Montana-Dakota Utilities Co.
Gas Utility - South Dakota
Conservation Portfolio Summary
2018 - 2020 Program Years

Programs	Total Participants	Total Energy Reduction	Total Cost	Lifetime Cost/Dk
Conservation Programs				
Residential Program				
Furnaces - 95+% AFUE - New	630	56,700	$203,118	$3.58
Furnaces - 95+% AFUE - Replacement	900	331,200	290,170	0.88
Programmable Thermostats - Tier 1	300	7,500	4,837	0.64
Programmable Thermostats - Tier 2	390	14,430	25,148	1.74
Residential Energy Assessments	150	0	72,543	
	2,370	409,830	$595,816	$1.45
Commercial Program				
Furnaces - 95+% AFUE - New	15	1,360	$4,836	$3.56
Furnaces - 95+% AFUE - Replacement	48	17,660	15,476	0.88
Custom Efficiency	3	22,500	9,672	0.43
	66	41,520	$29,984	$0.72
Total Programs	2,436	451,350	$625,800	$1.39

Montana-Dakota Utilities Co.
Gas Utility - South Dakota
Conservation Portfolio Summary
2018 - 2020 Program Years

Programs	2018 Participants	2018 Cost	2018 Dk Savings	2019 Participants	2019 Cost	2019 Dk Savings	2020 Participants	2020 Cost	2020 Dk Savings	Lifetime Dk Savings
Residential Program										
Furnaces - 95+% AFUE - New	200	64,498	900	210	67,706	945	220	70,914	990	56,700
Furnaces - 95+% AFUE - Repl.	290	93,522	5,336	300	96,723	5,520	310	99,925	5,704	331,200
Programmable Thermostats - Tier 1	110	1,774	275	100	1,612	250	90	1,451	225	7,500
Programmable Thermostats - Tier 2	110	7,095	407	130	8,383	481	150	9,670	555	14,430
Residential Energy Assessments	50	24,187	0	50	24,181	0	50	24,175	0	0
Total Residential	760	191,076	6,918	790	198,605	7,196	820	206,135	7,474	409,830
Commercial Program										
Furnaces - 95+% AFUE - New	5	1,612	23	5	1,612	23	5	1,612	23	1,360
Furnaces - 95+% AFUE - Repl.	15	4,837	276	16	5,159	294	17	5,480	313	17,660
Custom Efficiency	1	3,225	500	1	3,224	500	1	3,223	500	22,500
Total Commercial	21	$9,674	799	22	$9,995	817	23	$10,315	836	41,520
Total Programs	781	$200,750	7,717	812	$208,600	8,013	843	$216,450	8,310	451,350

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

Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		1.36	2.22	1.81	3.01	1.17
Furnace (95+%) - New	Residential	0.68	0.85	2.29	5.83	1.49
Furnace (95+%) - Replacement	Residential	1.72	3.47	1.81	2.65	1.16
Programmable Thermostats - Tier 1	Residential	2.18	5.70	3.87	4.90	2.95
Programmable Thermostats - Tier 2	Residential	1.32	2.11	1.65	2.76	1.27
Residential Energy Assessments	Residential	0.00	0.00	0.00	0.90	0.00
Furnace (95+%) - New	Commercial	0.73	0.86	2.31	5.44	1.51
Furnace (95+%) - Replacement	Commercial	1.97	3.46	1.81	2.40	1.16
Custom Efficiency	Commercial	2.91	7.75	2.37	2.19	1.64

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

Company: **Montana-Dakota Utilities Co.**
Project: **Total South Dakota Program**
Program Years: **2018 - 2020**

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 =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs = 1/	$14,000	$14,500	$15,000
16b) Incentive Costs =	186,750	194,100	201,450
16c) Total Utility Project Costs =	$200,750	$208,600	$216,450
17) Direct Participant Costs ($/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 =	781	812	843
24) Total Annual Dk Saved =	7,717	8,013	8,310
25) Incentive/Participant =			
26) Distribution Delivery Charge			
27) Effective Income Tax Rate =			
(Federal & State Taxes)			

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$345,707	1.36
Utility Cost Test	$714,409	2.22
Societal Test	$1,219,016	1.81
Participant Test	$2,738,633	3.01
Total Resource Cost Test	$250,337	1.17

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	2018	7,717		$21,176		$0	$21,176	77.0		$12,291	$33,467		$8,817	$14,000	$186,750	$209,567	($176,100)
2	2019	15,729		44,671		0	44,671	158.0		25,200	69,871		18,601	14,500	194,100	227,201	(157,330)
3	2020	24,039		70,651		0	70,651	240.0		38,945	109,596		29,440	15,000	201,450	245,890	(136,294)
4	2021	24,039		73,128		0	73,128	240.0		39,426	112,554		30,458	0	0	30,458	82,096
5	2022	24,039		75,699		0	75,699	240.0		39,667	115,366		31,522	0	0	31,522	83,844
6	2023	24,039		78,344		0	78,344	240.0		40,148	118,492		32,634	0	0	32,634	85,858
7	2024	24,039		81,083		0	81,083	240.0		40,628	121,711		33,777	0	0	33,777	87,934
8	2025	24,039		83,921		0	83,921	240.0		40,868	124,789		34,963	0	0	34,963	89,826
9	2026	24,039		86,854		0	86,854	240.0		41,349	128,203		36,181	0	0	36,181	92,022
10	2027	24,039		89,882		0	89,882	240.0		41,830	131,712		37,444	0	0	37,444	94,268
11	2028	23,357		90,390		0	90,390	234.0		41,131	131,521		37,625	0	0	37,625	93,896
12	2029	22,626		90,638		0	90,638	226.0		40,073	130,711		37,689	0	0	37,689	93,022
13	2030	21,846		90,574		0	90,574	219.0		39,111	129,685		37,635	0	0	37,635	92,050
14	2031	21,846		93,742		0	93,742	219.0		39,549	133,291		38,947	0	0	38,947	94,344
15	2032	21,846		97,018		0	97,018	219.0		39,985	137,003		40,311	0	0	40,311	96,692
16	2033	21,346		98,127		0	98,127	214.0		39,284	137,411		40,986	0	0	40,986	96,425
17	2034	20,846		99,185		0	99,185	209.0		38,781	137,966		41,663	0	0	41,663	96,303
18	2035	20,346		100,184		0	100,184	204.0		38,258	138,442		42,329	0	0	42,329	96,113
19	2036	20,346		103,704		0	103,704	204.0		38,665	142,369		43,819	0	0	43,819	98,550
20	2037	20,346		107,326		0	107,326	204.0		39,072	146,398		45,347	0	0	45,347	101,051
21	2038	13,811		75,408		0	75,408	138.0		26,811	102,219		31,860	0	0	31,860	70,359
22	2039	7,030		39,726		0	39,726	70.0		13,759	53,485		16,779	0	0	16,779	36,706
23	2040	0		0		0	0	0.0		0	0		0	0	0	0	0
	Total =	451,350									$2,586,262					$1,374,627	$1,211,635
									NPV =		$1,298,014					$952,307	$345,707

Total NPV = $345,707
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: **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)
2018	$21,176	$12,291	$33,467	$14,000	$186,750	$200,750	($167,283)
2019	44,671	25,200	69,871	14,500	194,100	208,600	(138,729)
2020	70,651	38,945	109,596	15,000	201,450	216,450	(106,854)
2021	73,128	39,426	112,554	0	0	0	112,554
2022	75,699	39,667	115,366	0	0	0	115,366
2023	78,344	40,148	118,492	0	0	0	118,492
2024	81,083	40,628	121,711	0	0	0	121,711
2025	83,921	40,868	124,789	0	0	0	124,789
2026	86,854	41,349	128,203	0	0	0	128,203
2027	89,882	41,830	131,712	0	0	0	131,712
2028	90,390	41,131	131,521	0	0	0	131,521
2029	90,638	40,073	130,711	0	0	0	130,711
2030	90,574	39,111	129,685	0	0	0	129,685
2031	93,742	39,549	133,291	0	0	0	133,291
2032	97,018	39,985	137,003	0	0	0	137,003
2033	98,127	39,284	137,411	0	0	0	137,411
2034	99,185	38,781	137,966	0	0	0	137,966
2035	100,184	38,258	138,442	0	0	0	138,442
2036	103,704	38,665	142,369	0	0	0	142,369
2037	107,326	39,072	146,398	0	0	0	146,398
2038	75,408	26,811	102,219	0	0	0	102,219
2039	39,726	13,759	53,485	0	0	0	53,485
2040	0	0	0	0	0	0	0
Total =			$2,586,262			$625,800	$1,960,462
		NPV =	$1,298,014			$583,605	$714,409

Total NPV =	$714,409
Benefit/Cost Ratio =	2.22

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)
2018	$21,176	$12,291		$8,920		$2,994	$45,381	$200,750	$292,850	$493,600	($448,219)
2019	44,671	25,200		18,984		6,244	95,099	208,600	303,567	512,167	(417,068)
2020	70,651	38,945		29,074		9,737	148,407	216,450	314,284	530,734	(382,327)
2021	73,128	39,426		30,238		9,953	152,745	0	0	0	152,745
2022	75,699	39,667		31,400		10,169	156,935	0	0	0	156,935
2023	78,344	40,148		32,563		10,384	161,439	0	0	0	161,439
2024	81,083	40,628		33,725		10,601	166,037	0	0	0	166,037
2025	83,921	40,868		34,889		10,843	170,521	0	0	0	170,521
2026	86,854	41,349		36,052		11,082	175,337	0	0	0	175,337
2027	89,882	41,830		37,215		11,323	180,250	0	0	0	180,250
2028	90,390	41,131		38,228		11,235	180,984	0	0	0	180,984
2029	90,638	40,073		40,359		11,110	182,180	0	0	0	182,180
2030	90,574	39,111		41,291		10,966	181,942	0	0	0	181,942
2031	93,742	39,549		42,438		11,207	186,936	0	0	0	186,936
2032	97,018	39,985		43,584		11,448	192,035	0	0	0	192,035
2033	98,127	39,284		45,878		11,420	194,709	0	0	0	194,709
2034	99,185	38,781		47,026		11,382	196,374	0	0	0	196,374
2035	100,184	38,258		49,319		11,353	199,114	0	0	0	199,114
2036	103,704	38,665		50,466		11,597	204,432	0	0	0	204,432
2037	107,326	39,072		52,761		11,862	211,021	0	0	0	211,021
2038	75,408	26,811		36,648		8,217	147,084	0	0	0	147,084
2039	39,726	13,759		19,475		4,274	77,234	0	0	0	77,234
2040	0	0		0		0	0	0	0	0	0
Total =							$3,606,196			$1,536,501	$2,069,695
						NPV =	$2,714,806			$1,495,790	$1,219,016

Total NPV = $1,219,016
Benefit/Cost Ratio = 1.81

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

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)
2018	$186,750	7,717		$49,893		$51,910	$288,553	$479,600	($191,047)
2019	194,100	15,729		105,271		109,842	409,213	497,667	(88,454)
2020	201,450	24,039		166,519		174,035	542,004	515,734	26,270
2021	0	24,039		172,347		179,849	352,196	0	352,196
2022	0	24,039		178,385		186,782	365,167	0	365,167
2023	0	24,039		184,639		193,713	378,352	0	378,352
2024	0	24,039		191,104		199,574	390,678	0	390,678
2025	0	24,039		197,784		206,507	404,291	0	404,291
2026	0	24,039		204,704		214,601	419,305	0	419,305
2027	0	24,039		211,880		221,579	433,459	0	433,459
2028	0	23,357		212,978		228,782	441,760	0	441,760
2029	0	22,626		213,428		235,799	449,227	0	449,227
2030	0	21,846		213,154		242,565	455,719	0	455,719
2031	0	21,846		220,615		250,594	471,209	0	471,209
2032	0	21,846		228,331		259,724	488,055	0	488,055
2033	0	21,346		231,618		268,855	500,473	0	500,473
2034	0	20,846		234,856		278,031	512,887	0	512,887
2035	0	20,346		238,027		288,308	526,335	0	526,335
2036	0	20,346		246,372		297,484	543,856	0	543,856
2037	0	20,346		254,983		308,908	563,891	0	563,891
2038	0	13,811		179,134		217,026	396,160	0	396,160
2039	10	7,030		94,365		114,576	208,951	0	208,951
2040	0	0		0		0	0	0	0
Total =		451,350					$9,541,741	$1,493,001	$8,048,740
						NPV =	$4,100,575	$1,361,942	2,738,633

Total NPV =	$2,738,633
Benefit/Cost Ratio =	3.01

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 **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)
2018	$21,176	$12,291	$8,920	$42,387	$200,750	$292,850	$493,600	($451,213)
2019	44,671	25,200	18,984	88,855	208,600	303,567	512,167	(423,312)
2020	70,651	38,945	29,074	138,670	216,450	314,284	530,734	(392,064)
2021	73,128	39,426	30,238	142,792	0	0	0	142,792
2022	75,699	39,667	31,400	146,766	0	0	0	146,766
2023	78,344	40,148	32,563	151,055	0	0	0	151,055
2024	81,083	40,628	33,725	155,436	0	0	0	155,436
2025	83,921	40,868	34,889	159,678	0	0	0	159,678
2026	86,854	41,349	36,052	164,255	0	0	0	164,255
2027	89,882	41,830	37,215	168,927	0	0	0	168,927
2028	90,390	41,131	38,228	169,749	0	0	0	169,749
2029	90,638	40,073	40,359	171,070	0	0	0	171,070
2030	90,574	39,111	41,291	170,976	0	0	0	170,976
2031	93,742	39,549	42,438	175,729	0	0	0	175,729
2032	97,018	39,985	43,584	180,587	0	0	0	180,587
2033	98,127	39,284	45,878	183,289	0	0	0	183,289
2034	99,185	38,781	47,026	184,992	0	0	0	184,992
2035	100,184	38,258	49,319	187,761	0	0	0	187,761
2036	103,704	38,665	50,466	192,835	0	0	0	192,835
2037	107,326	39,072	52,761	199,159	0	0	0	199,159
2038	75,408	26,811	36,648	138,867	0	0	0	138,867
2039	39,726	13,759	19,475	72,960	0	0	0	72,960
2040	0	0	0	0	0	0	0	0
			Total =	$3,386,795			$1,536,501	$1,850,294
			NPV =	$1,683,331			$1,432,994	250,337

Total NPV =	$250,337
Benefit/Cost Ratio =	1.17

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 - New**
Program Years: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$6.341
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.13546
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$4,498	$4,706	$4,914
16b) Incentive Costs =	60,000	63,000	66,000
16c) Total Utility Project Costs =	$64,498	$67,706	$70,914
17) Direct Participant Costs ($/Part.) =	$333	$333	$333
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 =	4.500	4.500	4.500
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 =	200	210	220
24) Total Annual Dk Saved =	900	945	990
25) Incentive/Participant =	$300	$300	$300
26) Distribution Delivery Charge			$1.744
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($75,543)	0.68
Utility Cost Test	($28,686)	0.85
Societal Test	$282,215	2.29
Participant Test	$924,603	5.83
Total Resource Cost Test	$103,060	1.49

Table 1
Ratepayer Impact Measure Test

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

		Benefits										Distribution	Costs				Annual
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)	Delivery Charge (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Program Costs (O)	Benefits Less Costs (P)
1	2018	900	$2.744	$2,470	$0.000	$0	$2,470	9.0	$159	$1,431	$3,901	$1.805	$1,056	$4,498	$60,000	$65,554	($61,653)
2	2019	1,845	2.840	5,240	0.000	0	5,240	18.5	160	2,960	8,200	1.868	2,240	4,706	63,000	69,946	(61,746)
3	2020	2,835	2.939	8,332	0.000	0	8,332	28.4	162	4,601	12,933	1.934	3,564	4,914	66,000	74,478	(61,545)
4	2021	2,835	3.042	8,624	0.000	0	8,624	28.4	164	4,658	13,282	2.001	3,687	0	0	3,687	9,595
5	2022	2,835	3.149	8,927	0.000	0	8,927	28.4	165	4,686	13,613	2.071	3,816	0	0	3,816	9,797
6	2023	2,835	3.259	9,239	0.000	0	9,239	28.4	167	4,743	13,982	2.144	3,951	0	0	3,951	10,031
7	2024	2,835	3.373	9,562	0.000	0	9,562	28.4	169	4,800	14,362	2.219	4,089	0	0	4,089	10,273
8	2025	2,835	3.491	9,897	0.000	0	9,897	28.4	170	4,828	14,725	2.297	4,233	0	0	4,233	10,492
9	2026	2,835	3.613	10,243	0.000	0	10,243	28.4	172	4,885	15,128	2.377	4,380	0	0	4,380	10,748
10	2027	2,835	3.739	10,600	0.000	0	10,600	28.4	174	4,942	15,542	2.460	4,533	0	0	4,533	11,009
11	2028	2,835	3.870	10,971	0.000	0	10,971	28.4	176	4,998	15,969	2.546	4,692	0	0	4,692	11,277
12	2029	2,835	4.006	11,357	0.000	0	11,357	28.4	177	5,027	16,384	2.635	4,856	0	0	4,856	11,528
13	2030	2,835	4.146	11,754	0.000	0	11,754	28.4	179	5,084	16,838	2.728	5,027	0	0	5,027	11,811
14	2031	2,835	4.291	12,165	0.000	0	12,165	28.4	181	5,140	17,305	2.823	5,202	0	0	5,202	12,103
15	2032	2,835	4.441	12,590	0.000	0	12,590	28.4	183	5,197	17,787	2.922	5,385	0	0	5,385	12,402
16	2033	2,835	4.597	13,032	0.000	0	13,032	28.4	184	5,226	18,258	3.024	5,572	0	0	5,572	12,686
17	2034	2,835	4.758	13,489	0.000	0	13,489	28.4	186	5,282	18,771	3.130	5,768	0	0	5,768	13,003
18	2035	2,835	4.924	13,960	0.000	0	13,960	28.4	188	5,339	19,299	3.239	5,969	0	0	5,969	13,330
19	2036	2,835	5.097	14,450	0.000	0	14,450	28.4	190	5,396	19,846	3.353	6,179	0	0	6,179	13,667
20	2037	2,835	5.275	14,955	0.000	0	14,955	28.4	192	5,453	20,408	3.470	6,394	0	0	6,394	14,014
21	2038	1,935	5.460	10,565	0.000	0	10,565	19.4	194	3,764	14,329	3.592	4,518	0	0	4,518	9,811
22	2039	990	5.651	5,594	0.000	0	5,594	9.9	196	1,940	7,534	3.717	2,392	0	0	2,392	5,142
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	3.847	0	0	0	0	0
	Total =	56,700									$328,396					$300,621	$27,775
									NPV =		$160,651					$236,194	($75,543)

Total NPV = ($75,543)
Benefit/Cost Ratio = 0.68

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)
2018	$2,470	$1,431	$3,901	$4,498	$60,000	$64,498	($60,597)
2019	5,240	2,960	8,200	4,706	63,000	67,706	(59,506)
2020	8,332	4,601	12,933	4,914	66,000	70,914	(57,981)
2021	8,624	4,658	13,282	0	0	0	13,282
2022	8,927	4,686	13,613	0	0	0	13,613
2023	9,239	4,743	13,982	0	0	0	13,982
2024	9,562	4,800	14,362	0	0	0	14,362
2025	9,897	4,828	14,725	0	0	0	14,725
2026	10,243	4,885	15,128	0	0	0	15,128
2027	10,600	4,942	15,542	0	0	0	15,542
2028	10,971	4,998	15,969	0	0	0	15,969
2029	11,357	5,027	16,384	0	0	0	16,384
2030	11,754	5,084	16,838	0	0	0	16,838
2031	12,165	5,140	17,305	0	0	0	17,305
2032	12,590	5,197	17,787	0	0	0	17,787
2033	13,032	5,226	18,258	0	0	0	18,258
2034	13,489	5,282	18,771	0	0	0	18,771
2035	13,960	5,339	19,299	0	0	0	19,299
2036	14,450	5,396	19,846	0	0	0	19,846
2037	14,955	5,453	20,408	0	0	0	20,408
2038	10,565	3,764	14,329	0	0	0	14,329
2039	5,594	1,940	7,534	0	0	0	7,534
2040	0	0	0	0	0	0	0
Total =			$328,396			$203,118	$125,278
		NPV =	$160,651			$189,337	($28,686)

Total NPV = ($28,686)
Benefit/Cost Ratio = 0.85

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)
2018	$2,470	$1,431	$0.024	$3,456	$0.388	$349	$7,706	$64,498	$6,600	$71,098	($63,392)
2019	5,240	2,960	0.025	7,380	0.397	732	16,312	67,706	6,930	74,636	(58,324)
2020	8,332	4,601	0.025	11,340	0.405	1,148	25,421	70,914	7,260	78,174	(52,753)
2021	8,624	4,658	0.026	11,794	0.414	1,174	26,250	0	0	0	26,250
2022	8,927	4,686	0.027	12,247	0.423	1,199	27,059	0	0	0	27,059
2023	9,239	4,743	0.028	12,701	0.432	1,225	27,908	0	0	0	27,908
2024	9,562	4,800	0.029	13,154	0.441	1,250	28,766	0	0	0	28,766
2025	9,897	4,828	0.030	13,608	0.451	1,279	29,612	0	0	0	29,612
2026	10,243	4,885	0.031	14,062	0.461	1,307	30,497	0	0	0	30,497
2027	10,600	4,942	0.032	14,515	0.471	1,335	31,392	0	0	0	31,392
2028	10,971	4,998	0.033	14,969	0.481	1,364	32,302	0	0	0	32,302
2029	11,357	5,027	0.035	15,876	0.491	1,392	33,652	0	0	0	33,652
2030	11,754	5,084	0.036	16,330	0.502	1,423	34,591	0	0	0	34,591
2031	12,165	5,140	0.037	16,783	0.513	1,454	35,542	0	0	0	35,542
2032	12,590	5,197	0.038	17,237	0.524	1,486	36,510	0	0	0	36,510
2033	13,032	5,226	0.040	18,144	0.535	1,517	37,919	0	0	0	37,919
2034	13,489	5,282	0.041	18,598	0.546	1,548	38,917	0	0	0	38,917
2035	13,960	5,339	0.043	19,505	0.558	1,582	40,386	0	0	0	40,386
2036	14,450	5,396	0.044	19,958	0.570	1,616	41,420	0	0	0	41,420
2037	14,955	5,453	0.046	20,866	0.583	1,653	42,927	0	0	0	42,927
2038	10,565	3,764	0.047	14,551	0.595	1,151	30,031	0	0	0	30,031
2039	5,594	1,940	0.049	7,762	0.608	602	15,898	0	0	0	15,898
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$671,018			$223,908	$447,110
						NPV =	$500,147			$217,932	$282,215

Total NPV = $282,215
Benefit/Cost Ratio = 2.29

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

Table 4
Participant Test

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

	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)
2018	$60,000	900	$6.563	$5,907	$0.140	$20,160	$86,067	$66,600	$19,467
2019	63,000	1,845	6.793	12,533	0.145	42,804	118,337	69,930	48,407
2020	66,000	2,835	7.030	19,930	0.150	68,040	153,970	73,260	80,710
2021	0	2,835	7.276	20,627	0.155	70,308	90,935	0	90,935
2022	0	2,835	7.531	21,350	0.161	73,030	94,380	0	94,380
2023	0	2,835	7.795	22,099	0.167	75,751	97,850	0	97,850
2024	0	2,835	8.068	22,873	0.172	78,019	100,892	0	100,892
2025	0	2,835	8.350	23,672	0.178	80,741	104,413	0	104,413
2026	0	2,835	8.642	24,500	0.185	83,916	108,416	0	108,416
2027	0	2,835	8.945	25,359	0.191	86,638	111,997	0	111,997
2028	0	2,835	9.258	26,246	0.198	89,813	116,059	0	116,059
2029	0	2,835	9.582	27,165	0.205	92,988	120,153	0	120,153
2030	0	2,835	9.917	28,115	0.212	96,163	124,278	0	124,278
2031	0	2,835	10.264	29,098	0.219	99,338	128,436	0	128,436
2032	0	2,835	10.623	30,116	0.227	102,967	133,083	0	133,083
2033	0	2,835	10.995	31,171	0.235	106,596	137,767	0	137,767
2034	0	2,835	11.380	32,262	0.243	110,225	142,487	0	142,487
2035	0	2,835	11.778	33,391	0.252	114,307	147,698	0	147,698
2036	0	2,835	12.191	34,561	0.260	117,936	152,497	0	152,497
2037	0	2,835	12.617	35,769	0.270	122,472	158,241	0	158,241
2038	0	1,935	13.059	25,269	0.279	86,378	111,647	0	111,647
2039	0	990	13.516	13,381	0.289	45,778	59,159	0	59,159
2040	0	0	13.989	0	0.299	0	0	0	0
Total =		56,700					$2,598,762	$209,790	$2,388,972
						NPV =	$1,115,843	$191,241	924,603

Total NPV = $924,603
Benefit/Cost Ratio = 5.83

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)
2018	$2,470	$1,431	$3,456	$7,357	$64,498	$6,600	$71,098	($63,741)
2019	5,240	2,960	7,380	15,580	67,706	6,930	74,636	(59,056)
2020	8,332	4,601	11,340	24,273	70,914	7,260	78,174	(53,901)
2021	8,624	4,658	11,794	25,076	0	0	0	25,076
2022	8,927	4,686	12,247	25,860	0	0	0	25,860
2023	9,239	4,743	12,701	26,683	0	0	0	26,683
2024	9,562	4,800	13,154	27,516	0	0	0	27,516
2025	9,897	4,828	13,608	28,333	0	0	0	28,333
2026	10,243	4,885	14,062	29,190	0	0	0	29,190
2027	10,600	4,942	14,515	30,057	0	0	0	30,057
2028	10,971	4,998	14,969	30,938	0	0	0	30,938
2029	11,357	5,027	15,876	32,260	0	0	0	32,260
2030	11,754	5,084	16,330	33,168	0	0	0	33,168
2031	12,165	5,140	16,783	34,088	0	0	0	34,088
2032	12,590	5,197	17,237	35,024	0	0	0	35,024
2033	13,032	5,226	18,144	36,402	0	0	0	36,402
2034	13,489	5,282	18,598	37,369	0	0	0	37,369
2035	13,960	5,339	19,505	38,804	0	0	0	38,804
2036	14,450	5,396	19,958	39,804	0	0	0	39,804
2037	14,955	5,453	20,866	41,274	0	0	0	41,274
2038	10,565	3,764	14,551	28,880	0	0	0	28,880
2039	5,594	1,940	7,762	15,296	0	0	0	15,296
2040	0	0	0	0	0	0	0	0
			Total =	$643,232			$223,908	$419,324
			NPV =	$311,776			$208,716	103,060

Total NPV =	$103,060
Benefit/Cost Ratio =	1.49

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: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$6.341
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.13546
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$6,522	$6,723	$6,925
16b) Incentive Costs =	87,000	90,000	93,000
16c) Total Utility Project Costs =	$93,522	$96,723	$99,925
17) Direct Participant Costs ($/Part.) =	$1,167	$1,167	$1,167
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 =	18.400	18.400	18.400
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 =	290	300	310
24) Total Annual Dk Saved =	5,336	5,520	5,704
25) Incentive/Participant =	$300	$300	$300
26) Distribution Delivery Charge			$1.744
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$393,813	1.72
Utility Cost Test	$667,609	3.47
Societal Test	$847,186	1.81
Participant Test	$1,579,779	2.65
Total Resource Cost Test	$155,742	1.16

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	2018	5,336	$2.744	$14,642	$0.000	$0	$14,642	53.4	$159	$8,491	$23,133	$1.805	$6,260	$6,522	$87,000	$99,782	($76,649)
2	2019	10,856	2.840	30,831	0.000	0	30,831	108.6	160	17,376	48,207	1.868	13,181	6,723	90,000	109,904	(61,697)
3	2020	16,560	2.939	48,670	0.000	0	48,670	165.6	162	26,827	75,497	1.934	20,818	6,925	93,000	120,743	(45,246)
4	2021	16,560	3.042	50,376	0.000	0	50,376	165.6	164	27,158	77,534	2.001	21,539	0	0	21,539	55,995
5	2022	16,560	3.149	52,147	0.000	0	52,147	165.6	165	27,324	79,471	2.071	22,292	0	0	22,292	57,179
6	2023	16,560	3.259	53,969	0.000	0	53,969	165.6	167	27,655	81,624	2.144	23,078	0	0	23,078	58,546
7	2024	16,560	3.373	55,857	0.000	0	55,857	165.6	169	27,986	83,843	2.219	23,885	0	0	23,885	59,958
8	2025	16,560	3.491	57,811	0.000	0	57,811	165.6	170	28,152	85,963	2.297	24,725	0	0	24,725	61,238
9	2026	16,560	3.613	59,831	0.000	0	59,831	165.6	172	28,483	88,314	2.377	25,586	0	0	25,586	62,728
10	2027	16,560	3.739	61,918	0.000	0	61,918	165.6	174	28,814	90,732	2.460	26,479	0	0	26,479	64,253
11	2028	16,560	3.870	64,087	0.000	0	64,087	165.6	176	29,146	93,233	2.546	27,405	0	0	27,405	65,828
12	2029	16,560	4.006	66,339	0.000	0	66,339	165.6	177	29,311	95,650	2.635	28,363	0	0	28,363	67,287
13	2030	16,560	4.146	68,658	0.000	0	68,658	165.6	179	29,642	98,300	2.728	29,364	0	0	29,364	68,936
14	2031	16,560	4.291	71,059	0.000	0	71,059	165.6	181	29,974	101,033	2.823	30,387	0	0	30,387	70,646
15	2032	16,560	4.441	73,543	0.000	0	73,543	165.6	183	30,305	103,848	2.922	31,452	0	0	31,452	72,396
16	2033	16,560	4.597	76,126	0.000	0	76,126	165.6	184	30,470	106,596	3.024	32,550	0	0	32,550	74,046
17	2034	16,560	4.758	78,792	0.000	0	78,792	165.6	186	30,802	109,594	3.130	33,691	0	0	33,691	75,903
18	2035	16,560	4.924	81,541	0.000	0	81,541	165.6	188	31,133	112,674	3.239	34,865	0	0	34,865	77,809
19	2036	16,560	5.097	84,406	0.000	0	84,406	165.6	190	31,464	115,870	3.353	36,092	0	0	36,092	79,778
20	2037	16,560	5.275	87,354	0.000	0	87,354	165.6	192	31,795	119,149	3.470	37,351	0	0	37,351	81,798
21	2038	11,224	5.460	61,283	0.000	0	61,283	112.2	194	21,767	83,050	3.592	26,206	0	0	26,206	56,844
22	2039	5,704	5.651	32,233	0.000	0	32,233	57.0	196	11,172	43,405	3.717	13,781	0	0	13,781	29,624
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	3.847	0	0	0	0	0
	Total =	331,200									$1,916,720					$859,520	$1,057,200
									NPV =		$938,271					$544,458	$393,813

Total NPV = $393,813
Benefit/Cost Ratio = 1.72

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

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)
2018	$14,642	$8,491	$23,133	$6,522	$87,000	$93,522	($70,389)
2019	30,831	17,376	48,207	6,723	90,000	96,723	(48,516)
2020	48,670	26,827	75,497	6,925	93,000	99,925	(24,428)
2021	50,376	27,158	77,534	0	0	0	77,534
2022	52,147	27,324	79,471	0	0	0	79,471
2023	53,969	27,655	81,624	0	0	0	81,624
2024	55,857	27,986	83,843	0	0	0	83,843
2025	57,811	28,152	85,963	0	0	0	85,963
2026	59,831	28,483	88,314	0	0	0	88,314
2027	61,918	28,814	90,732	0	0	0	90,732
2028	64,087	29,146	93,233	0	0	0	93,233
2029	66,339	29,311	95,650	0	0	0	95,650
2030	68,658	29,642	98,300	0	0	0	98,300
2031	71,059	29,974	101,033	0	0	0	101,033
2032	73,543	30,305	103,848	0	0	0	103,848
2033	76,126	30,470	106,596	0	0	0	106,596
2034	78,792	30,802	109,594	0	0	0	109,594
2035	81,541	31,133	112,674	0	0	0	112,674
2036	84,406	31,464	115,870	0	0	0	115,870
2037	87,354	31,795	119,149	0	0	0	119,149
2038	61,283	21,767	83,050	0	0	0	83,050
2039	32,233	11,172	43,405	0	0	0	43,405
2040	0	0	0	0	0	0	0
Total =			$1,916,720			$290,170	$1,626,550
		NPV =	$938,271			$270,662	$667,609

Total NPV = $667,609
Benefit/Cost Ratio = 3.47

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)
2018	$14,642	$8,491	$0.024	$5,011	$0.388	$2,070	$30,214	$93,522	$251,430	$344,952	($314,738)
2019	30,831	17,376	0.025	10,620	0.397	4,310	63,137	96,723	260,100	356,823	(293,686)
2020	48,670	26,827	0.025	16,200	0.405	6,707	98,404	99,925	268,770	368,695	(270,291)
2021	50,376	27,158	0.026	16,848	0.414	6,856	101,238	0	0	0	101,238
2022	52,147	27,324	0.027	17,496	0.423	7,005	103,972	0	0	0	103,972
2023	53,969	27,655	0.028	18,144	0.432	7,154	106,922	0	0	0	106,922
2024	55,857	27,986	0.029	18,792	0.441	7,303	109,938	0	0	0	109,938
2025	57,811	28,152	0.030	19,440	0.451	7,469	112,872	0	0	0	112,872
2026	59,831	28,483	0.031	20,088	0.461	7,634	116,036	0	0	0	116,036
2027	61,918	28,814	0.032	20,736	0.471	7,800	119,268	0	0	0	119,268
2028	64,087	29,146	0.033	21,384	0.481	7,965	122,582	0	0	0	122,582
2029	66,339	29,311	0.035	22,680	0.491	8,131	126,461	0	0	0	126,461
2030	68,658	29,642	0.036	23,328	0.502	8,313	129,941	0	0	0	129,941
2031	71,059	29,974	0.037	23,976	0.513	8,495	133,504	0	0	0	133,504
2032	73,543	30,305	0.038	24,624	0.524	8,677	137,149	0	0	0	137,149
2033	76,126	30,470	0.040	25,920	0.535	8,860	141,376	0	0	0	141,376
2034	78,792	30,802	0.041	26,568	0.546	9,042	145,204	0	0	0	145,204
2035	81,541	31,133	0.043	27,864	0.558	9,240	149,778	0	0	0	149,778
2036	84,406	31,464	0.044	28,512	0.570	9,439	153,821	0	0	0	153,821
2037	87,354	31,795	0.046	29,808	0.583	9,654	158,611	0	0	0	158,611
2038	61,283	21,767	0.047	20,642	0.595	6,678	110,370	0	0	0	110,370
2039	32,233	11,172	0.049	10,937	0.608	3,468	57,810	0	0	0	57,810
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$2,528,608			$1,070,470	$1,458,138
						NPV =	$1,889,348			$1,042,162	$847,186

Total NPV = $847,186
Benefit/Cost Ratio = 1.81

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

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)
2018	$87,000	5,336	$6.563	$35,020	$0.140	$29,232	$151,252	$338,430	($187,178)
2019	90,000	10,856	6.793	73,745	0.145	61,596	225,341	350,100	(124,759)
2020	93,000	16,560	7.030	116,417	0.150	97,200	306,617	361,770	(55,153)
2021	0	16,560	7.276	120,491	0.155	100,440	220,931	0	220,931
2022	0	16,560	7.531	124,713	0.161	104,328	229,041	0	229,041
2023	0	16,560	7.795	129,085	0.167	108,216	237,301	0	237,301
2024	0	16,560	8.068	133,606	0.172	111,456	245,062	0	245,062
2025	0	16,560	8.350	138,276	0.178	115,344	253,620	0	253,620
2026	0	16,560	8.642	143,112	0.185	119,880	262,992	0	262,992
2027	0	16,560	8.945	148,129	0.191	123,768	271,897	0	271,897
2028	0	16,560	9.258	153,312	0.198	128,304	281,616	0	281,616
2029	0	16,560	9.582	158,678	0.205	132,840	291,518	0	291,518
2030	0	16,560	9.917	164,226	0.212	137,376	301,602	0	301,602
2031	0	16,560	10.264	169,972	0.219	141,912	311,884	0	311,884
2032	0	16,560	10.623	175,917	0.227	147,096	323,013	0	323,013
2033	0	16,560	10.995	182,077	0.235	152,280	334,357	0	334,357
2034	0	16,560	11.380	188,453	0.243	157,464	345,917	0	345,917
2035	0	16,560	11.778	195,044	0.252	163,296	358,340	0	358,340
2036	0	16,560	12.191	201,883	0.260	168,480	370,363	0	370,363
2037	0	16,560	12.617	208,938	0.270	174,960	383,898	0	383,898
2038	0	11,224	13.059	146,574	0.279	122,537	269,111	0	269,111
2039	0	5,704	13.516	77,095	0.289	64,505	141,600	0	141,600
2040	0	0	13.989	0	0.299	0	0	0	0
Total =		331,200					$6,117,273	$1,050,300	$5,066,973
						NPV =	$2,538,057	$958,278	1,579,779

Total NPV = $1,579,779
Benefit/Cost Ratio = 2.65

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 - 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)
2018	$14,642	$8,491	$5,011	$28,144	$93,522	$251,430	$344,952	($316,808)
2019	30,831	17,376	10,620	58,827	96,723	260,100	356,823	(297,996)
2020	48,670	26,827	16,200	91,697	99,925	268,770	368,695	(276,998)
2021	50,376	27,158	16,848	94,382	0	0	0	94,382
2022	52,147	27,324	17,496	96,967	0	0	0	96,967
2023	53,969	27,655	18,144	99,768	0	0	0	99,768
2024	55,857	27,986	18,792	102,635	0	0	0	102,635
2025	57,811	28,152	19,440	105,403	0	0	0	105,403
2026	59,831	28,483	20,088	108,402	0	0	0	108,402
2027	61,918	28,814	20,736	111,468	0	0	0	111,468
2028	64,087	29,146	21,384	114,617	0	0	0	114,617
2029	66,339	29,311	22,680	118,330	0	0	0	118,330
2030	68,658	29,642	23,328	121,628	0	0	0	121,628
2031	71,059	29,974	23,976	125,009	0	0	0	125,009
2032	73,543	30,305	24,624	128,472	0	0	0	128,472
2033	76,126	30,470	25,920	132,516	0	0	0	132,516
2034	78,792	30,802	26,568	136,162	0	0	0	136,162
2035	81,541	31,133	27,864	140,538	0	0	0	140,538
2036	84,406	31,464	28,512	144,382	0	0	0	144,382
2037	87,354	31,795	29,808	148,957	0	0	0	148,957
2038	61,283	21,767	20,642	103,692	0	0	0	103,692
2039	32,233	11,172	10,937	54,342	0	0	0	54,342
2040	0	0	0	0	0	0	0	0
			Total =	$2,366,338			$1,070,470	$1,295,868
			NPV =	$1,154,238			$998,496	155,742

Total NPV =	$155,742
Benefit/Cost Ratio =	1.16

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: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$6.341
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.13546
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$124	$112	$101
16b) Incentive Costs =	1,650	1,500	1,350
16c) Total Utility Project Costs =	$1,774	$1,612	$1,451
17) Direct Participant Costs ($/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 =	2.500	2.500	2.500
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 =	110	100	90
24) Total Annual Dk Saved =	275	250	225
25) Incentive/Participant =	$15	$15	$15
26) Distribution Delivery Charge			$1.744
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$14,015	2.18
Utility Cost Test	$21,320	5.70
Societal Test	$26,154	3.87
Participant Test	$32,304	4.90
Total Resource Cost Test	$17,097	2.95

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	2018	275	$2.744	$755	$0.000	$0	$755	2.8	$159	$445	$1,200	$1.805	$323	$124	$1,650	$2,097	($897)
2	2019	525	2.840	1,491	0.000	0	1,491	5.3	160	848	2,339	1.868	637	112	1,500	2,249	90
3	2020	750	2.939	2,204	0.000	0	2,204	7.5	162	1,215	3,419	1.934	943	101	1,350	2,394	1,025
4	2021	750	3.042	2,282	0.000	0	2,282	7.5	164	1,230	3,512	2.001	975	0	0	975	2,537
5	2022	750	3.149	2,362	0.000	0	2,362	7.5	165	1,238	3,600	2.071	1,010	0	0	1,010	2,590
6	2023	750	3.259	2,444	0.000	0	2,444	7.5	167	1,253	3,697	2.144	1,045	0	0	1,045	2,652
7	2024	750	3.373	2,530	0.000	0	2,530	7.5	169	1,268	3,798	2.219	1,082	0	0	1,082	2,716
8	2025	750	3.491	2,618	0.000	0	2,618	7.5	170	1,275	3,893	2.297	1,120	0	0	1,120	2,773
9	2026	750	3.613	2,710	0.000	0	2,710	7.5	172	1,290	4,000	2.377	1,159	0	0	1,159	2,841
10	2027	750	3.739	2,804	0.000	0	2,804	7.5	174	1,305	4,109	2.460	1,199	0	0	1,199	2,910
11	2028	475	3.870	1,838	0.000	0	1,838	4.8	176	845	2,683	2.546	786	0	0	786	1,897
12	2029	225	4.006	901	0.000	0	901	2.3	177	407	1,308	2.635	385	0	0	385	923
13	2030	0	4.146	0	0.000	0	0	0.0	179	0	0	2.728	0	0	0	0	0
14	2031	0	4.291	0	0.000	0	0	0.0	181	0	0	2.823	0	0	0	0	0
15	2032	0	4.441	0	0.000	0	0	0.0	183	0	0	2.922	0	0	0	0	0
16	2033	0	4.597	0	0.000	0	0	0.0	184	0	0	3.024	0	0	0	0	0
17	2034	0	4.758	0	0.000	0	0	0.0	186	0	0	3.130	0	0	0	0	0
18	2035	0	4.924	0	0.000	0	0	0.0	188	0	0	3.239	0	0	0	0	0
19	2036	0	5.097	0	0.000	0	0	0.0	190	0	0	3.353	0	0	0	0	0
20	2037	0	5.275	0	0.000	0	0	0.0	192	0	0	3.470	0	0	0	0	0
21	2038	0	5.460	0	0.000	0	0	0.0	194	0	0	3.592	0	0	0	0	0
22	2039	0	5.651	0	0.000	0	0	0.0	196	0	0	3.717	0	0	0	0	0
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	3.847	0	0	0	0	0
	Total =	7,500									$37,558					$15,501	$22,057
									NPV =		$25,860					$11,845	$14,015

Total NPV = $14,015
Benefit/Cost Ratio = 2.18

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)
2018	$755	$445	$1,200	$124	$1,650	$1,774	($574)
2019	1,491	848	2,339	112	1,500	1,612	727
2020	2,204	1,215	3,419	101	1,350	1,451	1,968
2021	2,282	1,230	3,512	0	0	0	3,512
2022	2,362	1,238	3,600	0	0	0	3,600
2023	2,444	1,253	3,697	0	0	0	3,697
2024	2,530	1,268	3,798	0	0	0	3,798
2025	2,618	1,275	3,893	0	0	0	3,893
2026	2,710	1,290	4,000	0	0	0	4,000
2027	2,804	1,305	4,109	0	0	0	4,109
2028	1,838	845	2,683	0	0	0	2,683
2029	901	407	1,308	0	0	0	1,308
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0
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
Total =			$37,558			$4,837	$32,721
		NPV =	$25,860			$4,540	$21,320

Total NPV = $21,320
Benefit/Cost Ratio = 5.70

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)
2018	$755	$445	$0.024	$0	$0.388	$107	$1,307	$1,774	$1,650	$3,424	($2,117)
2019	1,491	848	0.025	0	0.397	208	2,547	1,612	1,500	3,112	(565)
2020	2,204	1,215	0.025	0	0.405	304	3,723	1,451	1,350	2,801	922
2021	2,282	1,230	0.026	0	0.414	311	3,823	0	0	0	3,823
2022	2,362	1,238	0.027	0	0.423	317	3,917	0	0	0	3,917
2023	2,444	1,253	0.028	0	0.432	324	4,021	0	0	0	4,021
2024	2,530	1,268	0.029	0	0.441	331	4,129	0	0	0	4,129
2025	2,618	1,275	0.030	0	0.451	338	4,231	0	0	0	4,231
2026	2,710	1,290	0.031	0	0.461	346	4,346	0	0	0	4,346
2027	2,804	1,305	0.032	0	0.471	353	4,462	0	0	0	4,462
2028	1,838	845	0.033	0	0.481	228	2,911	0	0	0	2,911
2029	901	407	0.035	0	0.491	110	1,418	0	0	0	1,418
2030	0	0	0.036	0	0.502	0	0	0	0	0	0
2031	0	0	0.037	0	0.513	0	0	0	0	0	0
2032	0	0	0.038	0	0.524	0	0	0	0	0	0
2033	0	0	0.040	0	0.535	0	0	0	0	0	0
2034	0	0	0.041	0	0.546	0	0	0	0	0	0
2035	0	0	0.043	0	0.558	0	0	0	0	0	0
2036	0	0	0.044	0	0.570	0	0	0	0	0	0
2037	0	0	0.046	0	0.583	0	0	0	0	0	0
2038	0	0	0.047	0	0.595	0	0	0	0	0	0
2039	0	0	0.049	0	0.608	0	0	0	0	0	0
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$40,835			$9,337	$31,498
						NPV =	$35,265			$9,111	$26,154

Total NPV = $26,154
Benefit/Cost Ratio = 3.87

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

Table 4
Participant Test

Company: **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - 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)
2018	$1,650	275	$6.563	$1,805	$0.140	$0	$3,455	$3,300	$155
2019	1,500	525	6.793	3,566	0.145	0	5,066	3,000	2,066
2020	1,350	750	7.030	5,273	0.150	0	6,623	2,700	3,923
2021	0	750	7.276	5,457	0.155	0	5,457	0	5,457
2022	0	750	7.531	5,648	0.161	0	5,648	0	5,648
2023	0	750	7.795	5,846	0.167	0	5,846	0	5,846
2024	0	750	8.068	6,051	0.172	0	6,051	0	6,051
2025	0	750	8.350	6,263	0.178	0	6,263	0	6,263
2026	0	750	8.642	6,482	0.185	0	6,482	0	6,482
2027	0	750	8.945	6,709	0.191	0	6,709	0	6,709
2028	0	475	9.258	4,398	0.198	0	4,398	0	4,398
2029	0	225	9.582	2,156	0.205	0	2,156	0	2,156
2030	0	0	9.917	0	0.212	0	0	0	0
2031	0	0	10.264	0	0.219	0	0	0	0
2032	0	0	10.623	0	0.227	0	0	0	0
2033	0	0	10.995	0	0.235	0	0	0	0
2034	0	0	11.380	0	0.243	0	0	0	0
2035	0	0	11.778	0	0.252	0	0	0	0
2036	0	0	12.191	0	0.260	0	0	0	0
2037	0	0	12.617	0	0.270	0	0	0	0
2038	0	0	13.059	0	0.279	0	0	0	0
2039	0	0	13.516	0	0.289	0	0	0	0
2040	0	0	13.989	0	0.299	0	0	0	0
Total =		7,500					$64,154	$9,000	$55,154
						NPV =	$40,583	$8,279	32,304

Total NPV = $32,304
Benefit/Cost Ratio = 4.90

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 **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)
2018	$755	$445	$0	$1,200	$1,774	$1,650	$3,424	($2,224)
2019	1,491	848	0	2,339	1,612	1,500	3,112	(773)
2020	2,204	1,215	0	3,419	1,451	1,350	2,801	618
2021	2,282	1,230	0	3,512	0	0	0	3,512
2022	2,362	1,238	0	3,600	0	0	0	3,600
2023	2,444	1,253	0	3,697	0	0	0	3,697
2024	2,530	1,268	0	3,798	0	0	0	3,798
2025	2,618	1,275	0	3,893	0	0	0	3,893
2026	2,710	1,290	0	4,000	0	0	0	4,000
2027	2,804	1,305	0	4,109	0	0	0	4,109
2028	1,838	845	0	2,683	0	0	0	2,683
2029	901	407	0	1,308	0	0	0	1,308
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
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
			Total =	$37,558			$9,337	$28,221
			NPV =	$25,860			$8,763	17,097

Total NPV = $17,097
Benefit/Cost Ratio = 2.95

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: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$6.341
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.13546
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$495	$583	$670
16b) Incentive Costs =	6,600	7,800	9,000
16c) Total Utility Project Costs =	$7,095	$8,383	$9,670
17) Direct Participant Costs ($/Part.) =	$110	$110	$110
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 =	3.700	3.700	3.700
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 =	110	130	150
24) Total Annual Dk Saved =	407	481	555
25) Incentive/Participant =	$60	$60	$60
26) Distribution Delivery Charge			$1.744
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$12,034	1.32
Utility Cost Test	$26,005	2.11
Societal Test	$28,339	1.65
Participant Test	$68,197	2.76
Total Resource Cost Test	$11,031	1.27

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	2018	407	$2.744	$1,117	$0.000	$0	$1,117	4.1	$159	$652	$1,769	$1.805	$478	$495	$6,600	$7,573	($5,804)
2	2019	888	2.840	2,522	0.000	0	2,522	8.9	160	1,424	3,946	1.868	1,078	583	7,800	9,461	(5,515)
3	2020	1,443	2.939	4,241	0.000	0	4,241	14.4	162	2,333	6,574	1.934	1,814	670	9,000	11,484	(4,910)
4	2021	1,443	3.042	4,390	0.000	0	4,390	14.4	164	2,362	6,752	2.001	1,877	0	0	1,877	4,875
5	2022	1,443	3.149	4,544	0.000	0	4,544	14.4	165	2,376	6,920	2.071	1,942	0	0	1,942	4,978
6	2023	1,443	3.259	4,703	0.000	0	4,703	14.4	167	2,405	7,108	2.144	2,011	0	0	2,011	5,097
7	2024	1,443	3.373	4,867	0.000	0	4,867	14.4	169	2,434	7,301	2.219	2,081	0	0	2,081	5,220
8	2025	1,443	3.491	5,038	0.000	0	5,038	14.4	170	2,448	7,486	2.297	2,154	0	0	2,154	5,332
9	2026	1,443	3.613	5,214	0.000	0	5,214	14.4	172	2,477	7,691	2.377	2,230	0	0	2,230	5,461
10	2027	1,443	3.739	5,395	0.000	0	5,395	14.4	174	2,506	7,901	2.460	2,307	0	0	2,307	5,594
11	2028	1,036	3.870	4,009	0.000	0	4,009	10.4	176	1,830	5,839	2.546	1,714	0	0	1,714	4,125
12	2029	555	4.006	2,223	0.000	0	2,223	5.6	177	991	3,214	2.635	951	0	0	951	2,263
13	2030	0	4.146	0	0.000	0	0	0.0	179	0	0	2.728	0	0	0	0	0
14	2031	0	4.291	0	0.000	0	0	0.0	181	0	0	2.823	0	0	0	0	0
15	2032	0	4.441	0	0.000	0	0	0.0	183	0	0	2.922	0	0	0	0	0
16	2033	0	4.597	0	0.000	0	0	0.0	184	0	0	3.024	0	0	0	0	0
17	2034	0	4.758	0	0.000	0	0	0.0	186	0	0	3.130	0	0	0	0	0
18	2035	0	4.924	0	0.000	0	0	0.0	188	0	0	3.239	0	0	0	0	0
19	2036	0	5.097	0	0.000	0	0	0.0	190	0	0	3.353	0	0	0	0	0
20	2037	0	5.275	0	0.000	0	0	0.0	192	0	0	3.470	0	0	0	0	0
21	2038	0	5.460	0	0.000	0	0	0.0	194	0	0	3.592	0	0	0	0	0
22	2039	0	5.651	0	0.000	0	0	0.0	196	0	0	3.717	0	0	0	0	0
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	3.847	0	0	0	0	0
	Total =	14,430									$72,501					$45,785	$26,716
									NPV =		$49,331					$37,297	$12,034

Total NPV = $12,034
Benefit/Cost Ratio = 1.32

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)
2018	$1,117	$652	$1,769	$495	$6,600	$7,095	($5,326)
2019	2,522	1,424	3,946	583	7,800	8,383	(4,437)
2020	4,241	2,333	6,574	670	9,000	9,670	(3,096)
2021	4,390	2,362	6,752	0	0	0	6,752
2022	4,544	2,376	6,920	0	0	0	6,920
2023	4,703	2,405	7,108	0	0	0	7,108
2024	4,867	2,434	7,301	0	0	0	7,301
2025	5,038	2,448	7,486	0	0	0	7,486
2026	5,214	2,477	7,691	0	0	0	7,691
2027	5,395	2,506	7,901	0	0	0	7,901
2028	4,009	1,830	5,839	0	0	0	5,839
2029	2,223	991	3,214	0	0	0	3,214
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0
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
Total =			$72,501			$25,148	$47,353
		NPV =	$49,331			$23,326	$26,005

Total NPV =	$26,005
Benefit/Cost Ratio =	2.11

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)
2018	$1,117	$652	$0.024	$108	$0.388	$158	$2,035	$7,095	$5,500	$12,595	($10,560)
2019	2,522	1,424	0.025	246	0.397	353	4,545	8,383	6,500	14,883	(10,338)
2020	4,241	2,333	0.025	400	0.405	584	7,558	9,670	7,500	17,170	(9,612)
2021	4,390	2,362	0.026	416	0.414	597	7,765	0	0	0	7,765
2022	4,544	2,376	0.027	432	0.423	610	7,962	0	0	0	7,962
2023	4,703	2,405	0.028	448	0.432	623	8,179	0	0	0	8,179
2024	4,867	2,434	0.029	464	0.441	636	8,401	0	0	0	8,401
2025	5,038	2,448	0.030	480	0.451	651	8,617	0	0	0	8,617
2026	5,214	2,477	0.031	496	0.461	665	8,852	0	0	0	8,852
2027	5,395	2,506	0.032	512	0.471	680	9,093	0	0	0	9,093
2028	4,009	1,830	0.033	379	0.481	498	6,716	0	0	0	6,716
2029	2,223	991	0.035	215	0.491	273	3,702	0	0	0	3,702
2030	0	0	0.036	0	0.502	0	0	0	0	0	0
2031	0	0	0.037	0	0.513	0	0	0	0	0	0
2032	0	0	0.038	0	0.524	0	0	0	0	0	0
2033	0	0	0.040	0	0.535	0	0	0	0	0	0
2034	0	0	0.041	0	0.546	0	0	0	0	0	0
2035	0	0	0.043	0	0.558	0	0	0	0	0	0
2036	0	0	0.044	0	0.570	0	0	0	0	0	0
2037	0	0	0.046	0	0.583	0	0	0	0	0	0
2038	0	0	0.047	0	0.595	0	0	0	0	0	0
2039	0	0	0.049	0	0.608	0	0	0	0	0	0
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$83,425			$44,648	$38,777
						NPV =	$71,714			$43,375	$28,339

Total NPV = $28,339
Benefit/Cost Ratio = 1.65

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

Table 4
Participant Test

Company: **Montana-Dakota Utilities Co.**
Project: **Programmable Thermostats - 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)
2018	$6,600	407	$6.563	$2,671	$0.140	$631	$9,902	$12,100	($2,198)
2019	7,800	888	6.793	6,032	0.145	1,427	15,259	14,300	959
2020	9,000	1,443	7.030	10,144	0.150	2,399	21,543	16,500	5,043
2021	0	1,443	7.276	10,499	0.155	2,478	12,977	0	12,977
2022	0	1,443	7.531	10,867	0.161	2,574	13,441	0	13,441
2023	0	1,443	7.795	11,248	0.167	2,670	13,918	0	13,918
2024	0	1,443	8.068	11,642	0.172	2,750	14,392	0	14,392
2025	0	1,443	8.350	12,049	0.178	2,846	14,895	0	14,895
2026	0	1,443	8.642	12,470	0.185	2,958	15,428	0	15,428
2027	0	1,443	8.945	12,908	0.191	3,054	15,962	0	15,962
2028	0	1,036	9.258	9,591	0.198	2,273	11,864	0	11,864
2029	0	555	9.582	5,318	0.205	1,261	6,579	0	6,579
2030	0	0	9.917	0	0.212	0	0	0	0
2031	0	0	10.264	0	0.219	0	0	0	0
2032	0	0	10.623	0	0.227	0	0	0	0
2033	0	0	10.995	0	0.235	0	0	0	0
2034	0	0	11.380	0	0.243	0	0	0	0
2035	0	0	11.778	0	0.252	0	0	0	0
2036	0	0	12.191	0	0.260	0	0	0	0
2037	0	0	12.617	0	0.270	0	0	0	0
2038	0	0	13.059	0	0.279	0	0	0	0
2039	0	0	13.516	0	0.289	0	0	0	0
2040	0	0	13.989	0	0.299	0	0	0	0
Total =		14,430					$166,160	$42,900	$123,260
						NPV =	$107,047	$38,850	68,197

Total NPV = $68,197
Benefit/Cost Ratio = 2.76

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

Compa **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)
2018	$1,117	$652	$108	$1,877	$7,095	$5,500	$12,595	($10,718)
2019	2,522	1,424	246	4,192	8,383	6,500	14,883	(10,691)
2020	4,241	2,333	400	6,974	9,670	7,500	17,170	(10,196)
2021	4,390	2,362	416	7,168	0	0	0	7,168
2022	4,544	2,376	432	7,352	0	0	0	7,352
2023	4,703	2,405	448	7,556	0	0	0	7,556
2024	4,867	2,434	464	7,765	0	0	0	7,765
2025	5,038	2,448	480	7,966	0	0	0	7,966
2026	5,214	2,477	496	8,187	0	0	0	8,187
2027	5,395	2,506	512	8,413	0	0	0	8,413
2028	4,009	1,830	379	6,218	0	0	0	6,218
2029	2,223	991	215	3,429	0	0	0	3,429
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
2033	0	0	0	0	0	0	0	0
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
			Total =	$77,097			$44,648	$32,449
			NPV =	$52,443			$41,413	11,031

Total NPV =	$11,031
Benefit/Cost Ratio =	1.27

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 Energy Assessments**
Program Years: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$6.341
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.13546
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$1,687	$1,681	$1,675
16b) Incentive Costs =	22,500	22,500	22,500
16c) Total Utility Project Costs =	$24,187	$24,181	$24,175
17) Direct Participant Costs ($/Part.) =	$500	$500	$500
18) Participant Non-Energy Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
19) Participant Non-Energy Savings (Annual $/Part) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	1.40%
20) Project Life (Years) =	0	0	0
21) Avg. Dk/Part. Saved =	0.000	0.000	0.000
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 =	50	50	50
24) Total Annual Dk Saved =	0	0	0
25) Incentive/Participant =	$450	$450	$450
26) Distribution Delivery Charge			$1.744
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($67,771)	0.00
Utility Cost Test	($67,771)	0.00
Societal Test	($77,972)	0.00
Participant Test	($6,857)	0.90
Total Resource Cost Test	($74,777)	0.00

Table 1
Ratepayer Impact Measure Test

Company: **Montana-Dakota Utilities Co.**
Project: **Residential Energy Assessments**

			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	2018	0	$2.744	$0	$0.000	$0	$0	0.0	$159	$0	$0	$0.655	$0	$1,687	$22,500	$24,187	($24,187)
2	2019	0	2.840	0	0.000	0	0	0.0	160	0	0	0.678	0	1,681	22,500	24,181	(24,181)
3	2020	0	2.939	0	0.000	0	0	0.0	162	0	0	0.702	0	1,675	22,500	24,175	(24,175)
4	2021	0	3.042	0	0.000	0	0	0.0	164	0	0	0.726	0	0	0	0	0
5	2022	0	3.149	0	0.000	0	0	0.0	165	0	0	0.752	0	0	0	0	0
6	2023	0	3.259	0	0.000	0	0	0.0	167	0	0	0.778	0	0	0	0	0
7	2024	0	3.373	0	0.000	0	0	0.0	169	0	0	0.805	0	0	0	0	0
8	2025	0	3.491	0	0.000	0	0	0.0	170	0	0	0.834	0	0	0	0	0
9	2026	0	3.613	0	0.000	0	0	0.0	172	0	0	0.863	0	0	0	0	0
10	2027	0	3.739	0	0.000	0	0	0.0	174	0	0	0.893	0	0	0	0	0
11	2028	0	3.870	0	0.000	0	0	0.0	176	0	0	0.924	0	0	0	0	0
12	2029	0	4.006	0	0.000	0	0	0.0	177	0	0	0.957	0	0	0	0	0
13	2030	0	4.146	0	0.000	0	0	0.0	179	0	0	0.990	0	0	0	0	0
14	2031	0	4.291	0	0.000	0	0	0.0	181	0	0	1.025	0	0	0	0	0
15	2032	0	4.441	0	0.000	0	0	0.0	183	0	0	1.060	0	0	0	0	0
16	2033	0	4.597	0	0.000	0	0	0.0	184	0	0	1.098	0	0	0	0	0
17	2034	0	4.758	0	0.000	0	0	0.0	186	0	0	1.136	0	0	0	0	0
18	2035	0	4.924	0	0.000	0	0	0.0	188	0	0	1.176	0	0	0	0	0
19	2036	0	5.097	0	0.000	0	0	0.0	190	0	0	1.217	0	0	0	0	0
20	2037	0	5.275	0	0.000	0	0	0.0	192	0	0	1.260	0	0	0	0	0
21	2038	0	5.460	0	0.000	0	0	0.0	194	0	0	1.304	0	0	0	0	0
22	2039	0	5.651	0	0.000	0	0	0.0	196	0	0	1.349	0	0	0	0	0
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	1.396	0	0	0	0	0
Total =		0									$0					$72,543	($72,543)
									NPV =		$0					$67,771	($67,771)

Total NPV = ($67,771)
Benefit/Cost Ratio = 0.00

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 Energy Assessments**

	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)
2018	$0	$0	$0	$1,687	$22,500	$24,187	($24,187)
2019	0	0	0	1,681	22,500	24,181	(24,181)
2020	0	0	0	1,675	22,500	24,175	(24,175)
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0
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
Total =			$0			$72,543	($72,543)
		NPV =	$0			$67,771	($67,771)

Total NPV = ($67,771)
Benefit/Cost Ratio = 0.00

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 Energy Assessments**

	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)
2018	$0	$0	$0.024	$0	$0.388	$0	$0	$24,187	$2,500	$26,687	($26,687)
2019	0	0	0.025	0	0.397	0	0	24,181	2,500	26,681	(26,681)
2020	0	0	0.025	0	0.405	0	0	24,175	2,500	26,675	(26,675)
2021	0	0	0.026	0	0.414	0	0	0	0	0	0
2022	0	0	0.027	0	0.423	0	0	0	0	0	0
2023	0	0	0.028	0	0.432	0	0	0	0	0	0
2024	0	0	0.029	0	0.441	0	0	0	0	0	0
2025	0	0	0.030	0	0.451	0	0	0	0	0	0
2026	0	0	0.031	0	0.461	0	0	0	0	0	0
2027	0	0	0.032	0	0.471	0	0	0	0	0	0
2028	0	0	0.033	0	0.481	0	0	0	0	0	0
2029	0	0	0.035	0	0.491	0	0	0	0	0	0
2030	0	0	0.036	0	0.502	0	0	0	0	0	0
2031	0	0	0.037	0	0.513	0	0	0	0	0	0
2032	0	0	0.038	0	0.524	0	0	0	0	0	0
2033	0	0	0.040	0	0.535	0	0	0	0	0	0
2034	0	0	0.041	0	0.546	0	0	0	0	0	0
2035	0	0	0.043	0	0.558	0	0	0	0	0	0
2036	0	0	0.044	0	0.570	0	0	0	0	0	0
2037	0	0	0.046	0	0.583	0	0	0	0	0	0
2038	0	0	0.047	0	0.595	0	0	0	0	0	0
2039	0	0	0.049	0	0.608	0	0	0	0	0	0
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$0			$80,043	($80,043)
						NPV =	$0			$77,972	($77,972)

Total NPV = ($77,972)
Benefit/Cost Ratio = 0.00

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 Energy Assessments**

	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)
2018	$22,500	0	$6.563	$0	$0.140	$0	$22,500	$25,000	($2,500)
2019	22,500	0	6.793	0	0.145	0	22,500	25,000	(2,500)
2020	22,500	0	7.030	0	0.150	0	22,500	25,000	(2,500)
2021	0	0	7.276	0	0.155	0	0	0	0
2022	0	0	7.531	0	0.161	0	0	0	0
2023	0	0	7.795	0	0.167	0	0	0	0
2024	0	0	8.068	0	0.172	0	0	0	0
2025	0	0	8.350	0	0.178	0	0	0	0
2026	0	0	8.642	0	0.185	0	0	0	0
2027	0	0	8.945	0	0.191	0	0	0	0
2028	0	0	9.258	0	0.198	0	0	0	0
2029	0	0	9.582	0	0.205	0	0	0	0
2030	0	0	9.917	0	0.212	0	0	0	0
2031	0	0	10.264	0	0.219	0	0	0	0
2032	0	0	10.623	0	0.227	0	0	0	0
2033	0	0	10.995	0	0.235	0	0	0	0
2034	0	0	11.380	0	0.243	0	0	0	0
2035	0	0	11.778	0	0.252	0	0	0	0
2036	0	0	12.191	0	0.260	0	0	0	0
2037	0	0	12.617	0	0.270	0	0	0	0
2038	0	0	13.059	0	0.279	0	0	0	0
2039	0	0	13.516	0	0.289	0	0	0	0
2040	0	0	13.989	0	0.299	0	0	0	0
Total =		0					$67,500	$75,000	($7,500)
						NPV =	$61,713	$68,570	(6,857)

Total NPV = ($6,857)
Benefit/Cost Ratio = 0.90

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 Energy Assessments**

	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)
2018	$0	$0	$0	$0	$24,187	$2,500	$26,687	($26,687)
2019	0	0	0	0	24,181	2,500	26,681	(26,681)
2020	0	0	0	0	24,175	2,500	26,675	(26,675)
2021	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0
2031	0	0	0	0	0	0	0	0
2032	0	0	0	0	0	0	0	0
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
			Total =	$0			$80,043	($80,043)
			NPV =	$0			$74,777	(74,777)

Total NPV = ($74,777)
Benefit/Cost Ratio = 0.00

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: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$5.430
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12698
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$112	$112	$112
16b) Incentive Costs =	1,500	1,500	1,500
16c) Total Utility Project Costs =	$1,612	$1,612	$1,612
17) Direct Participant Costs ($/Part.) =	$333	$333	$333
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 =	4.500	4.500	4.500
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 =	5	5	5
24) Total Annual Dk Saved =	23	23	23
25) Incentive/Participant =	$300	$300	$300
26) Distribution Delivery Charge			$1.302
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($1,465)	0.73
Utility Cost Test	($625)	0.86
Societal Test	$6,812	2.31
Participant Test	$20,276	5.44
Total Resource Cost Test	$2,515	1.51

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	2018	23	$2.744	$63	$0.000	$0	$63	0.2	$159	$32	$95	$1.348	$20	$112	$1,500	$1,632	($1,537)
2	2019	45	2.840	128	0.000	0	128	0.5	160	80	208	1.395	41	112	1,500	1,653	(1,445)
3	2020	68	2.939	200	0.000	0	200	0.7	162	113	313	1.444	64	112	1,500	1,676	(1,363)
4	2021	68	3.042	207	0.000	0	207	0.7	164	115	322	1.494	66	0	0	66	256
5	2022	68	3.149	214	0.000	0	214	0.7	165	116	330	1.546	68	0	0	68	262
6	2023	68	3.259	222	0.000	0	222	0.7	167	117	339	1.600	71	0	0	71	268
7	2024	68	3.373	229	0.000	0	229	0.7	169	118	347	1.657	73	0	0	73	274
8	2025	68	3.491	237	0.000	0	237	0.7	170	119	356	1.714	76	0	0	76	280
9	2026	68	3.613	246	0.000	0	246	0.7	172	120	366	1.774	78	0	0	78	288
10	2027	68	3.739	254	0.000	0	254	0.7	174	122	376	1.837	81	0	0	81	295
11	2028	68	3.870	263	0.000	0	263	0.7	176	123	386	1.901	84	0	0	84	302
12	2029	68	4.006	272	0.000	0	272	0.7	177	124	396	1.967	87	0	0	87	309
13	2030	68	4.146	282	0.000	0	282	0.7	179	125	407	2.036	90	0	0	90	317
14	2031	68	4.291	292	0.000	0	292	0.7	181	127	419	2.108	93	0	0	93	326
15	2032	68	4.441	302	0.000	0	302	0.7	183	128	430	2.181	96	0	0	96	334
16	2033	68	4.597	313	0.000	0	313	0.7	184	129	442	2.258	100	0	0	100	342
17	2034	68	4.758	324	0.000	0	324	0.7	186	130	454	2.337	103	0	0	103	351
18	2035	68	4.924	335	0.000	0	335	0.7	188	132	467	2.418	107	0	0	107	360
19	2036	68	5.097	347	0.000	0	347	0.7	190	133	480	2.503	111	0	0	111	369
20	2037	68	5.275	359	0.000	0	359	0.7	192	134	493	2.591	115	0	0	115	378
21	2038	45	5.460	246	0.000	0	246	0.5	194	97	343	2.681	78	0	0	78	265
22	2039	23	5.651	130	0.000	0	130	0.2	196	39	169	2.775	41	0	0	41	128
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	2.872	0	0	0	0	0
	Total =	1,360									$7,938					$6,579	$1,359
									NPV =		$3,893					$5,357	($1,465)

Total NPV = ($1,465)
Benefit/Cost Ratio = 0.73

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

Table 2
Utility Cost Test

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial 95+% AFUE Furnace - 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)
2018	$63	$32	$95	$112	$1,500	$1,612	($1,517)
2019	128	80	208	112	1,500	1,612	(1,404)
2020	200	113	313	112	1,500	1,612	(1,299)
2021	207	115	322	0	0	0	322
2022	214	116	330	0	0	0	330
2023	222	117	339	0	0	0	339
2024	229	118	347	0	0	0	347
2025	237	119	356	0	0	0	356
2026	246	120	366	0	0	0	366
2027	254	122	376	0	0	0	376
2028	263	123	386	0	0	0	386
2029	272	124	396	0	0	0	396
2030	282	125	407	0	0	0	407
2031	292	127	419	0	0	0	419
2032	302	128	430	0	0	0	430
2033	313	129	442	0	0	0	442
2034	324	130	454	0	0	0	454
2035	335	132	467	0	0	0	467
2036	347	133	480	0	0	0	480
2037	359	134	493	0	0	0	493
2038	246	97	343	0	0	0	343
2039	130	39	169	0	0	0	169
2040	0	0	0	0	0	0	0
Total =			$7,938			$4,836	$3,102
		NPV =	$3,893			$4,518	($625)

Total NPV =	($625)
Benefit/Cost Ratio =	0.86

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)
2018	$63	$32	$0.024	$86	$0.388	$9	$190	$1,612	$165	$1,777	($1,587)
2019	128	80	0.025	180	0.397	18	406	1,612	165	1,777	(1,371)
2020	200	113	0.025	270	0.405	28	611	1,612	165	1,777	(1,166)
2021	207	115	0.026	281	0.414	28	631	0	0	0	631
2022	214	116	0.027	292	0.423	29	651	0	0	0	651
2023	222	117	0.028	302	0.432	29	670	0	0	0	670
2024	229	118	0.029	313	0.441	30	690	0	0	0	690
2025	237	119	0.030	324	0.451	31	711	0	0	0	711
2026	246	120	0.031	335	0.461	31	732	0	0	0	732
2027	254	122	0.032	346	0.471	32	754	0	0	0	754
2028	263	123	0.033	356	0.481	33	775	0	0	0	775
2029	272	124	0.035	378	0.491	33	807	0	0	0	807
2030	282	125	0.036	389	0.502	34	830	0	0	0	830
2031	292	127	0.037	400	0.513	35	854	0	0	0	854
2032	302	128	0.038	410	0.524	36	876	0	0	0	876
2033	313	129	0.040	432	0.535	36	910	0	0	0	910
2034	324	130	0.041	443	0.546	37	934	0	0	0	934
2035	335	132	0.043	464	0.558	38	969	0	0	0	969
2036	347	133	0.044	475	0.570	39	994	0	0	0	994
2037	359	134	0.046	497	0.583	40	1,030	0	0	0	1,030
2038	246	97	0.047	338	0.595	27	708	0	0	0	708
2039	130	39	0.049	176	0.608	14	359	0	0	0	359
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$16,092			$5,331	$10,761
						NPV =	$12,005			$5,193	$6,812

Total NPV = $6,812
Benefit/Cost Ratio = 2.31

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: **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)
2018	$1,500	23	$5.620	$129	$0.131	$472	$2,101	$1,665	$436
2019	1,500	45	5.817	262	0.136	979	2,741	1,665	1,076
2020	1,500	68	6.020	409	0.141	1,523	3,432	1,665	1,767
2021	0	68	6.231	424	0.146	1,577	2,001	0	2,001
2022	0	68	6.449	439	0.151	1,631	2,070	0	2,070
2023	0	68	6.675	454	0.156	1,685	2,139	0	2,139
2024	0	68	6.908	470	0.162	1,750	2,220	0	2,220
2025	0	68	7.150	486	0.167	1,804	2,290	0	2,290
2026	0	68	7.401	503	0.173	1,868	2,371	0	2,371
2027	0	68	7.660	521	0.179	1,933	2,454	0	2,454
2028	0	68	7.928	539	0.185	1,998	2,537	0	2,537
2029	0	68	8.205	558	0.192	2,074	2,632	0	2,632
2030	0	68	8.492	577	0.199	2,149	2,726	0	2,726
2031	0	68	8.790	598	0.206	2,225	2,823	0	2,823
2032	0	68	9.097	619	0.213	2,300	2,919	0	2,919
2033	0	68	9.416	640	0.220	2,376	3,016	0	3,016
2034	0	68	9.745	663	0.228	2,462	3,125	0	3,125
2035	0	68	10.086	686	0.236	2,549	3,235	0	3,235
2036	0	68	10.439	710	0.244	2,635	3,345	0	3,345
2037	0	68	10.805	735	0.253	2,732	3,467	0	3,467
2038	0	45	11.183	503	0.262	1,886	2,389	0	2,389
2039	0	23	11.574	266	0.271	976	1,242	0	1,242
2040	0	0	11.979	0	0.280	0	0	0	0
Total =		1,360					$57,275	$4,995	$52,280
						NPV =	$24,843	$4,567	20,276

Total NPV =	$20,276
Benefit/Cost Ratio =	5.44

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

Compa **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)
2018	$63	$32	$86	$181	$1,612	$165	$1,777	($1,596)
2019	128	80	180	388	1,612	165	1,777	(1,389)
2020	200	113	270	583	1,612	165	1,777	(1,194)
2021	207	115	281	603	0	0	0	603
2022	214	116	292	622	0	0	0	622
2023	222	117	302	641	0	0	0	641
2024	229	118	313	660	0	0	0	660
2025	237	119	324	680	0	0	0	680
2026	246	120	335	701	0	0	0	701
2027	254	122	346	722	0	0	0	722
2028	263	123	356	742	0	0	0	742
2029	272	124	378	774	0	0	0	774
2030	282	125	389	796	0	0	0	796
2031	292	127	400	819	0	0	0	819
2032	302	128	410	840	0	0	0	840
2033	313	129	432	874	0	0	0	874
2034	324	130	443	897	0	0	0	897
2035	335	132	464	931	0	0	0	931
2036	347	133	475	955	0	0	0	955
2037	359	134	497	990	0	0	0	990
2038	246	97	338	681	0	0	0	681
2039	130	39	176	345	0	0	0	345
2040	0	0	0	0	0	0	0	0
			Total =	$15,425			$5,331	$10,094
			NPV =	$7,495			$4,980	2,515

Total NPV = $2,515
Benefit/Cost Ratio = 1.51

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: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$5.430
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12698
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$337	$359	$380
16b) Incentive Costs =	4,500	4,800	5,100
16c) Total Utility Project Costs =	$4,837	$5,159	$5,480
17) Direct Participant Costs ($/Part.) =	$1,167	$1,167	$1,167
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 =	18.400	18.400	18.400
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	16	17
24) Total Annual Dk Saved =	276	294	313
25) Incentive/Participant =	$300	$300	$300
26) Distribution Delivery Charge			$1.302
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$24,638	1.97
Utility Cost Test	$35,530	3.46
Societal Test	$45,130	1.81
Participant Test	$71,171	2.40
Total Resource Cost Test	$8,275	1.16

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	2018	276	$2.744	$757	$0.000	$0	$757	2.8	$159	$445	$1,202	$1.348	$242	$337	$4,500	$5,079	($3,877)
2	2019	570	2.840	1,619	0.000	0	1,619	5.7	160	912	2,531	1.395	517	359	4,800	5,676	(3,145)
3	2020	883	2.939	2,595	0.000	0	2,595	8.8	162	1,426	4,021	1.444	829	380	5,100	6,309	(2,288)
4	2021	883	3.042	2,686	0.000	0	2,686	8.8	164	1,443	4,129	1.494	857	0	0	857	3,272
5	2022	883	3.149	2,781	0.000	0	2,781	8.8	165	1,452	4,233	1.546	887	0	0	887	3,346
6	2023	883	3.259	2,878	0.000	0	2,878	8.8	167	1,470	4,348	1.600	918	0	0	918	3,430
7	2024	883	3.373	2,978	0.000	0	2,978	8.8	169	1,487	4,465	1.657	951	0	0	951	3,514
8	2025	883	3.491	3,083	0.000	0	3,083	8.8	170	1,496	4,579	1.714	984	0	0	984	3,595
9	2026	883	3.613	3,190	0.000	0	3,190	8.8	172	1,514	4,704	1.774	1,018	0	0	1,018	3,686
10	2027	883	3.739	3,302	0.000	0	3,302	8.8	174	1,531	4,833	1.837	1,054	0	0	1,054	3,779
11	2028	883	3.870	3,417	0.000	0	3,417	8.8	176	1,549	4,966	1.901	1,091	0	0	1,091	3,875
12	2029	883	4.006	3,537	0.000	0	3,537	8.8	177	1,558	5,095	1.967	1,129	0	0	1,129	3,966
13	2030	883	4.146	3,661	0.000	0	3,661	8.8	179	1,575	5,236	2.036	1,169	0	0	1,169	4,067
14	2031	883	4.291	3,789	0.000	0	3,789	8.8	181	1,593	5,382	2.108	1,210	0	0	1,210	4,172
15	2032	883	4.441	3,921	0.000	0	3,921	8.8	183	1,610	5,531	2.181	1,252	0	0	1,252	4,279
16	2033	883	4.597	4,059	0.000	0	4,059	8.8	184	1,619	5,678	2.258	1,296	0	0	1,296	4,382
17	2034	883	4.758	4,201	0.000	0	4,201	8.8	186	1,637	5,838	2.337	1,341	0	0	1,341	4,497
18	2035	883	4.924	4,348	0.000	0	4,348	8.8	188	1,654	6,002	2.418	1,388	0	0	1,388	4,614
19	2036	883	5.097	4,501	0.000	0	4,501	8.8	190	1,672	6,173	2.503	1,437	0	0	1,437	4,736
20	2037	883	5.275	4,658	0.000	0	4,658	8.8	192	1,690	6,348	2.591	1,487	0	0	1,487	4,861
21	2038	607	5.460	3,314	0.000	0	3,314	6.1	194	1,183	4,497	2.681	1,058	0	0	1,058	3,439
22	2039	313	5.651	1,769	0.000	0	1,769	3.1	196	608	2,377	2.775	565	0	0	565	1,812
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	2.872	0	0	0	0	0
	Total =	17,660									$102,168					$38,156	$64,012
									NPV =		$49,946					$25,307	$24,638

Total NPV = $24,638
Benefit/Cost Ratio = 1.97

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)
2018	$757	$445	$1,202	$337	$4,500	$4,837	($3,635)
2019	1,619	912	2,531	359	4,800	5,159	(2,628)
2020	2,595	1,426	4,021	380	5,100	5,480	(1,459)
2021	2,686	1,443	4,129	0	0	0	4,129
2022	2,781	1,452	4,233	0	0	0	4,233
2023	2,878	1,470	4,348	0	0	0	4,348
2024	2,978	1,487	4,465	0	0	0	4,465
2025	3,083	1,496	4,579	0	0	0	4,579
2026	3,190	1,514	4,704	0	0	0	4,704
2027	3,302	1,531	4,833	0	0	0	4,833
2028	3,417	1,549	4,966	0	0	0	4,966
2029	3,537	1,558	5,095	0	0	0	5,095
2030	3,661	1,575	5,236	0	0	0	5,236
2031	3,789	1,593	5,382	0	0	0	5,382
2032	3,921	1,610	5,531	0	0	0	5,531
2033	4,059	1,619	5,678	0	0	0	5,678
2034	4,201	1,637	5,838	0	0	0	5,838
2035	4,348	1,654	6,002	0	0	0	6,002
2036	4,501	1,672	6,173	0	0	0	6,173
2037	4,658	1,690	6,348	0	0	0	6,348
2038	3,314	1,183	4,497	0	0	0	4,497
2039	1,769	608	2,377	0	0	0	2,377
2040	0	0	0	0	0	0	0
Total =			$102,168			$15,476	$86,692
		NPV =	$49,946			$14,416	$35,530

Total NPV = $35,530
Benefit/Cost Ratio = 3.46

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)
2018	$757	$445	$0.024	$259	$0.388	$107	$1,568	$4,837	$13,005	$17,842	($16,274)
2019	1,619	912	0.025	558	0.397	226	3,315	5,159	13,872	19,031	(15,716)
2020	2,595	1,426	0.025	864	0.405	358	5,243	5,480	14,739	20,219	(14,976)
2021	2,686	1,443	0.026	899	0.414	366	5,394	0	0	0	5,394
2022	2,781	1,452	0.027	933	0.423	374	5,540	0	0	0	5,540
2023	2,878	1,470	0.028	968	0.432	381	5,697	0	0	0	5,697
2024	2,978	1,487	0.029	1,002	0.441	389	5,856	0	0	0	5,856
2025	3,083	1,496	0.030	1,037	0.451	398	6,014	0	0	0	6,014
2026	3,190	1,514	0.031	1,071	0.461	407	6,182	0	0	0	6,182
2027	3,302	1,531	0.032	1,106	0.471	416	6,355	0	0	0	6,355
2028	3,417	1,549	0.033	1,140	0.481	425	6,531	0	0	0	6,531
2029	3,537	1,558	0.035	1,210	0.491	434	6,739	0	0	0	6,739
2030	3,661	1,575	0.036	1,244	0.502	443	6,923	0	0	0	6,923
2031	3,789	1,593	0.037	1,279	0.513	453	7,114	0	0	0	7,114
2032	3,921	1,610	0.038	1,313	0.524	463	7,307	0	0	0	7,307
2033	4,059	1,619	0.040	1,382	0.535	472	7,532	0	0	0	7,532
2034	4,201	1,637	0.041	1,417	0.546	482	7,737	0	0	0	7,737
2035	4,348	1,654	0.043	1,486	0.558	493	7,981	0	0	0	7,981
2036	4,501	1,672	0.044	1,521	0.570	503	8,197	0	0	0	8,197
2037	4,658	1,690	0.046	1,590	0.583	515	8,453	0	0	0	8,453
2038	3,314	1,183	0.047	1,117	0.595	361	5,975	0	0	0	5,975
2039	1,769	608	0.049	600	0.608	190	3,167	0	0	0	3,167
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$134,820			$57,092	$77,728
						NPV =	$100,684			$55,554	$45,130

Total NPV = $45,130
Benefit/Cost Ratio = 1.81

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

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)
2018	$4,500	276	$5.620	$1,551	$0.131	$1,415	$7,466	$17,505	($10,039)
2019	4,800	570	5.817	3,316	0.136	3,036	11,152	18,672	(7,520)
2020	5,100	883	6.020	5,316	0.141	4,873	15,289	19,839	(4,550)
2021	0	883	6.231	5,502	0.146	5,046	10,548	0	10,548
2022	0	883	6.449	5,694	0.151	5,219	10,913	0	10,913
2023	0	883	6.675	5,894	0.156	5,391	11,285	0	11,285
2024	0	883	6.908	6,100	0.162	5,599	11,699	0	11,699
2025	0	883	7.150	6,313	0.167	5,772	12,085	0	12,085
2026	0	883	7.401	6,535	0.173	5,979	12,514	0	12,514
2027	0	883	7.660	6,764	0.179	6,186	12,950	0	12,950
2028	0	883	7.928	7,000	0.185	6,394	13,394	0	13,394
2029	0	883	8.205	7,245	0.192	6,636	13,881	0	13,881
2030	0	883	8.492	7,498	0.199	6,877	14,375	0	14,375
2031	0	883	8.790	7,762	0.206	7,119	14,881	0	14,881
2032	0	883	9.097	8,033	0.213	7,361	15,394	0	15,394
2033	0	883	9.416	8,314	0.220	7,603	15,917	0	15,917
2034	0	883	9.745	8,605	0.228	7,880	16,485	0	16,485
2035	0	883	10.086	8,906	0.236	8,156	17,062	0	17,062
2036	0	883	10.439	9,218	0.244	8,433	17,651	0	17,651
2037	0	883	10.805	9,541	0.253	8,744	18,285	0	18,285
2038	0	607	11.183	6,788	0.262	6,225	13,013	0	13,013
2039	0	313	11.574	3,623	0.271	3,317	6,940	0	6,940
2040	0	0	11.979	0	0.280	0	0	0	0
Total =		17,660					$293,179	$56,016	$237,163
						NPV =	$122,187	$51,016	71,171

Total NPV = $71,171
Benefit/Cost Ratio = 2.40

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 **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)
2018	$757	$445	$259	$1,461	$4,837	$13,005	$17,842	($16,381)
2019	1,619	912	558	3,089	5,159	13,872	19,031	(15,942)
2020	2,595	1,426	864	4,885	5,480	14,739	20,219	(15,334)
2021	2,686	1,443	899	5,028	0	0	0	5,028
2022	2,781	1,452	933	5,166	0	0	0	5,166
2023	2,878	1,470	968	5,316	0	0	0	5,316
2024	2,978	1,487	1,002	5,467	0	0	0	5,467
2025	3,083	1,496	1,037	5,616	0	0	0	5,616
2026	3,190	1,514	1,071	5,775	0	0	0	5,775
2027	3,302	1,531	1,106	5,939	0	0	0	5,939
2028	3,417	1,549	1,140	6,106	0	0	0	6,106
2029	3,537	1,558	1,210	6,305	0	0	0	6,305
2030	3,661	1,575	1,244	6,480	0	0	0	6,480
2031	3,789	1,593	1,279	6,661	0	0	0	6,661
2032	3,921	1,610	1,313	6,844	0	0	0	6,844
2033	4,059	1,619	1,382	7,060	0	0	0	7,060
2034	4,201	1,637	1,417	7,255	0	0	0	7,255
2035	4,348	1,654	1,486	7,488	0	0	0	7,488
2036	4,501	1,672	1,521	7,694	0	0	0	7,694
2037	4,658	1,690	1,590	7,938	0	0	0	7,938
2038	3,314	1,183	1,117	5,614	0	0	0	5,614
2039	1,769	608	600	2,977	0	0	0	2,977
2040	0	0	0	0	0	0	0	0
			Total =	$126,164			$57,092	$69,072
			NPV =	$61,456			$53,181	8,275

Total NPV =	$8,275
Benefit/Cost Ratio =	1.16

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: **2018 - 2020**

Input Data	
1) Retail Rate ($/Dk) =	$5.430
Escalation Rate =	3.50%
2) Non-Gas Fuel Retail Rate ($/Fuel Unit) =	$0.12698
Escalation Rate =	3.50%
Non-Gas Fuel Units (ie. kWh,Gallons, etc) =	Kwh
3) Commodity Cost ($/Dk) =	$2.651
Escalation Rate =	3.50%
4) Demand Cost ($/Unit/Yr) =	$157.31
Escalation Rate =	1.00%
5) Peak Reduction Factor =	1.000%
6) Variable O&M ($/Dk) =	$0.000
Escalation Rate =	0.00%
7) Non-Gas Fuel Cost ($/Fuel Unit) =	$0.02174
Escalation Rate =	3.50%
8) Non-Gas Fuel Loss Factor	5.10%
9) Gas Environmental Damage Factor =	$0.380
Escalation Rate =	2.16%
10) Non Gas Fuel Environmental Damage Factor =	$0.000
Escalation Rate =	0.00%
11) Participant Discount Rate =	9.69%
12) Utility Discount Rate =	7.22%
13) Societal Discount Rate =	2.68%
14) General Input Data Year =	2017
15) Project Analysis Year 1 =	2018
Project Analysis Year 2 =	2019
Project Analysis Year 3 =	2020

	First Year	Second Year	Third Year
16) Utility Project Costs			
16a) Administrative & Operating Costs =	$225	$224	$223
16b) Incentive Costs =	3,000	3,000	3,000
16c) Total Utility Project Costs =	$3,225	$3,224	$3,223
17) Direct Participant Costs ($/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 =	1	1	1
24) Total Annual Dk Saved =	500	500	500
25) Incentive/Participant =	$3,000	$3,000	$3,000
26) Distribution Delivery Charge			$1.302
27) Effective Income Tax Rate = (Federal & State Taxes)			35.000%

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$45,985	2.91
Utility Cost Test	$61,027	7.75
Societal Test	$61,153	2.37
Participant Test	$49,159	2.19
Total Resource Cost Test	$27,396	1.64

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	2018	500	$2.744	$1,372	$0.000	$0	$1,372	5.0	$159	$795	$2,167	$1.348	$438	$225	$3,000	$3,663	($1,496)
2	2019	1,000	2.840	2,840	0.000	0	2,840	10.0	160	1,600	4,440	1.395	907	224	3,000	4,131	309
3	2020	1,500	2.939	4,409	0.000	0	4,409	15.0	162	2,430	6,839	1.444	1,408	223	3,000	4,631	2,208
4	2021	1,500	3.042	4,563	0.000	0	4,563	15.0	164	2,460	7,023	1.494	1,457	0	0	1,457	5,566
5	2022	1,500	3.149	4,724	0.000	0	4,724	15.0	165	2,475	7,199	1.546	1,507	0	0	1,507	5,692
6	2023	1,500	3.259	4,889	0.000	0	4,889	15.0	167	2,505	7,394	1.600	1,560	0	0	1,560	5,834
7	2024	1,500	3.373	5,060	0.000	0	5,060	15.0	169	2,535	7,595	1.657	1,616	0	0	1,616	5,979
8	2025	1,500	3.491	5,237	0.000	0	5,237	15.0	170	2,550	7,787	1.714	1,671	0	0	1,671	6,116
9	2026	1,500	3.613	5,420	0.000	0	5,420	15.0	172	2,580	8,000	1.774	1,730	0	0	1,730	6,270
10	2027	1,500	3.739	5,609	0.000	0	5,609	15.0	174	2,610	8,219	1.837	1,791	0	0	1,791	6,428
11	2028	1,500	3.870	5,805	0.000	0	5,805	15.0	176	2,640	8,445	1.901	1,853	0	0	1,853	6,592
12	2029	1,500	4.006	6,009	0.000	0	6,009	15.0	177	2,655	8,664	1.967	1,918	0	0	1,918	6,746
13	2030	1,500	4.146	6,219	0.000	0	6,219	15.0	179	2,685	8,904	2.036	1,985	0	0	1,985	6,919
14	2031	1,500	4.291	6,437	0.000	0	6,437	15.0	181	2,715	9,152	2.108	2,055	0	0	2,055	7,097
15	2032	1,500	4.441	6,662	0.000	0	6,662	15.0	183	2,745	9,407	2.181	2,126	0	0	2,126	7,281
16	2033	1,000	4.597	4,597	0.000	0	4,597	10.0	184	1,840	6,437	2.258	1,468	0	0	1,468	4,969
17	2034	500	4.758	2,379	0.000	0	2,379	5.0	186	930	3,309	2.337	760	0	0	760	2,549
18	2035	0	4.924	0	0.000	0	0	0.0	188	0	0	2.418	0	0	0	0	0
19	2036	0	5.097	0	0.000	0	0	0.0	190	0	0	2.503	0	0	0	0	0
20	2037	0	5.275	0	0.000	0	0	0.0	192	0	0	2.591	0	0	0	0	0
21	2038	0	5.460	0	0.000	0	0	0.0	194	0	0	2.681	0	0	0	0	0
22	2039	0	5.651	0	0.000	0	0	0.0	196	0	0	2.775	0	0	0	0	0
23	2040	0	5.848	0	0.000	0	0	0.0	198	0	0	2.872	0	0	0	0	0
	Total =	22,500									$120,981					$35,922	$85,059
									NPV =		$70,063					$24,078	$45,985

Total NPV = $45,985
Benefit/Cost Ratio = 2.91

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)
2018	$1,372	$795	$2,167	$225	$3,000	$3,225	($1,058)
2019	2,840	1,600	4,440	224	3,000	3,224	1,216
2020	4,409	2,430	6,839	223	3,000	3,223	3,616
2021	4,563	2,460	7,023	0	0	0	7,023
2022	4,724	2,475	7,199	0	0	0	7,199
2023	4,889	2,505	7,394	0	0	0	7,394
2024	5,060	2,535	7,595	0	0	0	7,595
2025	5,237	2,550	7,787	0	0	0	7,787
2026	5,420	2,580	8,000	0	0	0	8,000
2027	5,609	2,610	8,219	0	0	0	8,219
2028	5,805	2,640	8,445	0	0	0	8,445
2029	6,009	2,655	8,664	0	0	0	8,664
2030	6,219	2,685	8,904	0	0	0	8,904
2031	6,437	2,715	9,152	0	0	0	9,152
2032	6,662	2,745	9,407	0	0	0	9,407
2033	4,597	1,840	6,437	0	0	0	6,437
2034	2,379	930	3,309	0	0	0	3,309
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
Total =			$120,981			$9,672	$111,309
		NPV =	$70,063			$9,036	$61,027

Total NPV = $61,027
Benefit/Cost Ratio = 7.75

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)
2018	$1,372	$795	$0.024	$0	$0.388	$194	$2,361	$3,225	$12,000	$15,225	($12,864)
2019	2,840	1,600	0.025	0	0.397	397	4,837	3,224	12,000	15,224	(10,387)
2020	4,409	2,430	0.025	0	0.405	608	7,447	3,223	12,000	15,223	(7,776)
2021	4,563	2,460	0.026	0	0.414	621	7,644	0	0	0	7,644
2022	4,724	2,475	0.027	0	0.423	635	7,834	0	0	0	7,834
2023	4,889	2,505	0.028	0	0.432	648	8,042	0	0	0	8,042
2024	5,060	2,535	0.029	0	0.441	662	8,257	0	0	0	8,257
2025	5,237	2,550	0.030	0	0.451	677	8,464	0	0	0	8,464
2026	5,420	2,580	0.031	0	0.461	692	8,692	0	0	0	8,692
2027	5,609	2,610	0.032	0	0.471	707	8,926	0	0	0	8,926
2028	5,805	2,640	0.033	0	0.481	722	9,167	0	0	0	9,167
2029	6,009	2,655	0.035	0	0.491	737	9,401	0	0	0	9,401
2030	6,219	2,685	0.036	0	0.502	753	9,657	0	0	0	9,657
2031	6,437	2,715	0.037	0	0.513	770	9,922	0	0	0	9,922
2032	6,662	2,745	0.038	0	0.524	786	10,193	0	0	0	10,193
2033	4,597	1,840	0.040	0	0.535	535	6,972	0	0	0	6,972
2034	2,379	930	0.041	0	0.546	273	3,582	0	0	0	3,582
2035	0	0	0.043	0	0.558	0	0	0	0	0	0
2036	0	0	0.044	0	0.570	0	0	0	0	0	0
2037	0	0	0.046	0	0.583	0	0	0	0	0	0
2038	0	0	0.047	0	0.595	0	0	0	0	0	0
2039	0	0	0.049	0	0.608	0	0	0	0	0	0
2040	0	0	0.051	0	0.621	0	0	0	0	0	0
Total =							$131,398			$45,672	$85,726
						NPV =	$105,643			$44,490	$61,153

Total NPV = $61,153
Benefit/Cost Ratio = 2.37

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)
2018	$3,000	500	$5.620	$2,810	$0.131	$0	$5,810	$15,000	($9,190)
2019	3,000	1,000	5.817	5,817	0.136	0	8,817	15,000	(6,183)
2020	3,000	1,500	6.020	9,030	0.141	0	12,030	15,000	(2,970)
2021	0	1,500	6.231	9,347	0.146	0	9,347	0	9,347
2022	0	1,500	6.449	9,674	0.151	0	9,674	0	9,674
2023	0	1,500	6.675	10,013	0.156	0	10,013	0	10,013
2024	0	1,500	6.908	10,362	0.162	0	10,362	0	10,362
2025	0	1,500	7.150	10,725	0.167	0	10,725	0	10,725
2026	0	1,500	7.401	11,102	0.173	0	11,102	0	11,102
2027	0	1,500	7.660	11,490	0.179	0	11,490	0	11,490
2028	0	1,500	7.928	11,892	0.185	0	11,892	0	11,892
2029	0	1,500	8.205	12,308	0.192	0	12,308	0	12,308
2030	0	1,500	8.492	12,738	0.199	0	12,738	0	12,738
2031	0	1,500	8.790	13,185	0.206	0	13,185	0	13,185
2032	0	1,500	9.097	13,646	0.213	0	13,646	0	13,646
2033	0	1,000	9.416	9,416	0.220	0	9,416	0	9,416
2034	0	500	9.745	4,873	0.228	0	4,873	0	4,873
2035	0	0	10.086	0	0.236	0	0	0	0
2036	0	0	10.439	0	0.244	0	0	0	0
2037	0	0	10.805	0	0.253	0	0	0	0
2038	0	0	11.183	0	0.262	0	0	0	0
2039	0	0	11.574	0	0.271	0	0	0	0
2040	0	0	11.979	0	0.280	0	0	0	0
Total =		22,500					$177,428	$45,000	$132,428
						NPV =	$90,301	$41,142	49,159

Total NPV =	$49,159
Benefit/Cost Ratio =	2.19

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 **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)
2018	$1,372	$795	$0	$2,167	$3,225	$12,000	$15,225	(13,058)
2019	2,840	1,600	0	4,440	3,224	12,000	15,224	(10,784)
2020	4,409	2,430	0	6,839	3,223	12,000	15,223	(8,384)
2021	4,563	2,460	0	7,023	0	0	0	7,023
2022	4,724	2,475	0	7,199	0	0	0	7,199
2023	4,889	2,505	0	7,394	0	0	0	7,394
2024	5,060	2,535	0	7,595	0	0	0	7,595
2025	5,237	2,550	0	7,787	0	0	0	7,787
2026	5,420	2,580	0	8,000	0	0	0	8,000
2027	5,609	2,610	0	8,219	0	0	0	8,219
2028	5,805	2,640	0	8,445	0	0	0	8,445
2029	6,009	2,655	0	8,664	0	0	0	8,664
2030	6,219	2,685	0	8,904	0	0	0	8,904
2031	6,437	2,715	0	9,152	0	0	0	9,152
2032	6,662	2,745	0	9,407	0	0	0	9,407
2033	4,597	1,840	0	6,437	0	0	0	6,437
2034	2,379	930	0	3,309	0	0	0	3,309
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
			Total =	$120,981			$45,672	$75,309
			NPV =	$70,063			$42,667	27,396

Total NPV =	$27,396
Benefit/Cost Ratio =	1.64

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.
2017 Input Data Summary
South Dakota Natural Gas Conservation Model

Input No.	Input Data Description	Information Source	SD Res.	SD Comm.
1	Retail Rate ($/dk)	Weighted Average of SD retail rate using projected 2017-2018 winter gas costs & October 2017 pipeline and distribution rates	6.341	5.43
	Escalation Rate		3.50%	3.50%
2	Non-Gas Fuel Retail ($/fuel/unit)	Average retail cost of non gas fuel if measures also saves kWh, gallons of water, etc. (for analysis purposes, used electric as Non-Gas Fuel Retail Rate)	0.13546	0.12698
	Escalation Rate		3.50%	3.50%
	Non-Gas Fuel Units (ie. kWh, Gallons, etc)		Kwh	Kwh
3	Commodity Cost ($/dk)	Estimated gas costs using projected 2017-18 winter gas costs October 2017 pipeline commodity	2.651	2.651
	Escalation Rate		3.50%	3.50%
4	Demand Cost ($/dk/Yr)	Annual cost of firm capacity on pipeline	$157.31	$157.31
	Escalation Rate		1.00%	1.00%
5	Peak Reduction Factor	Estimated average peak day reduction factor caused by implementing the measure (s)	1.000%	1.000%
6	Variable O&M ($/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)	$0.02174	$0.02174
	Escalation Rate		3.50%	3.50%
8	Non-Gas Fuel Loss Factor	Non-Gas fuel loss factor (for analysis purposes, used Montana-Dakota Utilities 12 month ending July 2017 line loss factor)	5.10%	5.10%
9	Gas Environmental Damage Factor	Per Minnesota CIP triennium 2015-2017	0.38	0.38
	Escalation Rate		2.16%	2.16%
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, 2016	9.69%	9.69%
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, 2017	2.68%	2.68%
14	General Input Data Year =	Year data was input	2017	2017

Montana-Dakota Utilities Co.
2017 Input Data Summary
South Dakota Natural Gas Conservation Model

Input No.	Input Data Description	Information Source	SD Res.	SD Comm.
15	Project Analysis Year	Year(s) program will be implemented	2018	2018
			2019	2019
			2020	2020
16	Utility Project Costs	Total direct cost to the utility caused by implementing the program(s)		
17	Direct Participant Costs ($/Part.)	Direct costs that the participant would have to participate in the program		
18	Participant Non-Energy Costs (Annual $/Part.) 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	1.744	1.302
27	Effective Fed & State Income Tax Rate	Montana-Dakota's effective tax rate	35%	35%

South Dakota Natural Gas DSM Programs
Technical Assumptions

2018 - 2020 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	200	210	220	20	90	95	4.5	720.0	$333	$300
Furnace Tier 2 - 95%+ AFUE - Replacement	Res	290	300	310	20	80	95	18.4	720.0	1,167	300
Programmable Thermostats - Tier 1	Res	110	100	90	10	NA	NA	2.5	0.0	30	15
Programmable Thermostats - Tier 2	Res	110	130	150	10	NA	NA	3.7	0.0	110	60
Residential Energy Assessments	Res	50	50	50	0	NA	NA	0.0	0.0	500	450
Commercial											
Furnace Tier 2 - 95%+ AFUE - New	Comm	5	5	5	20	90	95	4.5	720.0	333	300
Furnace Tier 2 - 95%+ AFUE - Replacement	Comm	15	16	17	20	80	95	18.4	720.0	1,167	300
Custom Efficiency	Comm	1	1	1	15	NA	NA	500.0	0.0	15,000	3,000
Totals		**2,436**	**781**	**812**	**843**						