	13,671	2.946	5,697	0	0	5,697	7,974
17	2037	2,448	3.968	9,714	0.000	0	9,714	24.5	175	4,288	14,002	3.035	5,869	0	0	5,869	8,133
18	2038	2,448	4.088	10,007	0.000	0	10,007	24.5	176	4,312	14,319	3.126	6,045	0	0	6,045	8,274
19	2039	2,448	4.210	10,306	0.000	0	10,306	24.5	178	4,361	14,667	3.219	6,225	0	0	6,225	8,442
20	2040	2,448	4.336	10,615	0.000	0	10,615	24.5	180	4,410	15,025	3.316	6,413	0	0	6,413	8,612
21	2041	1,680	4.467	7,505	0.000	0	7,505	16.8	182	3,058	10,563	3.416	4,534	0	0	4,534	6,029
22	2042	864	4.601	3,975	0.000	0	3,975	8.6	183	1,574	5,549	3.518	2,401	0	0	2,401	3,148
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	3.624	0	0	0	0	0
	Total =	48,960									$248,914					$185,664	$63,250
									NPV =		$122,763					$127,808	($5,045)

Total NPV = ($5,045)
Benefit/Cost Ratio = 0.96

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**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$1,899	$1,147	$3,046	$2,642	$24,000	$26,642	($23,596)
2022	4,034	2,370	6,404	2,596	25,500	28,096	(21,692)
2023	6,424	3,724	10,148	2,567	27,000	29,567	(19,419)
2024	6,614	3,749	10,363	0	0	0	10,363
2025	6,813	3,798	10,611	0	0	0	10,611
2026	7,018	3,822	10,840	0	0	0	10,840
2027	7,229	3,871	11,100	0	0	0	11,100
2028	7,447	3,920	11,367	0	0	0	11,367
2029	7,670	3,945	11,615	0	0	0	11,615
2030	7,900	3,994	11,894	0	0	0	11,894
2031	8,137	4,018	12,155	0	0	0	12,155
2032	8,380	4,067	12,447	0	0	0	12,447
2033	8,632	4,116	12,748	0	0	0	12,748
2034	8,891	4,141	13,032	0	0	0	13,032
2035	9,158	4,190	13,348	0	0	0	13,348
2036	9,432	4,239	13,671	0	0	0	13,671
2037	9,714	4,288	14,002	0	0	0	14,002
2038	10,007	4,312	14,319	0	0	0	14,319
2039	10,306	4,361	14,667	0	0	0	14,667
2040	10,615	4,410	15,025	0	0	0	15,025
2041	7,505	3,058	10,563	0	0	0	10,563
2042	3,975	1,574	5,549	0	0	0	5,549
2043	0	0	0	0	0	0	0
Total =			$248,914			$84,305	$164,609
		NPV =	$122,763			$78,568	$44,195

Total NPV =	$44,195
Benefit/Cost Ratio =	1.56

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**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$1,899	$1,147	$0.010	$0	$2.118	$1,627	$4,673	$26,642	$2,400	$29,042	($24,369)
2022	4,034	2,370	0.010	0	2.166	3,431	9,835	28,096	2,550	30,646	(20,811)
2023	6,424	3,724	0.010	0	2.216	5,425	15,573	29,567	2,700	32,267	(16,694)
2024	6,614	3,749	0.011	0	2.267	5,550	15,913	0	0	0	15,913
2025	6,813	3,798	0.011	0	2.319	5,677	16,288	0	0	0	16,288
2026	7,018	3,822	0.011	0	2.373	5,809	16,649	0	0	0	16,649
2027	7,229	3,871	0.012	0	2.427	5,941	17,041	0	0	0	17,041
2028	7,447	3,920	0.012	0	2.483	6,078	17,445	0	0	0	17,445
2029	7,670	3,945	0.012	0	2.540	6,218	17,833	0	0	0	17,833
2030	7,900	3,994	0.013	0	2.599	6,362	18,256	0	0	0	18,256
2031	8,137	4,018	0.013	0	2.658	6,507	18,662	0	0	0	18,662
2032	8,380	4,067	0.014	0	2.719	6,656	19,103	0	0	0	19,103
2033	8,632	4,116	0.014	0	2.782	6,810	19,558	0	0	0	19,558
2034	8,891	4,141	0.014	0	2.846	6,967	19,999	0	0	0	19,999
2035	9,158	4,190	0.015	0	2.911	7,126	20,474	0	0	0	20,474
2036	9,432	4,239	0.015	0	2.978	7,290	20,961	0	0	0	20,961
2037	9,714	4,288	0.016	0	3.047	7,459	21,461	0	0	0	21,461
2038	10,007	4,312	0.016	0	3.117	7,630	21,949	0	0	0	21,949
2039	10,306	4,361	0.017	0	3.189	7,807	22,474	0	0	0	22,474
2040	10,615	4,410	0.017	0	3.262	7,985	23,010	0	0	0	23,010
2041	7,505	3,058	0.018	0	3.337	5,606	16,169	0	0	0	16,169
2042	3,975	1,574	0.018	0	3.414	2,950	8,499	0	0	0	8,499
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$381,825			$91,955	$289,870
						NPV =	$295,034			$89,751	$205,283

Total NPV = $205,283
Benefit/Cost Ratio = 3.29

Worksheet Calculations

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

(H) = Table 2 (F)
(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(J) = (H) + (I)
(K) = (G) - (J)

Table 4
Participant Test

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

	Benefits							Costs	
Year	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)
2021	$24,000	768	$6.185	$4,750	$0.128	$0	$28,750	$26,400	$2,350
2022	25,500	1,584	6.371	10,092	0.132	0	35,592	28,050	7,542
2023	27,000	2,448	6.562	16,064	0.136	0	43,064	29,700	13,364
2024	0	2,448	6.759	16,546	0.140	0	16,546	0	16,546
2025	0	2,448	6.961	17,041	0.144	0	17,041	0	17,041
2026	0	2,448	7.170	17,552	0.148	0	17,552	0	17,552
2027	0	2,448	7.385	18,078	0.153	0	18,078	0	18,078
2028	0	2,448	7.607	18,622	0.157	0	18,622	0	18,622
2029	0	2,448	7.835	19,180	0.162	0	19,180	0	19,180
2030	0	2,448	8.070	19,755	0.167	0	19,755	0	19,755
2031	0	2,448	8.312	20,348	0.172	0	20,348	0	20,348
2032	0	2,448	8.562	20,960	0.177	0	20,960	0	20,960
2033	0	2,448	8.819	21,589	0.182	0	21,589	0	21,589
2034	0	2,448	9.083	22,235	0.188	0	22,235	0	22,235
2035	0	2,448	9.356	22,903	0.194	0	22,903	0	22,903
2036	0	2,448	9.636	23,589	0.199	0	23,589	0	23,589
2037	0	2,448	9.925	24,296	0.205	0	24,296	0	24,296
2038	0	2,448	10.223	25,026	0.211	0	25,026	0	25,026
2039	0	2,448	10.530	25,777	0.218	0	25,777	0	25,777
2040	0	2,448	10.846	26,551	0.224	0	26,551	0	26,551
2041	0	1,680	11.171	18,767	0.231	0	18,767	0	18,767
2042	0	864	11.506	9,941	0.238	0	9,941	0	9,941
2043	0	0	11.851	0	0.245	0	0	0	0
Total =		48,960					$496,162	$84,150	$412,012
						NPV =	$228,204	$76,229	151,975

Total NPV = $151,975
Benefit/Cost Ratio = 2.99

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

Table 5
Total Resource Cost Test

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

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$1,899	$1,147	$0	$3,046	$26,642	$2,400	$29,042	($25,996)
2022	4,034	2,370	0	6,404	28,096	2,550	30,646	(24,242)
2023	6,424	3,724	0	10,148	29,567	2,700	32,267	(22,119)
2024	6,614	3,749	0	10,363	0	0	0	10,363
2025	6,813	3,798	0	10,611	0	0	0	10,611
2026	7,018	3,822	0	10,840	0	0	0	10,840
2027	7,229	3,871	0	11,100	0	0	0	11,100
2028	7,447	3,920	0	11,367	0	0	0	11,367
2029	7,670	3,945	0	11,615	0	0	0	11,615
2030	7,900	3,994	0	11,894	0	0	0	11,894
2031	8,137	4,018	0	12,155	0	0	0	12,155
2032	8,380	4,067	0	12,447	0	0	0	12,447
2033	8,632	4,116	0	12,748	0	0	0	12,748
2034	8,891	4,141	0	13,032	0	0	0	13,032
2035	9,158	4,190	0	13,348	0	0	0	13,348
2036	9,432	4,239	0	13,671	0	0	0	13,671
2037	9,714	4,288	0	14,002	0	0	0	14,002
2038	10,007	4,312	0	14,319	0	0	0	14,319
2039	10,306	4,361	0	14,667	0	0	0	14,667
2040	10,615	4,410	0	15,025	0	0	0	15,025
2041	7,505	3,058	0	10,563	0	0	0	10,563
2042	3,975	1,574	0	5,549	0	0	0	5,549
2043	0	0	0	0	0	0	0	0
			Total =	$248,914			$91,955	$156,959
			NPV =	$122,763			$85,695	37,068

Total NPV =	$37,068
Benefit/Cost Ratio =	1.43

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$6.005
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12423
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$8,253	$8,246	$8,270
16b) Incentive Costs =	75,000	81,000	87,000
16c) Total Utility Project Costs =	$83,253	$89,246	$95,270
17) Direct Participant Costs ($/Part.) =	$736	$736	$736
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%	0.00%
20) Project Life (Years) =	20	20	20
21) Avg. Dk/Part. Saved =	19.500	19.500	19.500
22) Avg Non-Gas Fuel Units/Part. Saved =	720	720	720
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	250	270	290
24) Total Annual Dk Saved =	4,875	5,265	5,655
25) Incentive/Participant =	$300	$300	$300
26) Distribution Delivery Charge			$1.836
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$224,663	1.40
Utility Cost Test	$542,249	3.17
Societal Test	$1,419,183	3.34
Participant Test	$1,487,510	3.76
Total Resource Cost Test	$290,212	1.50

Table 1
Ratepayer Impact Measure Test

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

		Benefits										Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	4,875	$2.473	$12,056	$0.000	$0	$12,056	48.8	$149	$7,271	$19,327	$1.891	$7,283	$8,253	$75,000	$90,536	($71,209)
2	2022	10,140	2.547	25,827	0.000	0	25,827	101.4	150	15,210	41,037	1.948	15,605	8,246	81,000	104,851	(63,814)
3	2023	15,795	2.624	41,446	0.000	0	41,446	158.0	152	24,016	65,462	2.006	25,031	8,270	87,000	120,301	(54,839)
4	2024	15,795	2.702	42,678	0.000	0	42,678	158.0	153	24,174	66,852	2.066	25,780	0	0	25,780	41,072
5	2025	15,795	2.783	43,957	0.000	0	43,957	158.0	155	24,490	68,447	2.128	26,553	0	0	26,553	41,894
6	2026	15,795	2.867	45,284	0.000	0	45,284	158.0	156	24,648	69,932	2.192	27,352	0	0	27,352	42,580
7	2027	15,795	2.953	46,643	0.000	0	46,643	158.0	158	24,964	71,607	2.258	28,175	0	0	28,175	43,432
8	2028	15,795	3.042	48,048	0.000	0	48,048	158.0	160	25,280	73,328	2.326	29,024	0	0	29,024	44,304
9	2029	15,795	3.133	49,486	0.000	0	49,486	158.0	161	25,438	74,924	2.396	29,897	0	0	29,897	45,027
10	2030	15,795	3.227	50,970	0.000	0	50,970	158.0	163	25,754	76,724	2.467	30,783	0	0	30,783	45,941
11	2031	15,795	3.324	52,503	0.000	0	52,503	158.0	164	25,912	78,415	2.541	31,707	0	0	31,707	46,708
12	2032	15,795	3.423	54,066	0.000	0	54,066	158.0	166	26,228	80,294	2.618	32,668	0	0	32,668	47,626
13	2033	15,795	3.526	55,693	0.000	0	55,693	158.0	168	26,544	82,237	2.696	33,641	0	0	33,641	48,596
14	2034	15,795	3.632	57,367	0.000	0	57,367	158.0	169	26,702	84,069	2.777	34,652	0	0	34,652	49,417
15	2035	15,795	3.741	59,089	0.000	0	59,089	158.0	171	27,018	86,107	2.860	35,687	0	0	35,687	50,420
16	2036	15,795	3.853	60,858	0.000	0	60,858	158.0	173	27,334	88,192	2.946	36,760	0	0	36,760	51,432
17	2037	15,795	3.968	62,675	0.000	0	62,675	158.0	175	27,650	90,325	3.035	37,871	0	0	37,871	52,454
18	2038	15,795	4.088	64,570	0.000	0	64,570	158.0	176	27,808	92,378	3.126	39,006	0	0	39,006	53,372
19	2039	15,795	4.210	66,497	0.000	0	66,497	158.0	178	28,124	94,621	3.219	40,167	0	0	40,167	54,454
20	2040	15,795	4.336	68,487	0.000	0	68,487	158.0	180	28,440	96,927	3.316	41,377	0	0	41,377	55,550
21	2041	10,920	4.467	48,780	0.000	0	48,780	109.2	182	19,874	68,654	3.416	29,469	0	0	29,469	39,185
22	2042	5,655	4.601	26,019	0.000	0	26,019	56.6	183	10,358	36,377	3.518	15,716	0	0	15,716	20,661
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	3.624	0	0	0	0	0
Total =		315,900									$1,606,236					$921,973	$684,263
									NPV =		$791,619					$566,956	$224,663

Total NPV = $224,663
Benefit/Cost Ratio = 1.40

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 - Replacement**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$12,056	$7,271	$19,327	$8,253	$75,000	$83,253	($63,926)
2022	25,827	15,210	41,037	8,246	81,000	89,246	(48,209)
2023	41,446	24,016	65,462	8,270	87,000	95,270	(29,808)
2024	42,678	24,174	66,852	0	0	0	66,852
2025	43,957	24,490	68,447	0	0	0	68,447
2026	45,284	24,648	69,932	0	0	0	69,932
2027	46,643	24,964	71,607	0	0	0	71,607
2028	48,048	25,280	73,328	0	0	0	73,328
2029	49,486	25,438	74,924	0	0	0	74,924
2030	50,970	25,754	76,724	0	0	0	76,724
2031	52,503	25,912	78,415	0	0	0	78,415
2032	54,066	26,228	80,294	0	0	0	80,294
2033	55,693	26,544	82,237	0	0	0	82,237
2034	57,367	26,702	84,069	0	0	0	84,069
2035	59,089	27,018	86,107	0	0	0	86,107
2036	60,858	27,334	88,192	0	0	0	88,192
2037	62,675	27,650	90,325	0	0	0	90,325
2038	64,570	27,808	92,378	0	0	0	92,378
2039	66,497	28,124	94,621	0	0	0	94,621
2040	68,487	28,440	96,927	0	0	0	96,927
2041	48,780	19,874	68,654	0	0	0	68,654
2042	26,019	10,358	36,377	0	0	0	36,377
2043	0	0	0	0	0	0	0
Total =			$1,606,236			$267,769	$1,338,467
		NPV =	$791,619			$249,370	$542,249

Total NPV = $542,249
Benefit/Cost Ratio = 3.17

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 - Replacement**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$12,056	$7,271	$0.010	$1,800	$2.118	$10,325	$31,452	$83,253	$109,000	$192,253	($160,801)
2022	25,827	15,210	0.010	3,744	2.166	21,963	66,744	89,246	117,720	206,966	(140,222)
2023	41,446	24,016	0.010	5,832	2.216	35,002	106,296	95,270	126,440	221,710	(115,414)
2024	42,678	24,174	0.011	6,415	2.267	35,807	109,074	0	0	0	109,074
2025	43,957	24,490	0.011	6,415	2.319	36,629	111,491	0	0	0	111,491
2026	45,284	24,648	0.011	6,415	2.373	37,482	113,829	0	0	0	113,829
2027	46,643	24,964	0.012	6,998	2.427	38,334	116,939	0	0	0	116,939
2028	48,048	25,280	0.012	6,998	2.483	39,219	119,545	0	0	0	119,545
2029	49,486	25,438	0.012	6,998	2.540	40,119	122,041	0	0	0	122,041
2030	50,970	25,754	0.013	7,582	2.599	41,051	125,357	0	0	0	125,357
2031	52,503	25,912	0.013	7,582	2.658	41,983	127,980	0	0	0	127,980
2032	54,066	26,228	0.014	8,165	2.719	42,947	131,406	0	0	0	131,406
2033	55,693	26,544	0.014	8,165	2.782	43,942	134,344	0	0	0	134,344
2034	57,367	26,702	0.014	8,165	2.846	44,953	137,187	0	0	0	137,187
2035	59,089	27,018	0.015	8,748	2.911	45,979	140,834	0	0	0	140,834
2036	60,858	27,334	0.015	8,748	2.978	47,038	143,978	0	0	0	143,978
2037	62,675	27,650	0.016	9,331	3.047	48,127	147,783	0	0	0	147,783
2038	64,570	27,808	0.016	9,331	3.117	49,233	150,942	0	0	0	150,942
2039	66,497	28,124	0.017	9,914	3.189	50,370	154,905	0	0	0	154,905
2040	68,487	28,440	0.017	9,914	3.262	51,523	158,364	0	0	0	158,364
2041	48,780	19,874	0.018	7,258	3.337	36,440	112,352	0	0	0	112,352
2042	26,019	10,358	0.018	3,758	3.414	19,306	59,441	0	0	0	59,441
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$2,622,284			$620,929	$2,001,355
						NPV =	$2,025,051			$605,868	$1,419,183

Total NPV = $1,419,183
Benefit/Cost Ratio = 3.34

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 - Replacement**

	Benefits							Costs	
Year	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)
2021	$75,000	4,875	$6.185	$30,152	$0.128	$23,040	$128,192	$184,000	($55,808)
2022	81,000	10,140	6.371	64,602	0.132	49,421	195,023	198,720	(3,697)
2023	87,000	15,795	6.562	103,647	0.136	79,315	269,962	213,440	56,522
2024	0	15,795	6.759	106,758	0.140	81,648	188,406	0	188,406
2025	0	15,795	6.961	109,949	0.144	83,981	193,930	0	193,930
2026	0	15,795	7.170	113,250	0.148	86,314	199,564	0	199,564
2027	0	15,795	7.385	116,646	0.153	89,230	205,876	0	205,876
2028	0	15,795	7.607	120,153	0.157	91,562	211,715	0	211,715
2029	0	15,795	7.835	123,754	0.162	94,478	218,232	0	218,232
2030	0	15,795	8.070	127,466	0.167	97,394	224,860	0	224,860
2031	0	15,795	8.312	131,288	0.172	100,310	231,598	0	231,598
2032	0	15,795	8.562	135,237	0.177	103,226	238,463	0	238,463
2033	0	15,795	8.819	139,296	0.182	106,142	245,438	0	245,438
2034	0	15,795	9.083	143,466	0.188	109,642	253,108	0	253,108
2035	0	15,795	9.356	147,778	0.194	113,141	260,919	0	260,919
2036	0	15,795	9.636	152,201	0.199	116,057	268,258	0	268,258
2037	0	15,795	9.925	156,765	0.205	119,556	276,321	0	276,321
2038	0	15,795	10.223	161,472	0.211	123,055	284,527	0	284,527
2039	0	15,795	10.530	166,321	0.218	127,138	293,459	0	293,459
2040	0	15,795	10.846	171,313	0.224	130,637	301,950	0	301,950
2041	0	10,920	11.171	121,987	0.231	93,139	215,126	0	215,126
2042	0	5,655	11.506	65,066	0.238	49,694	114,760	0	114,760
2043	0	0	11.851	0	0.245	0	0	0	0
Total =		315,900					$5,019,687	$596,160	$4,423,527
						NPV =	$2,027,015	$539,505	1,487,510

Total NPV = $1,487,510
Benefit/Cost Ratio = 3.76

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

Table 5
Total Resource Cost Test

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

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$12,056	$7,271	$1,800	$21,127	$83,253	$109,000	$192,253	($171,126)
2022	25,827	15,210	3,744	44,781	89,246	117,720	206,966	(162,185)
2023	41,446	24,016	5,832	71,294	95,270	126,440	221,710	(150,416)
2024	42,678	24,174	6,415	73,267	0	0	0	73,267
2025	43,957	24,490	6,415	74,862	0	0	0	74,862
2026	45,284	24,648	6,415	76,347	0	0	0	76,347
2027	46,643	24,964	6,998	78,605	0	0	0	78,605
2028	48,048	25,280	6,998	80,326	0	0	0	80,326
2029	49,486	25,438	6,998	81,922	0	0	0	81,922
2030	50,970	25,754	7,582	84,306	0	0	0	84,306
2031	52,503	25,912	7,582	85,997	0	0	0	85,997
2032	54,066	26,228	8,165	88,459	0	0	0	88,459
2033	55,693	26,544	8,165	90,402	0	0	0	90,402
2034	57,367	26,702	8,165	92,234	0	0	0	92,234
2035	59,089	27,018	8,748	94,855	0	0	0	94,855
2036	60,858	27,334	8,748	96,940	0	0	0	96,940
2037	62,675	27,650	9,331	99,656	0	0	0	99,656
2038	64,570	27,808	9,331	101,709	0	0	0	101,709
2039	66,497	28,124	9,914	104,535	0	0	0	104,535
2040	68,487	28,440	9,914	106,841	0	0	0	106,841
2041	48,780	19,874	7,258	75,912	0	0	0	75,912
2042	26,019	10,358	3,758	40,135	0	0	0	40,135
2043	0	0	0	0	0	0	0	0
			Total =	$1,764,512			$620,929	$1,143,583
			NPV =	$868,372			$578,160	290,212

Total NPV =	$290,212
Benefit/Cost Ratio =	1.50

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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: **Programmable Thermostats - Tier 1**
Program Years: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$6.005
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12423
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$149	$130	$114
16b) Incentive Costs =	1,350	1,275	1,200
16c) Total Utility Project Costs =	$1,499	$1,405	$1,314
17) Direct Participant Costs ($/Part.) =	$30	$30	$30
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%	0.00%
20) Project Life (Years) =	10	10	10
21) Avg. Dk/Part. Saved =	2.300	2.300	2.300
22) Avg Non-Gas Fuel Units/Part. Saved =	0	0	0
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	90	85	80
24) Total Annual Dk Saved =	207	196	184
25) Incentive/Participant =	$15	$15	$15
26) Distribution Delivery Charge			$1.836
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$7,126	1.65
Utility Cost Test	$14,219	4.60
Societal Test	$27,646	4.52
Participant Test	$21,992	4.15
Total Resource Cost Test	$10,636	2.41

Table 1
Ratepayer Impact Measure Test

Company: **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - Tier 1**

		Benefits											Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	207	$2.473	$512	$0.000	$0	$512	2.1	$149	$313	$825	$1.891	$309	$149	$1,350	$1,808	($983)
2	2022	403	2.547	1,026	0.000	0	1,026	4.0	150	600	1,626	1.948	620	130	1,275	2,025	(399)
3	2023	587	2.624	1,540	0.000	0	1,540	5.9	152	897	2,437	2.006	930	114	1,200	2,244	193
4	2024	587	2.702	1,586	0.000	0	1,586	5.9	153	903	2,489	2.066	958	0	0	958	1,531
5	2025	587	2.783	1,634	0.000	0	1,634	5.9	155	915	2,549	2.128	987	0	0	987	1,562
6	2026	587	2.867	1,683	0.000	0	1,683	5.9	156	920	2,603	2.192	1,016	0	0	1,016	1,587
7	2027	587	2.953	1,733	0.000	0	1,733	5.9	158	932	2,665	2.258	1,047	0	0	1,047	1,618
8	2028	587	3.042	1,786	0.000	0	1,786	5.9	160	944	2,730	2.326	1,079	0	0	1,079	1,651
9	2029	587	3.133	1,839	0.000	0	1,839	5.9	161	950	2,789	2.396	1,111	0	0	1,111	1,678
10	2030	587	3.227	1,894	0.000	0	1,894	5.9	163	962	2,856	2.467	1,144	0	0	1,144	1,712
11	2031	380	3.324	1,263	0.000	0	1,263	3.8	164	623	1,886	2.541	763	0	0	763	1,123
12	2032	184	3.423	630	0.000	0	630	1.8	166	299	929	2.618	381	0	0	381	548
13	2033	0	3.526	0	0.000	0	0	0.0	168	0	0	2.696	0	0	0	0	0
14	2034	0	3.632	0	0.000	0	0	0.0	169	0	0	2.777	0	0	0	0	0
15	2035	0	3.741	0	0.000	0	0	0.0	171	0	0	2.860	0	0	0	0	0
16	2036	0	3.853	0	0.000	0	0	0.0	173	0	0	2.946	0	0	0	0	0
17	2037	0	3.968	0	0.000	0	0	0.0	175	0	0	3.035	0	0	0	0	0
18	2038	0	4.088	0	0.000	0	0	0.0	176	0	0	3.126	0	0	0	0	0
19	2039	0	4.210	0	0.000	0	0	0.0	178	0	0	3.219	0	0	0	0	0
20	2040	0	4.336	0	0.000	0	0	0.0	180	0	0	3.316	0	0	0	0	0
21	2041	0	4.467	0	0.000	0	0	0.0	182	0	0	3.416	0	0	0	0	0
22	2042	0	4.601	0	0.000	0	0	0.0	183	0	0	3.518	0	0	0	0	0
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	3.624	0	0	0	0	0
	Total =	5,870									$26,384					$14,563	$11,821
									NPV =		$18,172					$11,046	$7,126

Total NPV = $7,126
Benefit/Cost Ratio = 1.65

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 - Tier 1**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$512	$313	$825	$149	$1,350	$1,499	($674)
2022	1,026	600	1,626	130	1,275	1,405	221
2023	1,540	897	2,437	114	1,200	1,314	1,123
2024	1,586	903	2,489	0	0	0	2,489
2025	1,634	915	2,549	0	0	0	2,549
2026	1,683	920	2,603	0	0	0	2,603
2027	1,733	932	2,665	0	0	0	2,665
2028	1,786	944	2,730	0	0	0	2,730
2029	1,839	950	2,789	0	0	0	2,789
2030	1,894	962	2,856	0	0	0	2,856
2031	1,263	623	1,886	0	0	0	1,886
2032	630	299	929	0	0	0	929
2033	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0
Total =			$26,384			$4,218	$22,166
		NPV =	$18,172			$3,953	$14,219

Total NPV = $14,219
Benefit/Cost Ratio = 4.60

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 - Tier 1**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$512	$313	$0.010	$0	$2.118	$438	$1,263	$1,499	$1,350	$2,849	($1,586)
2022	1,026	600	0.010	0	2.166	873	2,499	1,405	1,275	2,680	(181)
2023	1,540	897	0.010	0	2.216	1,301	3,738	1,314	1,200	2,514	1,224
2024	1,586	903	0.011	0	2.267	1,331	3,820	0	0	0	3,820
2025	1,634	915	0.011	0	2.319	1,361	3,910	0	0	0	3,910
2026	1,683	920	0.011	0	2.373	1,393	3,996	0	0	0	3,996
2027	1,733	932	0.012	0	2.427	1,425	4,090	0	0	0	4,090
2028	1,786	944	0.012	0	2.483	1,458	4,188	0	0	0	4,188
2029	1,839	950	0.012	0	2.540	1,491	4,280	0	0	0	4,280
2030	1,894	962	0.013	0	2.599	1,526	4,382	0	0	0	4,382
2031	1,263	623	0.013	0	2.658	1,010	2,896	0	0	0	2,896
2032	630	299	0.014	0	2.719	500	1,429	0	0	0	1,429
2033	0	0	0.014	0	2.782	0	0	0	0	0	0
2034	0	0	0.014	0	2.846	0	0	0	0	0	0
2035	0	0	0.015	0	2.911	0	0	0	0	0	0
2036	0	0	0.015	0	2.978	0	0	0	0	0	0
2037	0	0	0.016	0	3.047	0	0	0	0	0	0
2038	0	0	0.016	0	3.117	0	0	0	0	0	0
2039	0	0	0.017	0	3.189	0	0	0	0	0	0
2040	0	0	0.017	0	3.262	0	0	0	0	0	0
2041	0	0	0.018	0	3.337	0	0	0	0	0	0
2042	0	0	0.018	0	3.414	0	0	0	0	0	0
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$40,491			$8,043	$32,448
						NPV =	$35,510			$7,864	$27,646

Total NPV = $27,646
Benefit/Cost Ratio = 4.52

Worksheet Calculations

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

Table 4
Participant Test

Company: **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - Tier 1**

	Benefits							Costs	
Year	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)
2021	$1,350	207	$6.185	$1,280	$0.128	$0	$2,630	$2,700	($70)
2022	1,275	403	6.371	2,568	0.132	0	3,843	2,550	1,293
2023	1,200	587	6.562	3,852	0.136	0	5,052	2,400	2,652
2024	0	587	6.759	3,968	0.140	0	3,968	0	3,968
2025	0	587	6.961	4,086	0.144	0	4,086	0	4,086
2026	0	587	7.170	4,209	0.148	0	4,209	0	4,209
2027	0	587	7.385	4,335	0.153	0	4,335	0	4,335
2028	0	587	7.607	4,465	0.157	0	4,465	0	4,465
2029	0	587	7.835	4,599	0.162	0	4,599	0	4,599
2030	0	587	8.070	4,737	0.167	0	4,737	0	4,737
2031	0	380	8.312	3,159	0.172	0	3,159	0	3,159
2032	0	184	8.562	1,575	0.177	0	1,575	0	1,575
2033	0	0	8.819	0	0.182	0	0	0	0
2034	0	0	9.083	0	0.188	0	0	0	0
2035	0	0	9.356	0	0.194	0	0	0	0
2036	0	0	9.636	0	0.199	0	0	0	0
2037	0	0	9.925	0	0.205	0	0	0	0
2038	0	0	10.223	0	0.211	0	0	0	0
2039	0	0	10.530	0	0.218	0	0	0	0
2040	0	0	10.846	0	0.224	0	0	0	0
2041	0	0	11.171	0	0.231	0	0	0	0
2042	0	0	11.506	0	0.238	0	0	0	0
2043	0	0	11.851	0	0.245	0	0	0	0
Total =		5,870					$46,658	$7,650	$39,008
						NPV =	$28,975	$6,983	21,992

Total NPV = $21,992
Benefit/Cost Ratio = 4.15

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

Table 5
Total Resource Cost Test

Compar **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - Tier 1**

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$512	$313	$0	$825	$1,499	$1,350	$2,849	($2,024)
2022	1,026	600	0	1,626	1,405	1,275	2,680	(1,054)
2023	1,540	897	0	2,437	1,314	1,200	2,514	(77)
2024	1,586	903	0	2,489	0	0	0	2,489
2025	1,634	915	0	2,549	0	0	0	2,549
2026	1,683	920	0	2,603	0	0	0	2,603
2027	1,733	932	0	2,665	0	0	0	2,665
2028	1,786	944	0	2,730	0	0	0	2,730
2029	1,839	950	0	2,789	0	0	0	2,789
2030	1,894	962	0	2,856	0	0	0	2,856
2031	1,263	623	0	1,886	0	0	0	1,886
2032	630	299	0	929	0	0	0	929
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
			Total =	$26,384			$8,043	$18,341
			NPV =	$18,172			$7,536	10,636

Total NPV =	$10,636
Benefit/Cost Ratio =	2.41

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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: **Programmable Thermostats - Tier 2**
Program Years: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$6.005
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12423
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$1,057	$1,069	$1,055
16b) Incentive Costs =	9,600	10,500	11,100
16c) Total Utility Project Costs =	$10,657	$11,569	$12,155
17) Direct Participant Costs ($/Part.) =	$155	$155	$155
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%	0.00%
20) Project Life (Years) =	10	10	10
21) Avg. Dk/Part. Saved =	5.840	5.840	5.840
22) Avg Non-Gas Fuel Units/Part. Saved =	41	41	41
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	160	175	185
24) Total Annual Dk Saved =	934	1,022	1,080
25) Incentive/Participant =	$60	$60	$60
26) Distribution Delivery Charge			$1.836
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$24,934	1.36
Utility Cost Test	$61,509	2.92
Societal Test	$103,978	2.27
Participant Test	$105,373	2.44
Total Resource Cost Test	$17,193	1.22

Table 1
Ratepayer Impact Measure Test

Company: **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - Tier 2**

		Benefits											Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	934	$2.473	$2,310	$0.000	$0	$2,310	9.3	$149	$1,386	$3,696	$1.891	$1,395	$1,057	$9,600	$12,052	($8,356)
2	2022	1,956	2.547	4,982	0.000	0	4,982	19.6	150	2,940	7,922	1.948	3,010	1,069	10,500	14,579	(6,657)
3	2023	3,037	2.624	7,969	0.000	0	7,969	30.4	152	4,621	12,590	2.006	4,813	1,055	11,100	16,968	(4,378)
4	2024	3,037	2.702	8,206	0.000	0	8,206	30.4	153	4,651	12,857	2.066	4,957	0	0	4,957	7,900
5	2025	3,037	2.783	8,452	0.000	0	8,452	30.4	155	4,712	13,164	2.128	5,106	0	0	5,106	8,058
6	2026	3,037	2.867	8,707	0.000	0	8,707	30.4	156	4,742	13,449	2.192	5,259	0	0	5,259	8,190
7	2027	3,037	2.953	8,968	0.000	0	8,968	30.4	158	4,803	13,771	2.258	5,417	0	0	5,417	8,354
8	2028	3,037	3.042	9,239	0.000	0	9,239	30.4	160	4,864	14,103	2.326	5,581	0	0	5,581	8,522
9	2029	3,037	3.133	9,515	0.000	0	9,515	30.4	161	4,894	14,409	2.396	5,749	0	0	5,749	8,660
10	2030	3,037	3.227	9,800	0.000	0	9,800	30.4	163	4,955	14,755	2.467	5,919	0	0	5,919	8,836
11	2031	2,102	3.324	6,987	0.000	0	6,987	21.0	164	3,444	10,431	2.541	4,220	0	0	4,220	6,211
12	2032	1,080	3.423	3,697	0.000	0	3,697	10.8	166	1,793	5,490	2.618	2,234	0	0	2,234	3,256
13	2033	0	3.526	0	0.000	0	0	0.0	168	0	0	2.696	0	0	0	0	0
14	2034	0	3.632	0	0.000	0	0	0.0	169	0	0	2.777	0	0	0	0	0
15	2035	0	3.741	0	0.000	0	0	0.0	171	0	0	2.860	0	0	0	0	0
16	2036	0	3.853	0	0.000	0	0	0.0	173	0	0	2.946	0	0	0	0	0
17	2037	0	3.968	0	0.000	0	0	0.0	175	0	0	3.035	0	0	0	0	0
18	2038	0	4.088	0	0.000	0	0	0.0	176	0	0	3.126	0	0	0	0	0
19	2039	0	4.210	0	0.000	0	0	0.0	178	0	0	3.219	0	0	0	0	0
20	2040	0	4.336	0	0.000	0	0	0.0	180	0	0	3.316	0	0	0	0	0
21	2041	0	4.467	0	0.000	0	0	0.0	182	0	0	3.416	0	0	0	0	0
22	2042	0	4.601	0	0.000	0	0	0.0	183	0	0	3.518	0	0	0	0	0
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	3.624	0	0	0	0	0
	Total =	30,368									$136,637					$88,041	$48,596
									NPV =		$93,530					$68,596	$24,934

Total NPV = $24,934
Benefit/Cost Ratio = 1.36

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 - Tier 2**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$2,310	$1,386	$3,696	$1,057	$9,600	$10,657	($6,961)
2022	4,982	2,940	7,922	1,069	10,500	11,569	(3,647)
2023	7,969	4,621	12,590	1,055	11,100	12,155	435
2024	8,206	4,651	12,857	0	0	0	12,857
2025	8,452	4,712	13,164	0	0	0	13,164
2026	8,707	4,742	13,449	0	0	0	13,449
2027	8,968	4,803	13,771	0	0	0	13,771
2028	9,239	4,864	14,103	0	0	0	14,103
2029	9,515	4,894	14,409	0	0	0	14,409
2030	9,800	4,955	14,755	0	0	0	14,755
2031	6,987	3,444	10,431	0	0	0	10,431
2032	3,697	1,793	5,490	0	0	0	5,490
2033	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0
Total =			$136,637			$34,381	$102,256
		NPV =	$93,530			$32,021	$61,509

Total NPV =	$61,509
Benefit/Cost Ratio =	2.92

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 - Tier 2**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$2,310	$1,386	$0.010	$66	$2.118	$1,978	$5,740	$10,657	$15,200	$25,857	($20,117)
2022	4,982	2,940	0.010	137	2.166	4,237	12,296	11,569	16,625	28,194	(15,898)
2023	7,969	4,621	0.010	213	2.216	6,730	19,533	12,155	17,575	29,730	(10,197)
2024	8,206	4,651	0.011	235	2.267	6,885	19,977	0	0	0	19,977
2025	8,452	4,712	0.011	235	2.319	7,043	20,442	0	0	0	20,442
2026	8,707	4,742	0.011	235	2.373	7,207	20,891	0	0	0	20,891
2027	8,968	4,803	0.012	256	2.427	7,371	21,398	0	0	0	21,398
2028	9,239	4,864	0.012	256	2.483	7,541	21,900	0	0	0	21,900
2029	9,515	4,894	0.012	256	2.540	7,714	22,379	0	0	0	22,379
2030	9,800	4,955	0.013	277	2.599	7,893	22,925	0	0	0	22,925
2031	6,987	3,444	0.013	192	2.658	5,587	16,210	0	0	0	16,210
2032	3,697	1,793	0.014	106	2.719	2,937	8,533	0	0	0	8,533
2033	0	0	0.014	0	2.782	0	0	0	0	0	0
2034	0	0	0.014	0	2.846	0	0	0	0	0	0
2035	0	0	0.015	0	2.911	0	0	0	0	0	0
2036	0	0	0.015	0	2.978	0	0	0	0	0	0
2037	0	0	0.016	0	3.047	0	0	0	0	0	0
2038	0	0	0.016	0	3.117	0	0	0	0	0	0
2039	0	0	0.017	0	3.189	0	0	0	0	0	0
2040	0	0	0.017	0	3.262	0	0	0	0	0	0
2041	0	0	0.018	0	3.337	0	0	0	0	0	0
2042	0	0	0.018	0	3.414	0	0	0	0	0	0
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$212,224			$83,781	$128,443
						NPV =	$185,729			$81,751	$103,978

Total NPV = $103,978
Benefit/Cost Ratio = 2.27

Worksheet Calculations

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

Table 4
Participant Test

Company: **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - Tier 2**

	Benefits							Costs	
Year	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)
2021	$9,600	934	$6.185	$5,777	$0.128	$840	$16,217	$24,800	($8,583)
2022	10,500	1,956	6.371	12,462	0.132	1,813	24,775	27,125	(2,350)
2023	11,100	3,037	6.562	19,929	0.136	2,900	33,929	28,675	5,254
2024	0	3,037	6.759	20,527	0.140	2,985	23,512	0	23,512
2025	0	3,037	6.961	21,141	0.144	3,070	24,211	0	24,211
2026	0	3,037	7.170	21,775	0.148	3,155	24,930	0	24,930
2027	0	3,037	7.385	22,428	0.153	3,262	25,690	0	25,690
2028	0	3,037	7.607	23,102	0.157	3,347	26,449	0	26,449
2029	0	3,037	7.835	23,795	0.162	3,454	27,249	0	27,249
2030	0	3,037	8.070	24,509	0.167	3,560	28,069	0	28,069
2031	0	2,102	8.312	17,472	0.172	2,539	20,011	0	20,011
2032	0	1,080	8.562	9,247	0.177	1,343	10,590	0	10,590
2033	0	0	8.819	0	0.182	0	0	0	0
2034	0	0	9.083	0	0.188	0	0	0	0
2035	0	0	9.356	0	0.194	0	0	0	0
2036	0	0	9.636	0	0.199	0	0	0	0
2037	0	0	9.925	0	0.205	0	0	0	0
2038	0	0	10.223	0	0.211	0	0	0	0
2039	0	0	10.530	0	0.218	0	0	0	0
2040	0	0	10.846	0	0.224	0	0	0	0
2041	0	0	11.171	0	0.231	0	0	0	0
2042	0	0	11.506	0	0.238	0	0	0	0
2043	0	0	11.851	0	0.245	0	0	0	0
Total =		30,368					$285,632	$80,600	$205,032
						NPV =	$178,322	$72,949	105,373

Total NPV = $105,373
Benefit/Cost Ratio = 2.44

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

Table 5
Total Resource Cost Test

Compar **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - Tier 2**

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$2,310	$1,386	$66	$3,762	$10,657	$15,200	$25,857	($22,095)
2022	4,982	2,940	137	8,059	11,569	16,625	28,194	(20,135)
2023	7,969	4,621	213	12,803	12,155	17,575	29,730	(16,927)
2024	8,206	4,651	235	13,092	0	0	0	13,092
2025	8,452	4,712	235	13,399	0	0	0	13,399
2026	8,707	4,742	235	13,684	0	0	0	13,684
2027	8,968	4,803	256	14,027	0	0	0	14,027
2028	9,239	4,864	256	14,359	0	0	0	14,359
2029	9,515	4,894	256	14,665	0	0	0	14,665
2030	9,800	4,955	277	15,032	0	0	0	15,032
2031	6,987	3,444	192	10,623	0	0	0	10,623
2032	3,697	1,793	106	5,596	0	0	0	5,596
2033	0	0	0	0	0	0	0	0
2034	0	0	0	0	0	0	0	0
2035	0	0	0	0	0	0	0	0
2036	0	0	0	0	0	0	0	0
2037	0	0	0	0	0	0	0	0
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
			Total =	$139,101			$83,781	$55,320
			NPV =	$95,209			$78,016	17,193

Total NPV =	$17,193
Benefit/Cost Ratio =	1.22

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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: **Commercial 95+% AFUE Furnace - New**
Program Years: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$5.099
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12049
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$83	$107	$143
16b) Incentive Costs =	750	1,050	1,500
16c) Total Utility Project Costs =	$833	$1,157	$1,643
17) Direct Participant Costs ($/Part.) =	$165	$165	$165
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%	0.00%
20) Project Life (Years) =	20	20	20
21) Avg. Dk/Part. Saved =	6.200	6.200	6.200
22) Avg Non-Gas Fuel Units/Part. Saved =	0	0	0
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	5	7	10
24) Total Annual Dk Saved =	31	43	62
25) Incentive/Participant =	$150	$150	$150
26) Distribution Delivery Charge			$0.930
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$2,098	1.44
Utility Cost Test	$3,472	2.04
Societal Test	$12,623	4.28
Participant Test	$7,106	3.20
Total Resource Cost Test	$3,168	1.87

Table 1
Ratepayer Impact Measure Test

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

		Benefits										Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	31	$2.473	$77	$0.000	$0	$77	0.3	$149	$45	$122	$0.958	$23	$83	$750	$856	($734)
2	2022	74	2.547	188	0.000	0	188	0.7	150	105	293	0.987	58	107	1,050	1,215	(922)
3	2023	136	2.624	357	0.000	0	357	1.4	152	213	570	1.016	109	143	1,500	1,752	(1,182)
4	2024	136	2.702	367	0.000	0	367	1.4	153	214	581	1.047	112	0	0	112	469
5	2025	136	2.783	378	0.000	0	378	1.4	155	217	595	1.078	116	0	0	116	479
6	2026	136	2.867	390	0.000	0	390	1.4	156	218	608	1.110	119	0	0	119	489
7	2027	136	2.953	402	0.000	0	402	1.4	158	221	623	1.144	123	0	0	123	500
8	2028	136	3.042	414	0.000	0	414	1.4	160	224	638	1.178	127	0	0	127	511
9	2029	136	3.133	426	0.000	0	426	1.4	161	225	651	1.213	130	0	0	130	521
10	2030	136	3.227	439	0.000	0	439	1.4	163	228	667	1.250	134	0	0	134	533
11	2031	136	3.324	452	0.000	0	452	1.4	164	230	682	1.287	138	0	0	138	544
12	2032	136	3.423	466	0.000	0	466	1.4	166	232	698	1.326	142	0	0	142	556
13	2033	136	3.526	480	0.000	0	480	1.4	168	235	715	1.366	147	0	0	147	568
14	2034	136	3.632	494	0.000	0	494	1.4	169	237	731	1.407	151	0	0	151	580
15	2035	136	3.741	509	0.000	0	509	1.4	171	239	748	1.449	156	0	0	156	592
16	2036	136	3.853	524	0.000	0	524	1.4	173	242	766	1.492	160	0	0	160	606
17	2037	136	3.968	540	0.000	0	540	1.4	175	245	785	1.537	165	0	0	165	620
18	2038	136	4.088	556	0.000	0	556	1.4	176	246	802	1.583	170	0	0	170	632
19	2039	136	4.210	573	0.000	0	573	1.4	178	249	822	1.631	175	0	0	175	647
20	2040	136	4.336	590	0.000	0	590	1.4	180	252	842	1.680	180	0	0	180	662
21	2041	105	4.467	469	0.000	0	469	1.1	182	200	669	1.730	144	0	0	144	525
22	2042	62	4.601	285	0.000	0	285	0.6	183	110	395	1.782	87	0	0	87	308
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	1.835	0	0	0	0	0
	Total =	2,720									$14,003					$6,499	$7,504
									NPV =		$6,813					$4,715	$2,098

Total NPV = $2,098
Benefit/Cost Ratio = 1.44

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 - New**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$77	$45	$122	$83	$750	$833	($711)
2022	188	105	293	107	1,050	1,157	(864)
2023	357	213	570	143	1,500	1,643	(1,073)
2024	367	214	581	0	0	0	581
2025	378	217	595	0	0	0	595
2026	390	218	608	0	0	0	608
2027	402	221	623	0	0	0	623
2028	414	224	638	0	0	0	638
2029	426	225	651	0	0	0	651
2030	439	228	667	0	0	0	667
2031	452	230	682	0	0	0	682
2032	466	232	698	0	0	0	698
2033	480	235	715	0	0	0	715
2034	494	237	731	0	0	0	731
2035	509	239	748	0	0	0	748
2036	524	242	766	0	0	0	766
2037	540	245	785	0	0	0	785
2038	556	246	802	0	0	0	802
2039	573	249	822	0	0	0	822
2040	590	252	842	0	0	0	842
2041	469	200	669	0	0	0	669
2042	285	110	395	0	0	0	395
2043	0	0	0	0	0	0	0
Total =			$14,003			$3,633	$10,370
		NPV =	$6,813			$3,341	$3,472

Total NPV = $3,472
Benefit/Cost Ratio = 2.04

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 - New**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$77	$45	$0.010	$0	$2.118	$66	$188	$833	$75	$908	($720)
2022	188	105	0.010	0	2.166	160	453	1,157	105	1,262	(809)
2023	357	213	0.010	0	2.216	301	871	1,643	150	1,793	(922)
2024	367	214	0.011	0	2.267	308	889	0	0	0	889
2025	378	217	0.011	0	2.319	315	910	0	0	0	910
2026	390	218	0.011	0	2.373	323	931	0	0	0	931
2027	402	221	0.012	0	2.427	330	953	0	0	0	953
2028	414	224	0.012	0	2.483	338	976	0	0	0	976
2029	426	225	0.012	0	2.540	345	996	0	0	0	996
2030	439	228	0.013	0	2.599	353	1,020	0	0	0	1,020
2031	452	230	0.013	0	2.658	361	1,043	0	0	0	1,043
2032	466	232	0.014	0	2.719	370	1,068	0	0	0	1,068
2033	480	235	0.014	0	2.782	378	1,093	0	0	0	1,093
2034	494	237	0.014	0	2.846	387	1,118	0	0	0	1,118
2035	509	239	0.015	0	2.911	396	1,144	0	0	0	1,144
2036	524	242	0.015	0	2.978	405	1,171	0	0	0	1,171
2037	540	245	0.016	0	3.047	414	1,199	0	0	0	1,199
2038	556	246	0.016	0	3.117	424	1,226	0	0	0	1,226
2039	573	249	0.017	0	3.189	434	1,256	0	0	0	1,256
2040	590	252	0.017	0	3.262	444	1,286	0	0	0	1,286
2041	469	200	0.018	0	3.337	350	1,019	0	0	0	1,019
2042	285	110	0.018	0	3.414	212	607	0	0	0	607
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$21,417			$3,963	$17,454
						NPV =	$16,474			$3,851	$12,623

Total NPV = $12,623
Benefit/Cost Ratio = 4.28

Worksheet Calculations

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

Table 4
Participant Test

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

	Benefits							Costs	
Year	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)
2021	$750	31	$5.252	$163	$0.124	$0	$913	$825	$88
2022	1,050	74	5.410	400	0.128	0	1,450	1,155	295
2023	1,500	136	5.572	758	0.132	0	2,258	1,650	608
2024	0	136	5.739	781	0.136	0	781	0	781
2025	0	136	5.911	804	0.140	0	804	0	804
2026	0	136	6.088	828	0.144	0	828	0	828
2027	0	136	6.271	853	0.148	0	853	0	853
2028	0	136	6.459	878	0.153	0	878	0	878
2029	0	136	6.653	905	0.157	0	905	0	905
2030	0	136	6.853	932	0.162	0	932	0	932
2031	0	136	7.058	960	0.167	0	960	0	960
2032	0	136	7.270	989	0.172	0	989	0	989
2033	0	136	7.488	1,018	0.177	0	1,018	0	1,018
2034	0	136	7.713	1,049	0.182	0	1,049	0	1,049
2035	0	136	7.944	1,080	0.188	0	1,080	0	1,080
2036	0	136	8.182	1,113	0.193	0	1,113	0	1,113
2037	0	136	8.428	1,146	0.199	0	1,146	0	1,146
2038	0	136	8.681	1,181	0.205	0	1,181	0	1,181
2039	0	136	8.941	1,216	0.211	0	1,216	0	1,216
2040	0	136	9.209	1,252	0.218	0	1,252	0	1,252
2041	0	105	9.486	996	0.224	0	996	0	996
2042	0	62	9.770	606	0.231	0	606	0	606
2043	0	0	10.063	0	0.238	0	0	0	0
Total =		2,720					$23,208	$3,630	$19,578
						NPV =	$10,334	$3,228	7,106

Total NPV = $7,106
Benefit/Cost Ratio = 3.20

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

Table 5
Total Resource Cost Test

Compai **Montana-Dakota Utilities Co.**
Project: **Commercial 95+% AFUE Furnace - New**

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$77	$45	$0	$122	$833	$75	$908	($786)
2022	188	105	0	293	1,157	105	1,262	(969)
2023	357	213	0	570	1,643	150	1,793	(1,223)
2024	367	214	0	581	0	0	0	581
2025	378	217	0	595	0	0	0	595
2026	390	218	0	608	0	0	0	608
2027	402	221	0	623	0	0	0	623
2028	414	224	0	638	0	0	0	638
2029	426	225	0	651	0	0	0	651
2030	439	228	0	667	0	0	0	667
2031	452	230	0	682	0	0	0	682
2032	466	232	0	698	0	0	0	698
2033	480	235	0	715	0	0	0	715
2034	494	237	0	731	0	0	0	731
2035	509	239	0	748	0	0	0	748
2036	524	242	0	766	0	0	0	766
2037	540	245	0	785	0	0	0	785
2038	556	246	0	802	0	0	0	802
2039	573	249	0	822	0	0	0	822
2040	590	252	0	842	0	0	0	842
2041	469	200	0	669	0	0	0	669
2042	285	110	0	395	0	0	0	395
2043	0	0	0	0	0	0	0	0
			Total =	$14,003			$3,963	$10,040
			NPV =	$6,813			$3,645	3,168

Total NPV =	$3,168
Benefit/Cost Ratio =	1.87

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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: **Commercial 95+% AFUE Furnace - Replacement**
Program Years: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$5.099
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12049
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$495	$519	$570
16b) Incentive Costs =	4,500	5,100	6,000
16c) Total Utility Project Costs =	$4,995	$5,619	$6,570
17) Direct Participant Costs ($/Part.) =	$736	$736	$736
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%	0.00%
20) Project Life (Years) =	20	20	20
21) Avg. Dk/Part. Saved =	20.900	20.900	20.900
22) Avg Non-Gas Fuel Units/Part. Saved =	720	720	720
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	15	17	20
24) Total Annual Dk Saved =	314	355	418
25) Incentive/Participant =	$300	$300	$300
26) Distribution Delivery Charge			$0.930
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$27,394	2.01
Utility Cost Test	$38,445	3.41
Societal Test	$100,008	3.57
Participant Test	$87,868	3.55
Total Resource Cost Test	$22,323	1.60

Table 1
Ratepayer Impact Measure Test

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

		Benefits											Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	314	$2.473	$777	$0.000	$0	$777	3.1	$149	$462	$1,239	$0.958	$238	$495	$4,500	$5,233	($3,994)
2	2022	669	2.547	1,704	0.000	0	1,704	6.7	150	1,005	2,709	0.987	522	519	5,100	6,141	(3,432)
3	2023	1,087	2.624	2,852	0.000	0	2,852	10.9	152	1,657	4,509	1.016	872	570	6,000	7,442	(2,933)
4	2024	1,087	2.702	2,937	0.000	0	2,937	10.9	153	1,668	4,605	1.047	899	0	0	899	3,706
5	2025	1,087	2.783	3,025	0.000	0	3,025	10.9	155	1,690	4,715	1.078	926	0	0	926	3,789
6	2026	1,087	2.867	3,116	0.000	0	3,116	10.9	156	1,700	4,816	1.110	953	0	0	953	3,863
7	2027	1,087	2.953	3,210	0.000	0	3,210	10.9	158	1,722	4,932	1.144	982	0	0	982	3,950
8	2028	1,087	3.042	3,307	0.000	0	3,307	10.9	160	1,744	5,051	1.178	1,012	0	0	1,012	4,039
9	2029	1,087	3.133	3,406	0.000	0	3,406	10.9	161	1,755	5,161	1.213	1,042	0	0	1,042	4,119
10	2030	1,087	3.227	3,508	0.000	0	3,508	10.9	163	1,777	5,285	1.250	1,073	0	0	1,073	4,212
11	2031	1,087	3.324	3,613	0.000	0	3,613	10.9	164	1,788	5,401	1.287	1,105	0	0	1,105	4,296
12	2032	1,087	3.423	3,721	0.000	0	3,721	10.9	166	1,809	5,530	1.326	1,139	0	0	1,139	4,391
13	2033	1,087	3.526	3,833	0.000	0	3,833	10.9	168	1,831	5,664	1.366	1,173	0	0	1,173	4,491
14	2034	1,087	3.632	3,948	0.000	0	3,948	10.9	169	1,842	5,790	1.407	1,208	0	0	1,208	4,582
15	2035	1,087	3.741	4,066	0.000	0	4,066	10.9	171	1,864	5,930	1.449	1,244	0	0	1,244	4,686
16	2036	1,087	3.853	4,188	0.000	0	4,188	10.9	173	1,886	6,074	1.492	1,281	0	0	1,281	4,793
17	2037	1,087	3.968	4,313	0.000	0	4,313	10.9	175	1,908	6,221	1.537	1,320	0	0	1,320	4,901
18	2038	1,087	4.088	4,444	0.000	0	4,444	10.9	176	1,918	6,362	1.583	1,359	0	0	1,359	5,003
19	2039	1,087	4.210	4,576	0.000	0	4,576	10.9	178	1,940	6,516	1.631	1,401	0	0	1,401	5,115
20	2040	1,087	4.336	4,713	0.000	0	4,713	10.9	180	1,962	6,675	1.680	1,443	0	0	1,443	5,232
21	2041	773	4.467	3,453	0.000	0	3,453	7.7	182	1,401	4,854	1.730	1,056	0	0	1,056	3,798
22	2042	418	4.601	1,923	0.000	0	1,923	4.2	183	769	2,692	1.782	588	0	0	588	2,104
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	1.835	0	0	0	0	0
	Total =	21,740									$110,731					$40,020	$70,711
									NPV =		$54,396					$27,002	$27,394

Total NPV = $27,394
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: **Commercial 95+% AFUE Furnace - Replacement**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$777	$462	$1,239	$495	$4,500	$4,995	($3,756)
2022	1,704	1,005	2,709	519	5,100	5,619	(2,910)
2023	2,852	1,657	4,509	570	6,000	6,570	(2,061)
2024	2,937	1,668	4,605	0	0	0	4,605
2025	3,025	1,690	4,715	0	0	0	4,715
2026	3,116	1,700	4,816	0	0	0	4,816
2027	3,210	1,722	4,932	0	0	0	4,932
2028	3,307	1,744	5,051	0	0	0	5,051
2029	3,406	1,755	5,161	0	0	0	5,161
2030	3,508	1,777	5,285	0	0	0	5,285
2031	3,613	1,788	5,401	0	0	0	5,401
2032	3,721	1,809	5,530	0	0	0	5,530
2033	3,833	1,831	5,664	0	0	0	5,664
2034	3,948	1,842	5,790	0	0	0	5,790
2035	4,066	1,864	5,930	0	0	0	5,930
2036	4,188	1,886	6,074	0	0	0	6,074
2037	4,313	1,908	6,221	0	0	0	6,221
2038	4,444	1,918	6,362	0	0	0	6,362
2039	4,576	1,940	6,516	0	0	0	6,516
2040	4,713	1,962	6,675	0	0	0	6,675
2041	3,453	1,401	4,854	0	0	0	4,854
2042	1,923	769	2,692	0	0	0	2,692
2043	0	0	0	0	0	0	0
Total =			$110,731			$17,184	$93,547
		NPV =	$54,396			$15,951	$38,445

Total NPV =	$38,445
Benefit/Cost Ratio =	3.41

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**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$777	$462	$0.010	$108	$2.118	$665	$2,012	$4,995	$6,540	$11,535	($9,523)
2022	1,704	1,005	0.010	230	2.166	1,449	4,388	5,619	7,412	13,031	(8,643)
2023	2,852	1,657	0.010	374	2.216	2,409	7,292	6,570	8,720	15,290	(7,998)
2024	2,937	1,668	0.011	412	2.267	2,464	7,481	0	0	0	7,481
2025	3,025	1,690	0.011	412	2.319	2,521	7,648	0	0	0	7,648
2026	3,116	1,700	0.011	412	2.373	2,579	7,807	0	0	0	7,807
2027	3,210	1,722	0.012	449	2.427	2,638	8,019	0	0	0	8,019
2028	3,307	1,744	0.012	449	2.483	2,699	8,199	0	0	0	8,199
2029	3,406	1,755	0.012	449	2.540	2,761	8,371	0	0	0	8,371
2030	3,508	1,777	0.013	487	2.599	2,825	8,597	0	0	0	8,597
2031	3,613	1,788	0.013	487	2.658	2,889	8,777	0	0	0	8,777
2032	3,721	1,809	0.014	524	2.719	2,956	9,010	0	0	0	9,010
2033	3,833	1,831	0.014	524	2.782	3,024	9,212	0	0	0	9,212
2034	3,948	1,842	0.014	524	2.846	3,094	9,408	0	0	0	9,408
2035	4,066	1,864	0.015	562	2.911	3,164	9,656	0	0	0	9,656
2036	4,188	1,886	0.015	562	2.978	3,237	9,873	0	0	0	9,873
2037	4,313	1,908	0.016	599	3.047	3,312	10,132	0	0	0	10,132
2038	4,444	1,918	0.016	599	3.117	3,388	10,349	0	0	0	10,349
2039	4,576	1,940	0.017	636	3.189	3,466	10,618	0	0	0	10,618
2040	4,713	1,962	0.017	636	3.262	3,546	10,857	0	0	0	10,857
2041	3,453	1,401	0.018	480	3.337	2,580	7,914	0	0	0	7,914
2042	1,923	769	0.018	259	3.414	1,427	4,378	0	0	0	4,378
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$179,998			$39,856	$140,142
						NPV =	$138,854			$38,846	$100,008

Total NPV =	$100,008
Benefit/Cost Ratio =	3.57

Worksheet Calculations

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

(H) = Table 2 (F)
(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(J) = (H) + (I)
(K) = (G) - (J)

Table 4
Participant Test

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

	Benefits							Costs	
Year	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)
2021	$4,500	314	$5.252	$1,649	$0.124	$1,339	$7,488	$11,040	($3,552)
2022	5,100	669	5.410	3,619	0.128	2,949	11,668	12,512	(844)
2023	6,000	1,087	5.572	6,057	0.132	4,942	16,999	14,720	2,279
2024	0	1,087	5.739	6,238	0.136	5,092	11,330	0	11,330
2025	0	1,087	5.911	6,425	0.140	5,242	11,667	0	11,667
2026	0	1,087	6.088	6,618	0.144	5,391	12,009	0	12,009
2027	0	1,087	6.271	6,817	0.148	5,541	12,358	0	12,358
2028	0	1,087	6.459	7,021	0.153	5,728	12,749	0	12,749
2029	0	1,087	6.653	7,232	0.157	5,878	13,110	0	13,110
2030	0	1,087	6.853	7,449	0.162	6,065	13,514	0	13,514
2031	0	1,087	7.058	7,672	0.167	6,252	13,924	0	13,924
2032	0	1,087	7.270	7,902	0.172	6,440	14,342	0	14,342
2033	0	1,087	7.488	8,139	0.177	6,627	14,766	0	14,766
2034	0	1,087	7.713	8,384	0.182	6,814	15,198	0	15,198
2035	0	1,087	7.944	8,635	0.188	7,039	15,674	0	15,674
2036	0	1,087	8.182	8,894	0.193	7,226	16,120	0	16,120
2037	0	1,087	8.428	9,161	0.199	7,451	16,612	0	16,612
2038	0	1,087	8.681	9,436	0.205	7,675	17,111	0	17,111
2039	0	1,087	8.941	9,719	0.211	7,900	17,619	0	17,619
2040	0	1,087	9.209	10,010	0.218	8,162	18,172	0	18,172
2041	0	773	9.486	7,333	0.224	5,967	13,300	0	13,300
2042	0	418	9.770	4,084	0.231	3,326	7,410	0	7,410
2043	0	0	10.063	0	0.238	0	0	0	0
Total =		21,740					$303,140	$38,272	$264,868
						NPV =	$122,344	$34,476	87,868

Total NPV = $87,868
Benefit/Cost Ratio = 3.55

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

Table 5
Total Resource Cost Test

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

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$777	$462	$108	$1,347	$4,995	$6,540	$11,535	($10,188)
2022	1,704	1,005	230	2,939	5,619	7,412	13,031	(10,092)
2023	2,852	1,657	374	4,883	6,570	8,720	15,290	(10,407)
2024	2,937	1,668	412	5,017	0	0	0	5,017
2025	3,025	1,690	412	5,127	0	0	0	5,127
2026	3,116	1,700	412	5,228	0	0	0	5,228
2027	3,210	1,722	449	5,381	0	0	0	5,381
2028	3,307	1,744	449	5,500	0	0	0	5,500
2029	3,406	1,755	449	5,610	0	0	0	5,610
2030	3,508	1,777	487	5,772	0	0	0	5,772
2031	3,613	1,788	487	5,888	0	0	0	5,888
2032	3,721	1,809	524	6,054	0	0	0	6,054
2033	3,833	1,831	524	6,188	0	0	0	6,188
2034	3,948	1,842	524	6,314	0	0	0	6,314
2035	4,066	1,864	562	6,492	0	0	0	6,492
2036	4,188	1,886	562	6,636	0	0	0	6,636
2037	4,313	1,908	599	6,820	0	0	0	6,820
2038	4,444	1,918	599	6,961	0	0	0	6,961
2039	4,576	1,940	636	7,152	0	0	0	7,152
2040	4,713	1,962	636	7,311	0	0	0	7,311
2041	3,453	1,401	480	5,334	0	0	0	5,334
2042	1,923	769	259	2,951	0	0	0	2,951
2043	0	0	0	0	0	0	0	0
			Total =	$120,905			$39,856	$81,049
			NPV =	$59,313			$36,990	22,323

Total NPV =	$22,323
Benefit/Cost Ratio =	1.60

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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: **Commercial Custom Efficiency**
Program Years: **2021 - 2023**

Input Data	
1) Retail Rate ($/Dk) =	$5.099
Escalation Rate =	3.00%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12049
Escalation Rate =	3.00%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.401
Escalation Rate =	3.00%
4) Demand Cost ($/Unit/Yr) =	$147.36
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.00886
Escalation Rate =	3.00%
8) Non-Gas Fuel Loss Factor	7.30%
9) Gas Environmental Damage Factor =	$2.070
Escalation Rate =	2.30%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	10.32%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.39%
14) General Input Data Year =	2020
15) Project Analysis Year 1 =	2021
Project Analysis Year 2 =	2022
Project Analysis Year 3 =	2023

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$1,321	$1,833	$2,281
16b) Incentive Costs =	12,000	18,000	24,000
16c) Total Utility Project Costs =	$13,321	$19,833	$26,281
17) Direct Participant Costs ($/Part.) =	$15,000	$15,000	$15,000
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%	0.00%
20) Project Life (Years) =	15	15	15
21) Avg. Dk/Part. Saved =	500.000	500.000	500.000
22) Avg Non-Gas Fuel Units/Part. Saved =	0	0	0
22a) Avg Additional Non-Gas Fuel Units/ Part. Used =	0	0	0
23) Number of Participants =	4	6	8
24) Total Annual Dk Saved =	2,000	3,000	4,000
25) Incentive/Participant =	$3,000	$3,000	$3,000
26) Distribution Delivery Charge			$0.930
27) Effective Income Tax Rate = (Federal & State Taxes)			21.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$241,728	2.87
Utility Cost Test	$316,329	6.78
Societal Test	$546,717	3.04
Participant Test	$229,619	1.96
Total Resource Cost Test	$117,663	1.46

Table 1
Ratepayer Impact Measure Test

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Custom Efficiency**

		Benefits											Costs				
t	Year	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)	Annual Benefits Less Costs (P)
1	2021	2,000	$2.473	$4,946	$0.000	$0	$4,946	20.0	$149	$2,980	$7,926	$0.958	$1,514	$1,321	$12,000	$14,835	($6,909)
2	2022	5,000	2.547	12,735	0.000	0	12,735	50.0	150	7,500	20,235	0.987	3,899	1,833	18,000	23,732	(3,497)
3	2023	9,000	2.624	23,616	0.000	0	23,616	90.0	152	13,680	37,296	1.016	7,224	2,281	24,000	33,505	3,791
4	2024	9,000	2.702	24,318	0.000	0	24,318	90.0	153	13,770	38,088	1.047	7,444	0	0	7,444	30,644
5	2025	9,000	2.783	25,047	0.000	0	25,047	90.0	155	13,950	38,997	1.078	7,665	0	0	7,665	31,332
6	2026	9,000	2.867	25,803	0.000	0	25,803	90.0	156	14,040	39,843	1.110	7,892	0	0	7,892	31,951
7	2027	9,000	2.953	26,577	0.000	0	26,577	90.0	158	14,220	40,797	1.144	8,134	0	0	8,134	32,663
8	2028	9,000	3.042	27,378	0.000	0	27,378	90.0	160	14,400	41,778	1.178	8,376	0	0	8,376	33,402
9	2029	9,000	3.133	28,197	0.000	0	28,197	90.0	161	14,490	42,687	1.213	8,624	0	0	8,624	34,063
10	2030	9,000	3.227	29,043	0.000	0	29,043	90.0	163	14,670	43,713	1.250	8,888	0	0	8,888	34,825
11	2031	9,000	3.324	29,916	0.000	0	29,916	90.0	164	14,760	44,676	1.287	9,151	0	0	9,151	35,525
12	2032	9,000	3.423	30,807	0.000	0	30,807	90.0	166	14,940	45,747	1.326	9,428	0	0	9,428	36,319
13	2033	9,000	3.526	31,734	0.000	0	31,734	90.0	168	15,120	46,854	1.366	9,712	0	0	9,712	37,142
14	2034	9,000	3.632	32,688	0.000	0	32,688	90.0	169	15,210	47,898	1.407	10,004	0	0	10,004	37,894
15	2035	9,000	3.741	33,669	0.000	0	33,669	90.0	171	15,390	49,059	1.449	10,302	0	0	10,302	38,757
16	2036	7,000	3.853	26,971	0.000	0	26,971	70.0	173	12,110	39,081	1.492	8,251	0	0	8,251	30,830
17	2037	4,000	3.968	15,872	0.000	0	15,872	40.0	175	7,000	22,872	1.537	4,857	0	0	4,857	18,015
18	2038	0	4.088	0	0.000	0	0	0.0	176	0	0	1.583	0	0	0	0	0
19	2039	0	4.210	0	0.000	0	0	0.0	178	0	0	1.631	0	0	0	0	0
20	2040	0	4.336	0	0.000	0	0	0.0	180	0	0	1.680	0	0	0	0	0
21	2041	0	4.467	0	0.000	0	0	0.0	182	0	0	1.730	0	0	0	0	0
22	2042	0	4.601	0	0.000	0	0	0.0	183	0	0	1.782	0	0	0	0	0
23	2043	0	4.739	0	0.000	0	0	0.0	185	0	0	1.835	0	0	0	0	0
	Total =	135,000									$647,547					$190,800	$456,747
									NPV =		$371,011					$129,283	$241,728

Total NPV = $241,728
Benefit/Cost Ratio = 2.87

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 Custom Efficiency**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Annual Total Savings (C)	Program Admin Costs (D)	Incentive Costs (E)	Utility Program Costs (F)	Annual Benefits Less Costs (G)
2021	$4,946	$2,980	$7,926	$1,321	$12,000	$13,321	($5,395)
2022	12,735	7,500	20,235	1,833	18,000	19,833	402
2023	23,616	13,680	37,296	2,281	24,000	26,281	11,015
2024	24,318	13,770	38,088	0	0	0	38,088
2025	25,047	13,950	38,997	0	0	0	38,997
2026	25,803	14,040	39,843	0	0	0	39,843
2027	26,577	14,220	40,797	0	0	0	40,797
2028	27,378	14,400	41,778	0	0	0	41,778
2029	28,197	14,490	42,687	0	0	0	42,687
2030	29,043	14,670	43,713	0	0	0	43,713
2031	29,916	14,760	44,676	0	0	0	44,676
2032	30,807	14,940	45,747	0	0	0	45,747
2033	31,734	15,120	46,854	0	0	0	46,854
2034	32,688	15,210	47,898	0	0	0	47,898
2035	33,669	15,390	49,059	0	0	0	49,059
2036	26,971	12,110	39,081	0	0	0	39,081
2037	15,872	7,000	22,872	0	0	0	22,872
2038	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0
Total =			$647,547			$59,435	$588,112
		NPV =	$371,011			$54,682	$316,329

Total NPV =	$316,329
Benefit/Cost Ratio =	6.78

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 Custom Efficiency**

	Benefits							Costs			
Year	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)	Annual Benefits Less Costs (K)
2021	$4,946	$2,980	$0.010	$0	$2.118	$4,236	$12,162	$13,321	$48,000	$61,321	($49,159)
2022	12,735	7,500	0.010	0	2.166	10,830	31,065	19,833	72,000	91,833	(60,768)
2023	23,616	13,680	0.010	0	2.216	19,944	57,240	26,281	96,000	122,281	(65,041)
2024	24,318	13,770	0.011	0	2.267	20,403	58,491	0	0	0	58,491
2025	25,047	13,950	0.011	0	2.319	20,871	59,868	0	0	0	59,868
2026	25,803	14,040	0.011	0	2.373	21,357	61,200	0	0	0	61,200
2027	26,577	14,220	0.012	0	2.427	21,843	62,640	0	0	0	62,640
2028	27,378	14,400	0.012	0	2.483	22,347	64,125	0	0	0	64,125
2029	28,197	14,490	0.012	0	2.540	22,860	65,547	0	0	0	65,547
2030	29,043	14,670	0.013	0	2.599	23,391	67,104	0	0	0	67,104
2031	29,916	14,760	0.013	0	2.658	23,922	68,598	0	0	0	68,598
2032	30,807	14,940	0.014	0	2.719	24,471	70,218	0	0	0	70,218
2033	31,734	15,120	0.014	0	2.782	25,038	71,892	0	0	0	71,892
2034	32,688	15,210	0.014	0	2.846	25,614	73,512	0	0	0	73,512
2035	33,669	15,390	0.015	0	2.911	26,199	75,258	0	0	0	75,258
2036	26,971	12,110	0.015	0	2.978	20,846	59,927	0	0	0	59,927
2037	15,872	7,000	0.016	0	3.047	12,188	35,060	0	0	0	35,060
2038	0	0	0.016	0	3.117	0	0	0	0	0	0
2039	0	0	0.017	0	3.189	0	0	0	0	0	0
2040	0	0	0.017	0	3.262	0	0	0	0	0	0
2041	0	0	0.018	0	3.337	0	0	0	0	0	0
2042	0	0	0.018	0	3.414	0	0	0	0	0	0
2043	0	0	0.019	0	3.492	0	0	0	0	0	0
Total =							$993,907			$275,435	$718,472
						NPV =	$814,366			$267,649	$546,717

Total NPV = $546,717
Benefit/Cost Ratio = 3.04

Worksheet Calculations

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

(H) = Table 2 (F)
(I) = Direct Part. Costs (17) x No. of Part. (23) - Table 1 (N)
(J) = (H) + (I)
(K) = (G) - (J)

Table 4
Participant Test

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Custom Efficiency**

	Benefits							Costs	
Year	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)
2021	$12,000	2,000	$5.252	######	$0.124	$0	$22,504	$60,000	($37,496)
2022	18,000	5,000	5.410	27,050	0.128	0	45,050	90,000	(44,950)
2023	24,000	9,000	5.572	50,148	0.132	0	74,148	120,000	(45,852)
2024	0	9,000	5.739	51,651	0.136	0	51,651	0	51,651
2025	0	9,000	5.911	53,199	0.140	0	53,199	0	53,199
2026	0	9,000	6.088	54,792	0.144	0	54,792	0	54,792
2027	0	9,000	6.271	56,439	0.148	0	56,439	0	56,439
2028	0	9,000	6.459	58,131	0.153	0	58,131	0	58,131
2029	0	9,000	6.653	59,877	0.157	0	59,877	0	59,877
2030	0	9,000	6.853	61,677	0.162	0	61,677	0	61,677
2031	0	9,000	7.058	63,522	0.167	0	63,522	0	63,522
2032	0	9,000	7.270	65,430	0.172	0	65,430	0	65,430
2033	0	9,000	7.488	67,392	0.177	0	67,392	0	67,392
2034	0	9,000	7.713	69,417	0.182	0	69,417	0	69,417
2035	0	9,000	7.944	71,496	0.188	0	71,496	0	71,496
2036	0	7,000	8.182	57,274	0.193	0	57,274	0	57,274
2037	0	4,000	8.428	33,712	0.199	0	33,712	0	33,712
2038	0	0	8.681	0	0.205	0	0	0	0
2039	0	0	8.941	0	0.211	0	0	0	0
2040	0	0	9.209	0	0.218	0	0	0	0
2041	0	0	9.486	0	0.224	0	0	0	0
2042	0	0	9.770	0	0.231	0	0	0	0
2043	0	0	10.063	0	0.238	0	0	0	0
Total =		135,000					$965,711	$270,000	$695,711
						NPV =	$469,799	$240,180	229,619

Total NPV =	$229,619
Benefit/Cost Ratio =	1.96

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

Table 5
Total Resource Cost Test

Compai **Montana-Dakota Utilities Co.**
Project: **Commercial Custom Efficiency**

	Benefits				Costs			
Year	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)	Annual Benefits Less Costs (H)
2021	$4,946	$2,980	$0	$7,926	$13,321	$48,000	$61,321	($53,395)
2022	12,735	7,500	0	20,235	19,833	72,000	91,833	(71,598)
2023	23,616	13,680	0	37,296	26,281	96,000	122,281	(84,985)
2024	24,318	13,770	0	38,088	0	0	0	38,088
2025	25,047	13,950	0	38,997	0	0	0	38,997
2026	25,803	14,040	0	39,843	0	0	0	39,843
2027	26,577	14,220	0	40,797	0	0	0	40,797
2028	27,378	14,400	0	41,778	0	0	0	41,778
2029	28,197	14,490	0	42,687	0	0	0	42,687
2030	29,043	14,670	0	43,713	0	0	0	43,713
2031	29,916	14,760	0	44,676	0	0	0	44,676
2032	30,807	14,940	0	45,747	0	0	0	45,747
2033	31,734	15,120	0	46,854	0	0	0	46,854
2034	32,688	15,210	0	47,898	0	0	0	47,898
2035	33,669	15,390	0	49,059	0	0	0	49,059
2036	26,971	12,110	0	39,081	0	0	0	39,081
2037	15,872	7,000	0	22,872	0	0	0	22,872
2038	0	0	0	0	0	0	0	0
2039	0	0	0	0	0	0	0	0
2040	0	0	0	0	0	0	0	0
2041	0	0	0	0	0	0	0	0
2042	0	0	0	0	0	0	0	0
2043	0	0	0	0	0	0	0	0
			Total =	$647,547			$275,435	$372,112
			NPV =	$371,011			$253,348	117,663

Total NPV =	$117,663
Benefit/Cost Ratio =	1.46

Worksheet Calculations
(A) = Table 1 (F)
(B) = Table 1 (I)
(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.
2020 Input Data Summary
South Dakota Natural Gas Conservation Model

Input No.	Input Data Description	Information Source	SD Res.	SD Comm.
1	Retail Rate ($/dk)	Weighted Average of SD retail rate using projected 2020-2021 winter gas costs & October 2020 pipeline and distribution rates	6.005	5.099
	Escalation Rate		3.00%	3.00%
2	Non-Gas Fuel Retail ($/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)	0.12423	0.12049
	Escalation Rate		3.00%	3.00%
	Non-Gas Fuel Units (ie. kWh, Gallons, etc)		Kwh	Kwh
3	Commodity Cost ($/dk)	Estimated gas costs using projected 2020-21 winter gas costs October 2020 pipeline commodity	2.401	2.401
	Escalation Rate		3.00%	3.00%
4	Demand Cost ($/dk/Yr)	Annual cost of firm capacity on pipeline	$147.36	$147.36
	Escalation Rate		1.00%	1.00%
5	Peak Reduction Factor	Estimated average peak day reduction factor caused by implementing the measure (s)	1.000%	1.000%
6	Variable O&M ($/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)	$0.00886	$0.00886
	Escalation Rate		3.00%	3.00%
8	Non-Gas Fuel Loss Factor	Non-Gas fuel loss factor (for analysis purposes, used Montana-Dakota Utilities 12 month ending July 2020 line loss factor)	7.30%	7.30%
9	Gas Environmental Damage Factor	Per Minnesota CIP triennium 2021-2023	2.07	2.07
	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	Federal Reserve Consumer Credit Interest Rate 12 Months ended December 31, 2019	10.32%	10.32%
12	Utility Discount Rate	Montana-Dakota's authorized average cost of capital	7.22%	7.22%
13	Societal Discount Rate	Equal to the 30 year T-Bill rate average for Twelve Months Ending March 31, 2019	2.39%	2.39%
14	General Input Data Year =	Year data was input	2020	2020
15	Project Analysis Year	Year(s) program will be implemented	2021	2021
			2022	2022
			2023	2023
16	Utility Project Costs	Total direct cost to the utility caused by implementing the program(s)		

Montana-Dakota Utilities Co.
2020 Input Data Summary
South Dakota Natural Gas Conservation Model

Input No.	Input Data Description	Information Source	SD Res.	SD Comm.
17	Direct Participant Costs ($/Part.)	Direct costs that the participant would have to participate in the program		
18	Participant Non-Energy Costs (Annual $/Part.) Yr. 1	Annual participant non-energy costs 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		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		0.00%	0.00%
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	1.836	0.93
27	Effective Fed & State Income Tax Rate	Montana-Dakota's effective tax rate	21%	21%

South Dakota Natural Gas DSM Programs
Technical Assumptions

2021 - 2023 Program Years	Customer Class	# of Particip Year 1	Number of Particip Year 2	Number of Particip Year 3	Project Life	Baseline Efficiency	Average High Efficiency	Average dk Saved / part	Average Non-Energy Benefits / Part	Increm Cost	Avg Incentive / Part
Residential											
Furnace Tier 2 - 95%+ AFUE - New	Res	160	170	180	20	90	95	4.8	0.0	165	150
Furnace Tier 2 - 95%+ AFUE - Replacement	Res	250	270	290	20	80	95	19.5	720.0	736	300
Programmable Thermostats - Tier 1	Res	90	85	80	10	NA	NA	2.3	0.0	30	15
Programmable Thermostats - Tier 2	Res	160	175	185	10	NA	NA	5.8	41.0	155	60
Commercial											
Furnace Tier 2 - 95%+ AFUE - New	Comm	5	7	10	20	90	95	6.2	0.0	165	150
Furnace Tier 2 - 95%+ AFUE - Replacement	Comm	15	17	20	20	80	95	20.9	720.0	736	300
Custom Efficiency	Comm	4	6	8	15	NA	NA	500.0	0.0	15,000	3,000
Totals	**2,187**	**684**	**730**	**773**							