Southern California Edison 1996 DSM Bidding Program Evaluation

Final Report

Submitted: April 30, 1998

FINAL REPORT

Evaluation of the

Southern California Edison
1996 DSM Bidding Program

Submitted By:
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April 30, 1998

Introduction:

In 1996 six Energy Services Companys (ESCOs), under contract to Southern California Edison Company (Edison) to provide and deliver both energy and demand savings on the Edison system, completed 132 projects which were expected to provide 16,007kW of demand savings and 79,924,415kWh of energy savings for Edison. This report chronicles the steps that have been taken to evaluate the effectiveness of these projects in meeting the energy and demand savings goals.

This document contains the results of the First Year Impact Study of Southern California Edison's 1996 DSM Bidding. The California Public Utilities Commission and California Energy Commission require Summary Tables and Study Documentation forms for each utility impact study. Tables 6 and 7 of the *Protocols and Procedures for the Verification of Costs, Benefits and Shareholder Earnings from Demand-Side Management Programs* (Protocols) as adopted by D.93-05-063 and most recently revised in January 1997 are the tables to be used to relate this summary information and documentation..

Bidding programs are not specifically covered by the protocols. The agreed upon method of reporting the impacts of bidding programs does not fit the mold developed for other programs and therefore, some of the information requested in tables 6 & 7 is either not available or not in the normally expected form.

This report consists of an independent review of the Annual Power Savings Report for each of the 132 projects and a Net-To-Gross analysis report which covers all 132 projects. Therefore, the designated unit of measure (DUOM) is the project for gross kW and kWh is the individual project.

Background:

For each project the ESCO was required to submit a Project Development Report (PDR) to Edison for review. The PDR contained a description of the project, a detailed listing of the equipment to be removed, the equipment to be installed and a plan for measurement of the energy savings.

Upon approval of the PDR, the ESCO implemented their plan and prepared a Project Implementation Report (PIR) for Edison. The PIR contained a detailed listing of all of the equipment actually removed, the equipment actually installed and the actual measurement plan to be implemented. Edison engaged the services of a third party engineering firm to inspect and verify both the energy improvements implemented and the ESCO's proposed measurement plan. Upon inspection and approval by the third party engineering firm and review and approval of the PIR and the engineering report, Edison accepted each project.

At the end of the first full year after implementation the ESCO submits an Annual Power Savings Report (APSR). The APSR describes the measurement(s) that were used to estimate the savings for each project and presents a summary of the energy and demand savings that have been achieved.

Evaluation Process:

Upon receipt of an APSR, the third party engineering firm performs a review to determine whether the ESCO has filed the APSR in the appropriate format, followed the agreed upon measurement plan, performed their savings calculations in an approved manner as described in "NAESCO Standard for Measurement of Energy Savings for Electric Utility Demand Side Management (DSM) Projects", checks the computations of the ESCO and finally, performs their own savings calculations using the inputs provided by the ESCO. The engineering firm provides Edison with a review of the APSR which includes recommendations to approve the APSR as submitted, approve with changes or to reject the APSR. Edison review the APSR and the engineering review report and either issues an approval letter to the ESCO or sends the APSR back for revision by the ESCO.

Engineering review reports and Edison approval letters for all approved projects are attached to this evaluation report. As of the filing of this evaluation report, all 132 APSR have been received by Edison. Fourteen APSRs are still under review by the engineering firm. Edison has used the savings as submitted by the ESCOs to calculate total savings for the program pending final approval of the subject APSRs. Upon final approval of these outstanding projects, Edison will file an ammended savings claim.

Net to Gross analysis:

Edison conducted a census survey of the 15 customer decision makers who represented all 132 projects in this evaluation. A separate NTG ratio was developed for each project. This NTGR was applied to the approved demand and energy savings for each project to arrive at net savings by project.

Summary of Results:

Estimated gross impacts prior to the first year measurement are 16,007kW and 79,924,415kWh. Adjusted gross savings as submitted are 14,869kW and 92,908,041kWh. This result produces realization rates for adjusted gross savings of 0.929 and 1.162 for demand and energy respectively.

The NTG analysis calculated NTGRs for kW and kWh by end use and sector (commercial or industrial) as well as by project. These NTGRs are:

HVAC & Lighting NTGRs

Sector	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Commercial	0.985	1.0	0.987	0.952	0.954	0.952
Industrial	0.918	1.0	0.923	0.833	0.836	0.833

Motors & Process NTGRs

Sector	Motors kWh	Motors kW	Motors Overall	Process kWh	Process kW	Process Overall
Industrial	1.0	1.0	1.0	0.889	0.948	0.891

The complete NTG study is contained in section two of this report.

The net savings (calculated by multiplying adjusted gross savings by the project NTGR) are 13,258kW and 82,306,658kWh. This result produces realization rates for net savings of .8282 and 1.0298 for demand and energy respectively. These results are shown in the "Summary of Savings Results" table on the following pages. This is then followed by Protocol Tables 6 and 7.

Southern California Edison Company
1996 DSM Bidding Pilot Program
Summary of Savings Results

CNTR NO.	CONTRACTOR NAME	PROJECT NO.	PIR ANN. KW	PIR ANN. KWH	NTGR	APSR SUBMITTED KW	APSR SUBMITTED KWH	APSR APPROVED KW	APSR APPROVED KWH	NET SAVINGS KW	NET SAVINGS KWH
110	County of Los Angeles [#110]	1	255	1,475,313	1	255	1,145,269	255	1,145,269	255	1,145,269
110	County of Los Angeles [#110]	2	124	561,521	1	124	574,099	124	574,099	124	574,099
110	County of Los Angeles [#110]	3	96	365,934	1	96	517,229	96	517,229	96	517,229
110	County of Los Angeles [#110]	4	142	563,811	1	143	642,217	143	642,217	143	642,217
110	County of Los Angeles [#110]	5	124	454,772	1	124	527,592	124	527,592	124	527,592
110	County of Los Angeles [#110]	6	176	611,674	1	176	817,235	176	817,235	176	817,235
110	County of Los Angeles [#110]	7	282	1,003,573	1	282	1,225,262	282	1,225,262	282	1,225,262
110	County of Los Angeles [#110]	8	121	606,795	1	121	664,785	121	664,785	121	664,785
110	County of Los Angeles [#110]	9	92	423,085	1	93	415,139	93	415,139	93	415,139
110	County of Los Angeles [#110]	10	117	536,321	1	117	624,612	117	624,612	117	624,612
110	County of Los Angeles [#110]	11	60	239,972	1	60	278,316	58	265,144	58	265,144
110	County of Los Angeles [#110]	12	153	525,254	1	95	312,751			95	312,751
110	County of Los Angeles [#110]	13	167	472,595	1	36	320,602			36	320,602
110	County of Los Angeles [#110]	14	206	571,521	1	33	343,919			33	343,919
110	County of Los Angeles [#110]	15	141	297,130	1	7	158,717			7	158,717
110	County of Los Angeles [#110]	16	143	536,552	1	43	536,561	43	487,975	43	487,975
110	County of Los Angeles [#110]	17	172	729,736	1	53	443,271			53	443,271
110	County of Los Angeles [#110]	18	47	306,101	1	14	594,226			14	594,226
110	County of Los Angeles [#110]	19	229	1,088,195	1	68	607,451			68	607,451
110	County of Los Angeles [#110]	20	167	613,000	1	167	681,657	167	681,650	167	681,650
110	County of Los Angeles [#110]	21	153	1,632,975	1	122	1,222,321	122	1,222,321	122	1,222,321
110	County of Los Angeles [#110]	22	101	337,248	1	28	376,165			28	376,165
110	County of Los Angeles [#110]	23	20	244,414	1	9	105,295			9	105,295
111	County of Los Angeles [#111]	1	602	4,515,000	1	615	5,575,304	592	5,364,588	592	5,364,588
111	County of Los Angeles [#111]	2	69	204,743	1	69	279,218	69	279,218	69	279,218
111	County of Los Angeles [#111]	3	216	970,162	1	216	1,736,065	216	1,736,065	216	1,736,065
111	County of Los Angeles [#111]	5	69	315,967	1	69	280,859	69	280,859	69	280,859
111	County of Los Angeles [#111]	6	449	2,250,617	1	449	3,114,050	449	3,114,185	449	3,114,185
111	County of Los Angeles [#111]	7	222	1,058,529	1	222	1,011,914	222	1,011,914	222	1,011,914
111	County of Los Angeles [#111]	9	77	358,237	1	83	325,582	77	325,582	77	325,582
119	Onsite Energy Corporation	12	880	6,123,770	0.86	871	6,074,550	871	6,074,550	749	5,224,113
119	Onsite Energy Corporation	13	173	834,063	0.8	173	859,520	173	859,520	138	687,616
119	Onsite Energy Corporation	14	225	1,124,565	0.8	225	1,203,458	225	1,198,915	180	959,132
120	Financial Energy & Savage, Inc.	3	305	1,604,282	0.98	305	1,784,697			299	1,749,003
120	Financial Energy & Savage, Inc.	4	120	327,582	0.72	126	319,304	86	322,283	62	232,044
120	Financial Energy & Savage, Inc.	5	21	399,980	0.36	14	1,005,430			5	361,955

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120	Financial Energy & Savage, Inc.	7	31	166,898	0.86	31	170,161	30	170,559	26	146,681
120	Financial Energy & Savage, Inc.	9	135	802,267	0.12	135	982,882	135	954,192	16	114,503
120	Financial Energy & Savage, Inc.	10	48	216,445	0.9	48	287,728	48	289,641	43	260,677
120	Financial Energy & Savage, Inc.	11	339	1,164,804	0.86	377	1,911,656	339	1,960,900	292	1,686,374
120	Financial Energy & Savage, Inc.	12	1,303	6,355,884	0.86	1,225	8,792,300	1,225	8,820,477	1,054	7,585,610
123	Onsite Energy Corporation	1	42	268,098	0.8	43	350,965	43	360,948	34	288,758
123	Onsite Energy Corporation	2	5	27,925	0.8	5	42,395	5	42,395	4	33,916
123	Onsite Energy Corporation	3	394	2,602,266	0.8	394	2,780,498	394	2,780,498	315	2,224,398
123	Onsite Energy Corporation	4	887	4,327,169	0.8	887	5,686,856	887	5,686,856	710	4,549,485
123	Onsite Energy Corporation	5	498	2,525,522	0.8	498	2,694,594	498	2,640,594	398	2,112,475
123	Onsite Energy Corporation	6	30	806,699	0.8	36	764,702	36	764,702	29	611,762
123	Onsite Energy Corporation	7	240	1,024,050	0.8	240	1,391,849	240	1,391,849	192	1,113,479
123	Onsite Energy Corporation	8	1,386	7,086,027	0.8	1,368	7,777,015	1,386	7,777,015	1,109	6,221,612
123	Onsite Energy Corporation	18	25	126,485	0.8	25	189,526	25	189,526	20	151,621
126	NORESCO	1	8	50,209	1	8	48,785	8	48,785	8	48,785
126	NORESCO	2	32	192,529	1	32	205,426	32	205,426	32	205,426
126	NORESCO	3	18	107,246	1	18	109,313	18	109,313	18	109,313
126	NORESCO	4	28	168,351	1	28	175,155	28	175,155	28	175,155
126	NORESCO	5	21	117,237	1	21	140,321	21	140,321	21	140,321
126	NORESCO	6	26	158,046	1	26	178,241	26	178,241	26	178,241
126	NORESCO	7	15	87,309	1	15	89,658	15	89,658	15	89,658
126	NORESCO	8	24	136,733	1	24	117,159	24	117,159	24	117,159
126	NORESCO	9	32	190,157	1	32	260,897	32	260,897	32	260,897
126	NORESCO	10	18	105,458	1	18	106,464	18	106,464	18	106,464
126	NORESCO	11	19	126,348	1	19	103,521	19	103,521	19	103,521
126	NORESCO	12	66	348,000	1	66	385,613	66	385,613	66	385,613
126	NORESCO	13	56	287,809	1	56	277,159	56	277,159	56	277,159
126	NORESCO	14	48	243,592	1	47	196,818	47	196,818	47	196,818
126	NORESCO	15	34	157,249	0.85	34	246,568	34	246,568	29	209,583
126	NORESCO	16	28	117,516	0.85	28	190,533	28	190,533	24	161,953
126	NORESCO	17	26	106,076	0.85	26	172,020	26	172,020	22	146,217
126	NORESCO	18	26	110,510	0.85	25	175,932	25	175,932	21	149,542
126	NORESCO	19	31	131,398	0.85	31	211,835	31	211,835	26	180,060
126	NORESCO	20	24	105,449	0.85	23	166,039	23	166,039	20	141,133
126	NORESCO	21	34	142,372	0.85	33	227,486	33	227,486	28	193,363
126	NORESCO	22	30	127,361	0.85	30	207,678	30	207,678	26	176,526

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126	NORESCO	25	32	142,358	0.85	31	224,279	31	224,279	27	190,637
126	NORESCO	26	32	128,543	0.85	32	211,732	32	211,732	27	179,972
126	NORESCO	27	23	96,977	0.85	23	155,332	23	155,332	20	132,032
126	NORESCO	28	23	95,347	0.85	22	151,119	22	151,119	19	128,451
126	NORESCO	29	21	95,464	0.85	21	150,243	21	150,243	18	127,707
126	NORESCO	30	29	121,516	0.85	29	196,360	29	196,360	25	166,906
126	NORESCO	32	19	88,326	0.85	19	138,224	19	138,224	16	117,490
126	NORESCO	33	12	52,481	0.85	12	84,723	12	84,723	10	72,015
126	NORESCO	35	24	112,522	0.85	25	175,429	25	175,429	21	149,115
126	NORESCO	37	26	114,395	0.85	26	181,682	26	181,682	22	154,430
126	NORESCO	39	28	117,898	0.85	28	190,699	28	190,699	24	162,094
126	NORESCO	41	5	18,827	0.85	5	30,951	5	30,951	4	26,308
126	NORESCO	43	13	59,198	0.85	13	94,107	13	94,107	11	79,991
126	NORESCO	45	26	68,837	1	26	80,423	26	80,423	26	80,423
126	NORESCO	46	58	293,323	1	58	310,209	58	310,209	58	310,209
126	NORESCO	47	56	283,333	1	56	210,575	56	210,575	56	210,575
126	NORESCO	48	27	121,321	1	27	83,510	27	83,510	27	83,510
126	NORESCO	49	21	104,912	1	20	90,718	20	90,718	20	90,718
126	NORESCO	50	74	380,586	1	74	294,623	74	294,623	74	294,623
126	NORESCO	52	34	145,454	0.85	33	232,817	33	232,817	28	197,894
126	NORESCO	53	28	117,384	0.85	28	189,897	28	189,897	24	161,412
126	NORESCO	54	25	112,559	0.85	25	179,611	25	179,611	21	152,669
126	NORESCO	55	29	129,048	0.85	29	204,556	29	204,556	25	173,873
126	NORESCO	56	26	113,249	0.85	26	179,381	26	179,381	22	152,474
126	NORESCO	57	25	103,543	0.85	25	166,942	25	166,942	21	141,901
126	NORESCO	58	8	34,386	0.85	8	54,615	8	54,615	7	46,423
126	NORESCO	61	22	134,616	1	22	135,619	22	135,619	22	135,619
126	NORESCO	63	45	107,838	1	45	196,962	45	196,962	45	196,962
126	NORESCO	64	34	167,561	1	34	131,711	34	131,711	34	131,711
126	NORESCO	65	55	281,672	1	55	264,543	55	264,543	55	264,543
126	NORESCO	66	29	146,009	1	29	89,854	29	89,854	29	89,854
126	NORESCO	67	13	23,372	1	13	25,038	13	25,038	13	25,038
126	NORESCO	68	23	45,969	1	23	131,534	23	131,534	23	131,534
126	NORESCO	69	26	63,429	1	26	108,250	26	108,250	26	108,250
126	NORESCO	70	65	197,313	1	65	267,990	65	267,990	65	267,990
126	NORESCO	71	48	151,533	1	48	155,264	48	155,264	48	155,264

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CNTR	CONTRACTOR NAME	PROJECT	PIR	PIR	NTGR	APSR SUBMITTED		APSR APPROVED		NET SAVINGS	
NO.		NO.	ANN. KW	ANN. KWH		KW	KWH	KW	KWH	KW	KWH
126	NORESCO	72	25	76,338	1	25	99,804	25	99,804	25	99,804
126	NORESCO	73	15	43,698	1	15	52,358	15	52,358	15	52,358
126	NORESCO	74	15	44,364	1	15	55,289	15	55,289	15	55,289
126	NORESCO	75	26	56,092	1	26	174,692	26	174,692	26	174,692
126	NORESCO	76	28	127,340	0.85	29	201,361	29	201,361	25	171,157
126	NORESCO	77	24	112,003	0.85	25	175,718	25	175,718	21	149,360
126	NORESCO	78	32	135,110	0.85	32	216,427	32	216,427	27	183,963
126	NORESCO	79	34	140,245	0.85	34	227,622	34	227,622	29	193,479
126	NORESCO	80	27	119,677	0.85	27	189,705	27	189,705	23	161,249
126	NORESCO	81	8	28,510	0.85	8	50,452	8	50,452	7	42,884
126	NORESCO	82	35	150,648	0.85	35	239,640	35	239,640	30	203,694
126	NORESCO	83	36	163,458	0.85	36	257,095	36	257,095	31	218,531
126	NORESCO	84	25	105,644	0.85	25	169,811	25	169,811	21	144,339
126	NORESCO	85	38	154,136	0.85	38	252,049	38	252,049	32	214,242
126	NORESCO	86	34	152,460	0.85	34	241,905	34	241,905	29	205,619
126	NORESCO	87	31	141,862	0.85	31	223,091	31	223,091	26	189,627
126	NORESCO	88	32	96,780	1	32	103,540	32	103,540	32	103,540
126	NORESCO	89	36	108,251	1	36	121,855	36	121,855	36	121,855
133	SISCO	1	339	1,526,471	1	297	1,830,348			297	1,830,348
133	SISCO	3	475	2,741,375	1	471	3,224,631			471	3,224,631
133	SISCO	4	502	1,797,637	1	480	2,224,706			480	2,224,706
133	SISCO	6	131	875,006	0.74	131	884,086	131	926,012	97	685,249
133	SISCO	9	122	853,865	0.68	122	853,898	122	829,295	83	563,921
133	SISCO	16	130	499,863	1	130	548,046	130	548,046	130	548,046
			16,007	79,924,415		14,869	92,908,041	12,867	79,326,270	13,258	82,306,658
										0.8282	1.0298

Summary Tables

TABLE 6

Section 6.1: This information is not available.

Section 6.2.A: Load impacts for the program are:

Gross kW	Net kW	Gross kWh	Net kWh
14,869	13,258	79,924,415	82,306,658

Section 6.2.B: Load impacts per designated unit are:

Gross kW	Net kW	Gross kWh	Net kWh
112.6	93.6	605,488	62,353

Section 6.2.C: There is no comparison group. This information is not available.

Section 6.2.D: Realization rates for the program are:

Gross kW	Net kW	Gross kWh	Net kWh
0.9289	0.8282	1.1624	1.0298

Section 3.A, B: Net-To-Gross Ratios and Section 5: Precision

Standard and Custom NTGRs

For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
COMMERCIAL						
Standard NTGR	0.565	0.520	0.562	0.617	0.625	0.618
80% Confidence	+/- .011	+/- .011	+/- .011	+/- .015	+/- .012	+/- .014
90% Confidence	+/- .015	+/- .015	+/- .015	+/- .019	+/- .016	+/- .018
Custom NTGR	0.987	1.0	0.987	0.952	0.954	0.952
80% Confidence	+/- .019	+/- .014	+/- .017	+/- .017	+/- .022	+/- .019
90% Confidence	+/- .024	+/- .018	+/- .022	+/- .021	+/- .028	+/- .024
INDUSTRIAL						
Standard NTGR	0.918	1.0	0.923	0.833	0.836	0.833
80% Confidence	+/- .065	+/- .108	+/- .065	+/- .031	+/- .029	+/- .030
90% Confidence	+/- .083	+/- .138	+/- .083	+/- .039	+/- .037	+/- .039
Custom NTGR	0.918	1.0	0.923	0.833	0.836	0.833
80% Confidence	+/- .065	+/- .108	+/- .065	+/- .031	+/- .029	+/- .030
90% Confidence	+/- .083	+/- .138	+/- .083	+/- .039	+/- .037	+/- .039

Standard and Custom Industrial NTGRs

For Motors and Process by kWh, kW, and Overall End Use

	Motors kWh	Motors kW	Motors Overall	Process kWh	Process kW	Process Overall
Standard NTGR	1.0	1.0	1.0	0.889	0.948	0.891
80% Confidence	+/- .221	+/- .254	+/- .223	+/- .053	+/- .049	+/- .052
90% Confidence	+/- .283	+/- .325	+/- .286	+/- .067	+/- .062	+/- .067
Custom NTGR	1.0	1.0	1.0	0.889	0.948	0.891
80% Confidence	+/- .221	+/- .254	+/- .223	+/- .053	+/- .049	+/- .052
90% Confidence	+/- .283	+/- .325	+/- .286	+/- .067	+/- .062	+/- .067

Standard and Custom Commercial NTGRs
by kWh, kW, and Overall Sector

	All Commercial kWh	All Commercial kW	All Commercial Overall
Standard NTGR	.605	0.605	0.605
80% Confidence	+/-.011	+/- .010	+/- .011
90% Confidence	+/-.014	+/- .013	+/- .014
Custom NTGR	.961	0.960	0.962
80% Confidence	+/-.013	+/- .011	+/- .013
90% Confidence	+/-.016	+/- .014	+/- .016

Standard and Custom Industrial NTGRs
by kWh, kW, and Overall Sector

	All Industrial kWh	All Industrial kW	All Industrial Overall
Standard NTGR	.843	0.849	0.844
80% Confidence	+/-.021	+/- .022	+/- .022
90% Confidence	+/-.027	+/- .028	+/- .028
Custom NTGR	.843	0.849	0.844
80% Confidence	+/-.021	+/- .022	+/- .022
90% Confidence	+/-.027	+/- .028	+/- .028

Section 6.3.C: This information is not available.

Section 4: Designated Unit Intermediate Data. This information is not available.

Section 6.A, B: Measure Count Data

Measures Installed

Measure	Total
Adjustable Speed Drive	4
Chiller 200 - <600 Tons	2
Chiller 75 - <200 Tons	12
Cooling Tower	3
Indoor Lighting System Modification	29
Indoor Lighting System Replacement	96
Led Lamps	1
Motors - Three Phase	3
Outdoor Lighting System Replacement	1
Outdoor Lighting System Replacement-CFL	1
Pump System Controls (Process)	1
Interactive Savings	99
Total	252

Section 6.C: There was no comparison group.

Section 7.B: Market Segment Data

Frequency of Projects by Sector

Sector	Frequency of Projects	Percent
Commercial	108	81.8
Industrial	24	18.2
Total	132	100.0

Information Requested in Table 7 of the Protocols

The following information is provided in direct response to the corresponding items in Table 7 of the Protocols. Essential information regarding this evaluation is provided below. When necessary, the reader is directed to the appropriate report section where additional information can be found.

A. Overview Information

1. *Study Title:* Evaluation of the Southern California Edison 1996 DSM Bidding Program
2. *Program, program year, and program description:* Energy Services Companies (ESCOs) were invited to submit bids to Edison in order to deliver kWh and kW savings. In 1996, six winning bidders signed a total of 7 contracts involving 132 projects and 252 measures with Edison. Payments to ESCOs were based on verified savings using measurement techniques consistent with NAESCO standards. Eligible measures include, but are not limited to, indoor lighting-system replacement, lighting efficiency modifications, packaged air conditioners, heat pumps, window treatment, daylighting controls, electronic adjustable-speed drives, electric motors, electric chillers, and thermal energy storage.
3. *.End uses and/or measures covered*: This Evaluation covered HVAC, lighting, process, and motor end uses.
4. *Methods and models used:*

   Gross kWh and kW Impacts
   NAESCO standards were used by the ESCOs as guidelines in estimating the gross kWh and kW impacts and by Edison in reviewing these estimates.

   Net-to-Gross Ratios (NTGRs)
   Since, in this study, there was no comparison group, the self-report method was used to estimate all NTGRs. Guidelines for the use of this method are contained in Chapter 4 of Appendix J of the Protocols. The measure-level NTGRs were estimated using information gathered from the person at each site most responsible for deciding to participate in the DSM Bidding Program. These NTGRs are referred to as the *standard* NTGRs.

   However, additional steps were taken to refine these NTGRs. To this end, additional quantitative and qualitative data were collected and analyzed to produce what is called a *custom* NTGR. All of the information gathered was integrated into a coherent narrative that either supported the standard NTGR or argued for changing it. The narrative for each custom measure is presented in Appendix C of this report.

Of course, when one attempts to estimate a NTGR beyond the measure level, one must combine all the NTGRs in a way that reflects the magnitude of the gross kW and kWh impacts specific to each measure. These gross impacts are ex ante estimates taken from the DSM Bidding Program database.

The measure-level NTGR was multiplied by the measure-level gross impacts to derive net impacts for both kWh and kW. Within each end use, the net kWh and kW were summed to produce end-use net kWh and kW impacts. Within each end use, the gross kWh and kW impacts were then summed to produce end-use gross kWh and kW impacts. Within each end use, the ratio of the net kWh and kW impacts to the gross kWh and kW impacts produced kWh and kW NTGRs for each end use.

The overall end-use NTGRs across both kWh and kW impacts were estimated by first converting both net and gross kWh and kW impacts into a common unit, dollars, using marginal energy and capacity costs. The end-use net impacts for kWh *and* kW were then summed. Next, the end-use gross impacts for kWh and kW were summed. Within each end use, the *combined* kWh and kW net impacts were divided by the *combined* kWh and kW gross impacts to derive the overall NTGR for each end use.

The NTGR for the overall sector (commercial or industrial) was derived by summing the combined net kWh and kW impacts across all end uses. Next, the combined gross kWh and kW impacts were summed across all end uses. Finally, calculating the ratio of the net impacts to the gross impacts yielded the overall sector NTGR.

As was mentioned above, there were two levels of decision-maker NTGR analysis, the standard and the custom. The standard measure-specific free-ridership analysis draws on information obtained from the Standard Decision-Maker survey. An analysis of closed-ended questions included in the decision-maker survey was carried out in order to derive a standard, self-report NTGR.

Inputs

Using the questionnaire for ESCO Projects in Appendix A as an example, the central inputs to the calculation of the Standard NTGR come from the decision-maker survey question numbers 8, 9, 20, 21, and 22. First the core questions 8, 9, 20, 21, and 22 are averaged, with question 9 and 20 values transposed to cause the large values to have the same meaning as the large values of the other questions, i.e., a large value means a high NTGR.

A potential conflict within the questionnaire occurs with question 9 which asks how likely it is that the customer would have installed the same thing without the financial assistance. It is known that question 9 is subject to

misunderstanding because of the necessarily negative phrasing of the question. It was necessary to ask if the customer would have made the same installation if the program had *not* been in effect. This negative in the question sometimes causes misunderstandings and, therefore, answers that imply the opposite of what the respondent wanted to communicate. This potential was handled by incorporating automatic checks into the survey form that detected clear contradictions between questions 8 and 9 since this is where such a misunderstanding would become visible. Where there was a contradiction between these two answers, the interviewer is instructed in how to resolve the contradiction with suggested phrasing for presenting the apparent conflict to the respondent and requesting resolution.

The custom free-ridership analysis includes the individual examination of a variety of quantitative and qualitative data. The custom analysis is a response to the concern that the core questions used to estimate the Standard NTGR could miss some critical pieces of the decision process. It is important to understand the entire story of the process of thinking about the change, considering alternatives, balancing costs and benefits, making decisions, etc. Energy efficiency could be the single reason for the change or it could be a small part of a larger picture. Because of these complexities, a wide variety of data, beginning with the Standard NTGR, were examined in estimating the Custom NTGR. The thrust of the method is to reconstruct the entire "story" (a comprehensive, internally consistent description) of the decision process.

Each data source, beyond the Standard NTGR, considered in estimating the Custom NTGR is described briefly below.

Financial Information

In cases in which financial calculations made prior to the installations were a part of the Program files, or where that or other financial information was reported in the decision-maker interview, it was taken into account in reviewing the Standard NTGR. This was accomplished by building in a probe contingent on the answer to question 9 and the financial information from two sources: payback information in the program file (when present), and the self-reported financial information from the interview. For example, when financial figures met or exceeded the criteria set by the customer for investment, without the financial assistance, but the Standard NTGR questions indicated high program influence (NTGR > .5), the respondent was questioned about why the financial assistance was necessary given the favorable financial calculations. The information gathered by such questioning was considered in the context of all the other information obtained for these projects.

Decision-Maker Open-Ended Interview Questions

This type of question had two uses. The first was to contribute to painting the whole picture of the decision process related to the installed equipment. The second, was to detect misunderstandings embedded in the decision-maker's answers to the Standard NTGR questions or to pick up complexities in the process that could not fit into structured categories, thus producing unexpected combinations of answers, including contradictory ones. Therefore, the answers to these questions could be compared to the pre-quantified answers to see if there were contradictions across those types of questions.

File Information

Any information contained in program files pertaining to timing and motivational issues was examined and used in estimating the final Custom NTGR.

Accelerated Installations

Question 14 on the Decision-maker questionnaire asks the respondent whether the same equipment might have been installed without the financial assistance, but later than was the case under the influence of the program. When accelerated installations were claimed, the respondent was asked why the equipment installation was accelerated by the time period mentioned. This information was considered and weighed in the context of all of the information gathered.

A more detailed description of the method and the aggregation from measure-level net and gross kWh and kW impacts and NTGRs to end-use net and gross kWh and kW impacts and NTGRs, to the overall end-use NTGRs, and finally to the overall sector-level NTGR is provided in Section 6.4.1 of this report.

5. *Participants and comparison group definition:* Participants are defined as all commercial industrial customers for whom contracts were approved in 1996.

6. *Analysis sample size:* There were 15 customer decision-makers associated with the 132 projects covering the 252 measures that were a part of the 1996 DSM Bidding Program.

   Given the number of projects, sites, and unique decision-makers, it was decided to perform a census of all 15 decision-makers and the related projects, covering all 132 projects and the associated 252 measures.

   The questionnaires were designed to estimate the extent to which Edison or the ESCOs influenced the customers to invest in energy efficiency measures. One questionnaire was designed for those contractors who are traditional ESCOs and another was designed for those contractors who are government

agencies, e.g., county government. This was done to account for differences in customer perceptions regarding the source of financial assistance. The ESCO questionnaire referred to financial assistance from the *ESCO* while the governmental questionnaire referred to financial assistance from the *Southern California Edison Company*. The only other difference was that the ESCO questionnaire included a question about satisfaction with the performance of the ESCO. Both questionnaires are included in Appendix A.

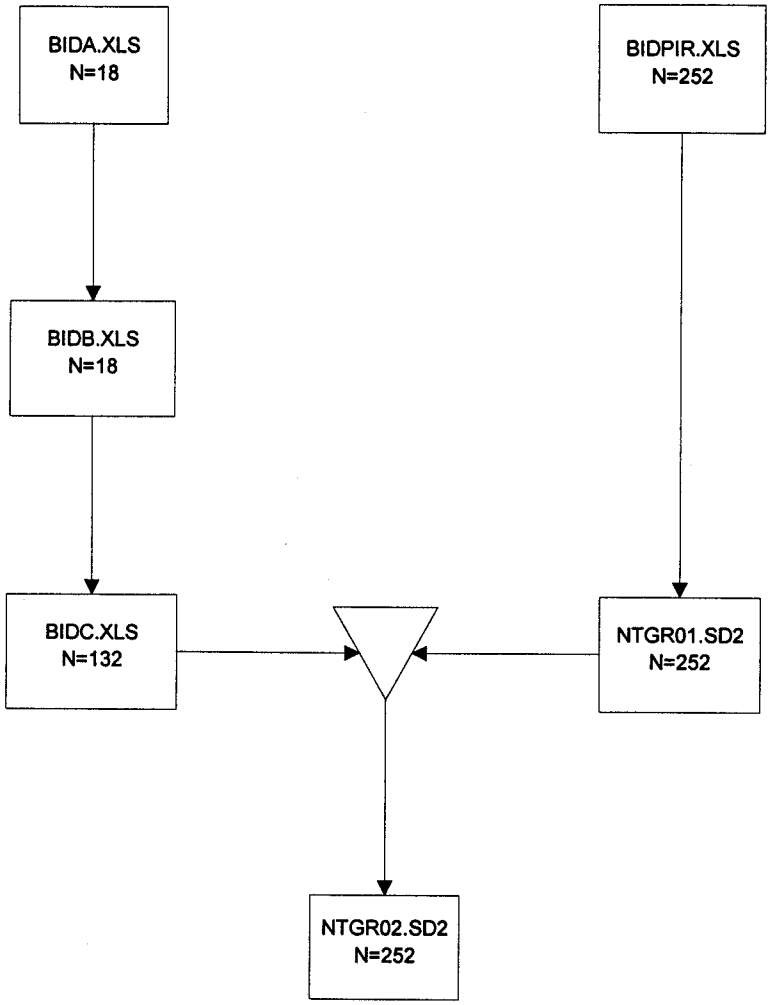
The telephone interviews took approximately ten minutes to complete and were conducted by AESC, Inc.

Of the 15 decision-makers, interviews were completed with all. In only two cases in which there were multiple sites, projects, or measures did the decision-makers indicate that their answers were different for other sites, projects, or measures. In one case, one decision-maker completed three questionnaires. In another case, the decision-maker completed two questionnaires. Thus, the 15 decision-makers accounted for 18 completed questionnaires covering 132 projects and 252 measures.

B. Database Management

1. *Describe and provide flow chart illustrating the relationships between data elements*

   The flowchart below illustrates the construction of the final analysis database used in estimating the NTGRs and the net kWh and kW impacts


BIDA.XLS
N=18
BIDPIR.XLS
N=252
BIDB.XLS
N=18
BIDC.XLS
N=132
NTGR01.SD2
N=252
NTGR02.SD2
N=252

Once the data from the 15 decision-makers were entered in an EXCEL spreadsheet, BIDA.XLS, they were examined for data entry errors and out-of-range values and placed in BIDB.XLS. Next, the responses for each decision-maker were duplicated for all those sites, projects and measures to which their answers were applicable and placed in BIDC.XLS. The program database, BIDPIR.XLS, was then read into a SAS database, NTGR01.SD2. The survey database, BIDC.XLS, was then merged with the master program database, NTGR01.SD2, and stored in NTGR02.SD2 so that the analysis could begin.

Additional details regarding the relevant datasets are presented in Table B-1 in Appendix B. All relevant EXCEL files and SAS files are listed in Table B-1.

2. *Identify the specific data sources for each data element:* The sources of all data elements are described below:

   - Data used in estimating the standard NTGRs were obtained via interviews with the key decision-maker.
   - *Ex ante* estimates of the gross impacts were obtained from the program database.
   - Additional data for estimating custom NTGRs were collected from Program files.

3. *Diagram and describe data attrition process:* There was no data attrition.

4. *Describe the internal organizational data quality checks:*

   NTGR quality checks

   Internal consistency checks were built into decision-maker interviews, so that interviewers were alerted to internal contradictions. Consistency checks were made also between file information, and the decision-maker interviews. Also, consistency between pre-quantified question responses and narrative question responses were reviewed systematically. Finally, all data entry was 100 percent verified and cleaned prior to analysis.

   Provide a summary of the data collected specifically for the analysis but not used: All data collected were used.

C. Sampling

1. *Sampling procedures and protocols:* For the NTGR estimates, a census of all 15 decision-makers was attempted and achieved. These 15 decision-makers were responsible for all 132 projects covering 252 measures. A complete

description of the sample design and implementation can be found in Section 4.

2. *Survey Information and survey instruments:* Data collection instruments are provided in Appendix A.
3. *Statistical Descriptions:* Not Applicable
4. *For the estimates of gross impacts, all projects received on-*site data collection and analysis.

D. Data Screening and Analysis

1. *Describe treatment for outliers, missing data points and weather adjustments:* There were no missing data and no outliers. No weather adjustments were needed for this method.
2. *Describe control of background effects:* Background variables were not an issue since the analytical methods used to estimate both gross and net impacts were based on an analysis of each individual project and its related measure(s). These approaches do not allow for the statistical control of such background effects as changes in economic conditions.
3. *Describe data screening procedures:* No screening of projects and measures was done prior to data collection. That is, a census was attempted. Also, since analysis did not depend on billing data, many of the usual reasons for screening data did not exist.
4. *Regression statistics*: Not Applicable
5. *Specification:* Not Applicable
6. *Error in measuring variables:* Potential errors in measuring customers' level of free ridership are dealt with by multiple measures of the same concept, increasing reliability of measures. Also, internal consistency checks were provided to detect contradictions and misunderstandings on closed-ended questions during the interview so that they can be addressed on the spot with the respondent. For projects in the custom evaluation group additional checks were provided by asking open-ended questions, whose answers could be compared to the closed-ended questions to check for contradictions. Also in this group were interviews with decision-makers. Whenever possible, input from the operations staff were incorporated during the interview. Any contradictions between the decision-maker and the operations staff were resolved during the interview. Finally, in the custom evaluation group, file information, including payback calculations, was used to detect contradictions in reported motivations for installations, especially pertaining to the role of the financial assistance.
7. *Autocorrelation:* Not Applicable

8. *Heteroskedasticity*: Not Applicable
9. *Collinearity:* Not Applicable
10. *Influential data points:* Not Applicable
11. *Missing data:* There were no missing data.
12. *Precision*: Both the 80 percent and 90 percent confidence intervals for the final, custom NTGRs were calculated for both kWh and kW within each end use, for the end use as a whole, and for the program. The 80 percent and 90 percent confidence intervals were also calculated for realization rates. Since these are the critical ratios, these confidence intervals were calculated in two steps. First, the variance of the ratio (either realization rate or NTGR) was estimated using the following equation:

$$v(\hat{R}) = \frac{(1-f)}{n\bar{x}^2}(s_y^2 + \hat{R}^2 s_x^2 - 2\hat{R}s_{yx})$$

Where:

$v(\hat{R}) =$ Variance of the NTGR

$\hat{R} = \frac{\bar{y}}{\bar{x}}$,the NTGR

$f =$ Sampling fraction

$n =$ Size of sample

$\bar{x} =$ Mean of gross impacts

$\bar{y} =$ Mean of net impacts

$s_x^2 =$ Variance of the gross impacts

$s_y^2 =$ Variance of the net impacts

$s_{yx} =$ Covariance of the gross and net impacts

Once the variance of $\hat{R}$ was estimated, then the following equation is used to estimate the 80 percent and 90 percent confidence intervals:

$$\hat{R} = \pm z\sqrt{v(\hat{R})}$$

where z = The critical values for the 80% and 90% levels of confidence. i.e., 1.28 and 1.64.

Confidence intervals for other reported variables were calculated using the following formula:

$$\bar{y} \pm ts_{\bar{y}}$$

where t = the critical value from the t distribution
s = the standard error of $\bar{y}$, the NTGR.

The critical values of t for the 80% and 90% levels of confidence are 1.28 and 1.64 respectively. These confidence intervals were calculated for both lighting and process and placed around the end-use and program-level NTGRs calculated above.

E. Data Interpretation and Application

1. *Net impact calculations*: The methods used to estimate the measure-level net impacts was a combination of the ones listed in E.1.c and E.1.d in Table 7 of the Protocols.

2. *Describe process, choices made, and rationale for choices made in Section E.1, above:* The self-report method for estimating the NTGR was chosen since a comparison group was not used.

The challenges of data interpretation and application occurred primarily in the custom analysis of those coupons with the largest savings. The interpretation and analysis of the quantitative and qualitative data for the *custom* measures was a complex task. Without an explicit set of principles that are applied consistently and systematically, any such analysis can become unreliable. To guard against unreliable results, two steps were taken. First, the self-report method was developed so that it is consistent with the guidelines in Chapter 4 of Appendix J of the Protocols. Second, additional principles were developed and applied independently by two analysts. The results were then compared to detect any serious discrepancies in interpretation and analysis. The agreement rate, indicating the reliability of the custom analysis, between the two analysts was 89 percent.

The principles that were developed and applied are summarized below:

- The standard NTGR should stand except when there is strong evidence that it should not. No one piece of information should be used to override the standard NTGR. Specifically, more than one piece or source of information should form a larger picture that contradicts the standard NTGR before an override is considered.

- The standard NTGR should not be changed unless the change is substantial.

- When information about the projected or forecasted timing of future installations was provided in the interview, it was not used in a routine manner. Rather, only when there was substantial evidence that accelerated installation was the *only* program influence was the specific degree of acceleration addressed.

More details about the development of the principles and their application can be found in Section 6.4 of this report.

FINAL REPORT

Evaluation
Of The
Southern California Edison
1996 DSM Bidding Program

Submitted to
Southern California Edison Company
300 North Lone Hill Avenue
San Dimas, CA 91773

Submitted by
Ridge & Associates
With
KVDR, Inc.

April 17, 1998

TABLE OF CONTENTS

Executive Summary

In accordance with CPUC Decision No. 9209-080, the Southern California Edison Company (Edison) developed a DSM bidding pilot to test the use of third parties to provide energy-efficiency services to Edison's industrial and large commercial customers. This pilot is limited to two of Edison's seven service regions (Southern and San Gabriel Valley). The pilot involves a two-year installation period, which began in 1994, followed by a three-year performance period.

Energy Services Companies (ESCOs) were invited to submit bids to Edison in order to deliver kWh and kW savings. In 1996, six winning bidders signed a total of 7 contracts involving 132 projects and 252 measures with Edison. Payments to ESCOs were based on verified savings using measurement techniques consistent with NAESCO standards. Eligible measures include, but are not limited to, indoor lighting-system replacement, lighting efficiency modifications, packaged air conditioners, heat pumps, window treatment, daylighting controls, electronic adjustable-speed drives, electric motors, electric chillers, and thermal energy storage.

The purpose of this evaluation is to estimate net-to-gross ratios (NTGRs) for 1996 projects only. The NTGRs were estimated at the measure, project, end-use, and sector levels consistent with the self-report methods described in Chapter 4 of the *Quality Assurance Guidelines for Statistical, Engineering, and Self-Report Methods for Estimating DSM Program Impacts* (QAG). The QAG is contained in Appendix J of the *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs.*

A census of the 15 decision-makers associated with the 132 projects covering 252 measures was successfully completed. Of the 132 projects, 108 were at commercial sites covering 197 measures and 24 were at industrial sites covering 55 measures. Structured interviews were conducted either in person or by telephone.

The resulting commercial and industrial end-use net-to-gross ratios that take into consideration the size of the kW and kWh impacts at the measure level are presented in Tables E-1 through E-5. Also included are the 80% and 90% confidence intervals.

Table E-1.Standard and Custom Commercial NTGRs For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Standard NTGR	0.565	0.520	0.562	0.617	0.625	0.618
80% Confidence	+/- .011	+/- .011	+/- .011	+/- .015	+/- .012	+/- .014
90% Confidence	+/- .015	+/- .015	+/- .015	+/- .019	+/- .016	+/- .018
Custom NTGR	0.987	1.0	0.987	0.952	0.954	0.952
80% Confidence	+/- .019	+/- .014	+/- .017	+/- .017	+/- .022	+/- .019
90% Confidence	+/- .024	+/- .018	+/- .022	+/- .021	+/- .028	+/- .024

Table E-2.Standard and Custom Industrial NTGRs For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Standard NTGR	0.918	1.0	0.923	0.833	0.836	0.833
80% Confidence	+/- .065	+/- .108	+/- .065	+/- .031	+/- .029	+/- .030
90% Confidence	+/- .083	+/- .138	+/- .083	+/- .039	+/- .037	+/- .039
Custom NTGR	0.918	1.0	0.923	0.833	0.836	0.833
80% Confidence	+/- .065	+/- .108	+/- .065	+/- .031	+/- .029	+/- .030
90% Confidence	+/- .083	+/- .138	+/- .083	+/- .039	+/- .037	+/- .039

Table E-3.Standard and Custom Industrial NTGRs For Motors and Process by kWh, kW, and Overall End Use

	Motors kWh	Motors kW	Motors Overall	Process kWh	Process kW	Process Overall
Standard NTGR	1.0	1.0	1.0	0.889	0.948	0.891
80% Confidence	+/- .221	+/- .254	+/- .223	+/- .053	+/- .049	+/- .052
90% Confidence	+/- .283	+/- .325	+/- .286	+/- .067	+/- .062	+/- .067
Custom NTGR	1.0	1.0	1.0	0.889	0.948	0.891
80% Confidence	+/- .221	+/- .254	+/- .223	+/- .053	+/- .049	+/- .052
90% Confidence	+/- .283	+/- .325	+/- .286	+/- .067	+/- .062	+/- .067

Table E-4. Standard and Custom Commercial NTGRs by kWh, kW, and Overall Sector

	All Commercial kWh	All Commercial kW	All Commercial Overall
Standard NTGR	.605	0.605	0.605
80% Confidence	+/-.011	+/- .010	+/- .011
90% Confidence	+/-.014	+/- .013	+/- .014
Custom NTGR	.961	0.960	0.962
80% Confidence	+/-.013	+/- .011	+/- .013
90% Confidence	+/-.016	+/- .014	+/- .016

Table E-5. Standard and Custom Industrial NTGRs by kWh, kW, and Overall Sector

	All Industrial kWh	All Industrial kW	All Industrial Overall
Standard NTGR	.843	0.849	0.844
80% Confidence	+/-.021	+/- .022	+/- .022
90% Confidence	+/-.027	+/- .028	+/- .028
Custom NTGR	.843	0.849	0.844
80% Confidence	+/-.021	+/- .022	+/- .022
90% Confidence	+/-.027	+/- .028	+/- .028

1 Introduction

In accordance with CPUC Decision No. 9209-080, the Southern California Edison Company (Edison) developed a DSM bidding pilot to test the use of third parties to provide energy-efficiency services to Edison's industrial and large commercial customers. This pilot is limited to two of Edison's seven service regions (Southern and San Gabriel Valley). The pilot involves a two-year installation period, which began in 1994, followed by a three-year performance period.

Energy Services Companies (ESCOs) as well as customers were invited to submit bids to Edison in order to deliver kWh and kW savings. In 1996, six winning bidders signed a total of 7 contracts involving 132 projects involving 252 measures with Edison. Payments to ESCOs and customers were based on verified savings using measurement techniques consistent with NAESCO standards. Eligible measures include, but are not limited to, indoor lighting-system replacement, lighting efficiency modifications, packaged air conditioners, heat pumps, window treatment, daylighting controls, electronic adjustable-speed drives, electric motors, electric chillers, and thermal energy storage.

2 Research Objectives

The objective of the pilot was to test the effectiveness and efficiency of using third-party energy services suppliers to deliver persistent and sustainable electric-energy services to selected Edison customers as a strategy to reduce utility administrative costs. The objective of the research presented in this report was to produce NTGRs for the pilot program. These NTGRs can then become part of the assessment of the effectiveness of the program.

2.2 Unit of Analysis

NTGRs were estimated at the measure, end-use and sector (commercial and industrial) levels. Within each end use and at the sector level, separate NTGRs were estimated for kWh and kW. NTGRs were also estimated for each end use that included the impacts of the combination of both kWh and kW together. Finally, sector level NTGRs were estimated across all end uses that included the impacts of both kWh and kW.

2.3 Compliance with M&E Protocols

In separate studies, Edison has complied with NAESCO standards to estimate gross impacts. In this current study, Edison has used the guidelines contained in the *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs* (Protocols) for estimating NTGRs, collecting data, and reporting results. In estimating the NTGRs, Edison has used the guidelines contained in Chapter 4 of the *Quality Assurance Guidelines for Statistical, Engineering, and Self-Report Methods for Estimating DSM Program Impacts* (QAG). The QAG is contained in Appendix J of the Protocols.

The Protocol tables listed in Table 2-1 were used as guidelines in conducting this evaluation.

Table: 2-1. Relevant Protocol Tables for the Evaluation of Industrial Incentive Programs

Table	Pertaining To:
5	Protocols for the general approach to load impact measurement
6	Protocols for reporting of results of impact measurement studies used to support an earnings claim
7	Documentation protocols for data quality & processing
11	Reporting of load impact results for use in planning & forecasting
C-5	Measurement requirements for industrial incentive programs
C-9	Measurement requirements for miscellaneous measures
C-12	Treatment of data perturbations

3 Research Approach

The method used to estimate the NTGR involves interviewing the key person responsible for making energy efficiency decisions for the sites in which efficient equipment was installed as a part of the DSM Bidding Program. This method, referred to as the "self-report" method, attempts to determine what these key decision-makers would have done in the absence of the Program. Guidelines for using this approach are contained in Chapter 4 of the QAG. Section 6 of this report describes how this approach was implemented.

The central feature of the method used for estimating the Standard NTGR is the set of five core questions in the interview. The responses to these questions required the Decision-Maker to assign a number between 0 and 10 to reflect the level of agreement, or the level of probability that the question or statement is true. The five items are:

1. How much influence did the financial assistance from (ESCO name) have on your decision to install (measure)?

2. If the financial assistance from (ESCO name) had not been available, how likely is it you would have installed exactly the same (measure) anyway?

3. The financial assistance from (ESCO name) was nice but it was *unnecessary* to cause the energy-efficient version of this equipment to be completed.

4. The financial assistance from (ESCO name) was a *critical factor* in doing the version of the equipment that we did.

5. We would not have been able to install the equipment that we did without the financial assistance from (ESCO name).

The NTGR interview was administered to a census of decision-makers responsible for all measures in all projects.

In order to produce a Custom NTGR, each Standard NTGR was reviewed in light of additional information in the rest of the interview, including open-ended questions, and from the program file. This review sometimes resulted in the modification of the Standard NTGR.

The objective of this research did not include estimating gross or net savings. However, an estimate of gross savings was necessary to weight the end-use level and sector-level NTGRs properly. This purpose was served by the use of the ex-ante gross savings contained in the program tracking system.

Details on how each of these pieces of information was used are presented in the following sections.

4 Sample Design

4.2 Sample Frame

The population of participants consists of 252 efficiency measures associated with 132 projects that are in turn associated with 7 contracts. Of the 132 projects, contracts with public agencies accounted for 30 (22.7%) and contracts with traditional ESCOs accounted for the remaining 102 (77.3%). Of these 132 projects, 108 are associated with commercial sites while 24 are associated with industrial sites. Table 4-1 presents the breakdown of all efficiency measures by sector.

Table 4-1. Measures Installed by Sector

Measure	Commercial	Industrial	Total
Adjustable Speed Drive	0	4	4
Chiller 200 - <600 Tons	0	2	2
Chiller 75 - <200 Tons	11	1	12
Cooling Tower	0	3	3
Indoor Lighting System Modification	19	10	29
Indoor Lighting System Replacement	78	18	96
Led Lamps	0	1	1
Motors - Three Phase	0	3	3
Outdoor Lighting System Replacement	0	1	1
Outdoor Lighting System Replacement-CFL	0	1	1
Pump System Controls (Process)	0	1	1
Interactive Savings	89	10	99
Total	197	55	252

Note that Interactive Savings is treated as a separate measure. These savings are often associated with lighting measures that were installed in buildings with HVAC systems. In Edison's "E" Tables, these interactive savings have been separated from the lighting

measures and placed in the HVAC end-use category. For consistency, this measure has been treated similarly in this study.

These measures were grouped into four end uses: 1) HVAC, 2) Lighting, and 3) Motors, and 4) Process. Table 4-2 presents the frequency of these end uses by sector.

Table 4-2. End Use Frequency by Sector

End Use	Commercial	Industrial	Total
Lighting	97	31	128
HVAC	100	13	113
Motors	0	2	2
Process	0	9	9
Total	197	55	252

There were 15 customer decision-makers associated with these 132 projects covering the 252 measures.

4.3 Sample Selection

Given the number of projects, sites, and unique decision-makers, it was decided to perform a census of all 15 decision-makers and the related projects, covering all 132 projects and the associated 252 measures.

5 Data Collection

5.2 Questionnaire Design

The questionnaires were designed to estimate the extent to which Edison or the ESCOs influenced the customers to invest in energy efficiency measures. One questionnaire was designed for those contractors who are traditional ESCOs and another was designed for those contractors who are government agencies, e.g., county government. This was done to account for differences in customer perceptions regarding the source of financial assistance. The ESCO questionnaire referred to financial assistance from the *ESCO* while the governmental questionnaire referred to financial assistance from the *Southern California Edison Company*. The only other difference was that the ESCO questionnaire included a question about satisfaction with the performance of the ESCO.

Both questionnaires are included in Appendix A.

5.3 Interviewer Training

Since the questionnaires are nearly identical to the one used in the evaluation of Edison's 1996 Energy Management Hardware Rebate Program (EMHRP) and the same firm, AESC, Inc., that collected the data for the EMHRP evaluation was hired for this study, there was no need for a formal interviewer training session. Rather, the small differences

in the Bidding questionnaire and the EMHRP questionnaire were discussed fully in the kickoff meeting.

5.4 Participant Interviews

The telephone interviews took approximately ten minutes to complete and were conducted by AESC, Inc. Data collection for all customers went as expected, except for four. Two decision-makers were extremely busy and requested that the survey be faxed to them. Both decision-makers returned the completed questionnaire. Because a third customer accounted for numerous projects, it was decided to conduct on-site interviews. Using the decision-maker questionnaire, AESC interviewed several decision-makers within the company concerning the measures installed at their separate sites. The fourth customer has recently been purchased by an out-of-state firm, which has completely changed the store management. As a result, all of the people involved with the decision to install the equipment had left the company. However, AESC was able to locate the key decision-maker for this customer and he agreed to complete the survey for each of the sites in that organization. Since this person now lives out-of-state, the surveys were conducted by telephone.

In some cases, one decision-maker was responsible for multiple sites, projects, and measures. In such cases, at the completion of the questionnaire for the first project, the decision-maker was asked whether their responses also applied to the other sites, projects and measures. This was done since such projects typically involved similar equipment, square footage, and investment economics. Table 5-1 presents a breakdown of the number of decision-makers and the number of projects with which each is associated.

As one can see, nine decision-makers are associated with only one project, two are associated with three projects each, one is associated with seven projects, one is associated with 11 projects, one is associated with 40 projects, and one is associated with 59 projects.

Table 5-1. Number of Decision-Makers and the Number of Projects with Which Each is Associated

	Number of Decision-Makers	Number of Projects For Each Decision-Maker	Total Number of Projects
	9	1	9
	2	3	6
	1	7	7
	1	11	11
	1	40	40
	1	59	59
Total	15		132

5.5 Sample Disposition

Of the 15 decision-makers, interviews were completed with all. In only two cases in which there were multiple sites, projects, or measures did the decision-makers indicate that their answers were different for other sites, projects, or measures. In one case, one decision-maker completed three questionnaires. In another case, the decision-maker completed two questionnaires. Thus, the 15 decision-makers accounted for 18 completed questionnaires covering 132 projects and 252 measures.

5.6 Data Preparation

Once the data from the 15 decision-makers were entered in an EXCEL spreadsheet, they were examined for data entry errors and out-of-range values. Next, the responses for each decision-maker were duplicated for all those sites, projects and measures to which their answers were applicable. The data were then merged with the master program database so that the analysis could begin. This process is illustrated in Figure B-1 in Appendix B.

Additional details regarding the relevant datasets are presented in Table B-1 in Appendix B. All relevant EXCEL files and SAS files are listed in Table B-1.

6 Methods for Estimating Net-To-Gross Ratios

6.2 Levels of NTGRs

NTGRs were estimated using two approaches. The first was based only on decision-maker responses to closed-ended questions. This is referred to as the Standard NTGR analysis. The second was based on all available information including program files and the answers to other closed-ended and open-ended questions on the decision-maker questionnaire. This is referred to as the Custom NTGR analysis. These two methods are described below.

Using these two methods, we estimated NTGRs at the measure level, the end-use level, and the sector level for both kWh and kW. Within each end use and at the sector level, we also estimated the overall NTGRs that took into account both the kWh and kW impacts.

6.2.1 Standard NTGRs

The standard free-ridership analysis draws on information obtained from the Decision-Maker survey. An analysis of closed-ended questions included in the Decision-Maker survey is carried out in order to derive the Standard NTGR. These core, closed-ended questions are sometimes referred to as "pre-quantified" questions since each potential answer has a specific number assigned to it.

Using the questionnaire for ESCO Projects in Appendix A as an example, the central inputs to the calculation of the Standard NTGR come from the decision-maker survey question numbers 8, 9, 20, 21, and 22. First the core questions 8, 9, 20, 21, and 22 are averaged, with question 9 and 20 values transposed to cause the large values to have the same meaning as the large values of the other questions, i.e., a large value means a high NTGR.

A potential conflict within the questionnaire occurs with question 9 which asks how likely it is that the customer would have installed the same thing without the rebate. It is known that question 9 is subject to misunderstanding because of the necessarily negative phrasing of the question. It was necessary to ask if the customer would have made the same installation if the program had *not* been in effect. This negative in the question sometimes causes misunderstandings and, therefore, answers that imply the opposite of what the respondent wanted to communicate. This potential was handled by incorporating automatic checks into the survey form that detected clear contradictions between questions 8 and 9 since this is where such a misunderstanding would become visible. Where there was a contradiction between these two answers, the interviewer is instructed in how to resolve the contradiction with suggested phrasing for presenting the apparent conflict to the respondent and requesting resolution.

6.2.2 Custom NTGRs

The custom free-ridership analysis includes the individual examination of a variety of quantitative and qualitative data. The custom analysis is a response to the concern that the core questions used to estimate the Standard NTGR could miss some critical pieces of the decision process. It is important to understand the entire story of the process of thinking about the change, considering alternatives, balancing costs and benefits, making decisions, etc. Energy efficiency could be the single reason for the change or it could be a small part of a larger picture. Because of these complexities, a wide variety of data, beginning with the Standard NTGR, were examined in estimating the Custom NTGR. The thrust of the method is to reconstruct the entire "story" (a comprehensive, internally consistent description) of the decision process.

Each data source, beyond the Standard NTGR, considered in estimating the Custom NTGR is described briefly below.

6.2.2.1 Financial Information

In cases in which financial calculations made prior to the installations were a part of the Program files, or where that or other financial information was reported in the decision-maker interview, it was taken into account in reviewing the Standard NTGR. This was accomplished by building in a probe contingent on the answer to question 9 and the financial information from two sources: payback information in the program file (when present), and the self-reported financial information from the interview. For example, when financial figures met or exceeded the criteria set by the customer for investment, without the rebate, but the Standard NTGR questions indicated high program influence (NTGR > .5), the respondent was questioned about why the rebate was necessary given the favorable financial calculations. The information gathered by such questioning was considered in the context of all the other information obtained for these projects.

6.2.2.2 Decision-Maker Open-Ended Interview Questions

This type of question had two uses. The first was to contribute to painting the whole picture of the decision process related to the rebated equipment. The second, was to detect misunderstandings embedded in the decision-maker's answers to the Standard

NTGR questions or to pick up complexities in the process that could not fit into structured categories, thus producing unexpected combinations of answers, including contradictory ones. Therefore, the answers to these questions could be compared to the pre-quantified answers to see if there were contradictions across those types of questions.

6.2.2.3 File Information

Any information contained in program files pertaining to timing and motivational issues was examined and used in estimating the final Custom NTGR.

6.2.2.4 Accelerated Installations

Question 14 on the Decision-maker questionnaire asks the respondent whether the same equipment might have been installed without the rebate, but later than was the case under the influence of the program. When accelerated installations were claimed, the respondent was asked why the equipment installation was accelerated by the time period mentioned. This information was considered and weighed in the context of all of the information gathered.

6.3 Reliability of the NTGR Analysis

For the NTGR analysis, there was a combination of quantitative and qualitative data from a variety of sources that was integrated in order to produce a final Custom NTGR. It was essential that all the projects be evaluated consistently using the same instrument. However, in a situation involving both quantitative and qualitative data, different interpretations of the data may vary from one item to another, which means that, in effect, the measurement instrument may vary from one item to another. Thus, the central issue here is one of reliability, which can be defined as obtaining consistent results over repeated measurements of the same items. The following section describes the process by which reliability was maximized.

6.4 The Integration of Data into Case Studies

Several steps were taken to ensure and to measure reliability. First, several principles were established to guide the integration of qualitative and quantitative data from the various sources associated with each project. Following is a list of the principles used together with an explanation of the principles.

1. **The Standard NTGR should stand except when there is strong evidence that it should not. No one piece of information should be used to override the Standard NTGR. Specifically, more than one piece or source of information should form a larger picture that contradicts the Standard NTGR before an override is considered.**

   The Standard NTGR is based on five pre-quantified questions in the decision-maker interview. The use of five items reduces greatly the possibility that the NTGR will be distorted in a large way by measurement error. Because of this multi-question approach, it was judged that this result should not be overridden easily. There were a number of instances where one comment in the interview could be interpreted to contradict the Standard NTGR. However, given the care with which the Standard NTGR was measured, it would be a mistake to override it with one piece of

information, which could be misinterpreted by the interviewer or by the analyst. Only when there were multiple items that contradicted the Standard NTGR were they seriously considered for forming the basis for changing the Standard NTGR.

2. **The Standard NTGR should not be changed unless the change is substantial.**

   This principle is based on several ideas. Although it was not possible to know the error band around any individual Standard NTGR, conceptually there is some band of uncertainty around any estimate. It seemed unwise to tinker in relatively small ways with the Standard NTGR, the results of which could well fall within reasonable error bands. Such tinkering would be based on qualitative information, which has to be quantified by the analysts. Unless the potential adjustment is fairly large, it seems less risky to stay with the direct, customer-based quantity than to rely on a qualitative judgement from a third party, such as the analysts, when that judgement is not based on any legitimate quantitative anchors such as payback or evidence of accelerated installations. Even where there are quantitative anchors, if the difference between the Standard NTGR and the potential customized NTGR is not great, it was judged better to adopt the Standard NTGR.

3. **When information about the projected or forecasted timing of future installations is provided in the interview, it should not be used in a routine manner. Rather, only when there is substantial evidence that accelerated installation was the *only* program influence should the specific degree of acceleration be addressed.**

   For a variety of reasons, the use of the responses to the question asking when the customer would have installed the same equipment without the program was not used routinely to affect the Standard or the Custom NTGR. Among these reasons is the fact that hypothetical forecasts are difficult to trust. Second, that question is only relevant when the customer indicates that *exactly* the same equipment would have been installed regardless of the program, but that it would have been installed later. This is an issue because it has become clear that many respondents give a projection of installation over time even when they have also said that the nature of the equipment would have been different in the absence of the program. It was decided to include the timing question only when the rest of the interview, including the open-ended questions, indicated that the *only* impact of the program was on timing. This judgement could only be made by examining the entire interview and other project documentation. When that condition was met, then it became essential to base the NTGR solely on the timing forecast. The translation of the forecasted installations into NTGR terms was done based on a Forecast Conversion Table used in other studies[1] and recently proposed by one ORA reviewer. Table 6-1 is the conversion table used in this project and others. While these factors appear to be gaining

[1] Spanner, G, and Riewer, S, 1990. "The Energy $avings Plan: Incentives for Efficiency Improvements in the Industrial Sector." Proceedings of the ACEEE Summer Study. Washington DC. Pp. 7.251 to 7.260.

Spanner, G., Dixon, D. and Fishbaugher, M, 1990. "Impact Evaluation of an Energy $avings Plan Project at Bellingham Cold Storage." Bonneville Power Administration, Portland OR. Pp. 2.8-2.9.

acceptance in the calculation of the NTGR, Edison is unaware of any studies, which confirm the validity of these conversion factors.

Table 6-1. Forecast Conversion

Forecasted Installation of Same Equipment	Implied NTGR
Less than 6 months	0
6 to 12 months	.125
1 to 2 years	.25
2 to 3 years	.5
3 to 4 years	.75
4 or more years	1.0
Never	1.0

Another basis for estimating a NTGR in the custom process was through the use of payback periods. A conversion of paybacks into NTGR terms was provided in the Protocols.[2] This table (Table 6-2) is repeated below for convenient reference.

Table 6-2. Payback Conversion

Payback Period	Implied NTGR
6 months or less	.40
More than 6 months and less than 2 years	.75
2 years or more	1.00

While this mapping of paybacks into NTGRs was designed for those measures and end uses that comprise the bottom 50 percent of a program's savings, it can be used to put a customer's payback into context so that it can be used, *along with all the other available information*, to estimate the final Custom NTGR.

With these principles in mind, the following steps were followed:

1. Each member of the team summarized information thought important to consider in customizing the NTGR. These summaries were not compared at this point.

[2] *Protocols and Procedures for the Verification of Costs, Benefits, and Shareholder Earnings from Demand Side Management Programs*, adopted by the California Public Utilities Commission in May of 1993, and most recently revised in January of 1997. Table C-5:Impact Measurement Protocols for the Industrial Energy Efficiency Incentives Program

2. Each member made independent judgments and categorized interviews and file information related to 18 completed interviews. Each project and its related measures was put into one of three groups:

    - Standard NTGR should be the same as the Custom NTGR
    - Standard NTGR should be higher than the Custom NTGR
    - Standard NTGR should be lower than the Custom NTGR

3. These judgements were compared and an inter-rater reliability calculation was made. There was an agreement rate of 86 percent on these 18 cases.

4. Disagreements on the 14 percent of the cases were resolved using the principles and further refinements of them. The disagreements fell into two categories.

    - One rater had missed a critical piece of information in the interview or program file, or

    - Disagreement about the weight to put on different pieces of conflicting information

    Neither of these bases for disagreement can be systematically corrected by rules or principles; they are a matter of judgement.

5. The reviewers then independently estimated the magnitude of the adjustment for those NTGRs that required an adjustment.

6. The recommended adjustments were then compared and any differences resolved.

7. Finally, the rationales for the custom results were written (see Appendix C).

6.4.1 End-Use and Sector-Level NTGRs

Of course, when one attempts to estimate a NTGR beyond the measure level, one must combine all the NTGRs in a way that reflects the magnitude of the gross kW and kWh impacts specific to each measure. These gross impacts are *ex ante* estimates taken from the DSM Bidding Program database.

6.4.1.1 End-Use and Sector-Level NTGRs for kWh and kW

The NTGRs for kWh and kW at the end-use level were calculated in four steps. They are:

1. For each measure, the *ex ante* gross kWh and kW were multiplied by the final NTGR to produce measure-level *net* kWh and kW,

2. Within each sector, the measure-level *net* kWh and kW impacts were then summed within each end use, and

3. Within each sector, the measure-level *ex ante gross* kWh and kW impacts were then summed within each end use,

4. Within each sector within each end use, the *net* kWh and kW impacts were divided by the *ex ante gross* kWh and kW impacts.

To estimate the sector-level kWh and kW NTGRs, the end use net and gross kWh and kW impacts within each sector are then summed *across* all end uses. Next, the net kWh and kW impacts are divided by the gross kWh and kW impacts to produce the sector-level kWh and kW NTGRs.

The procedures described above produced estimates of the NTGRs for both kWh and kW within each sector within each end use and at the sector-level (i.e., *across* all end uses).

6.4.1.2 Overall End-Use and Sector NTGRs

Before the overall end-use (across both kWh and kW) and sector-level NTGRs (across both kWh and kW *and* end uses) could be calculated, both the gross and net kWh and kW impacts were converted into a common monetary unit, dollars. This was accomplished by multiplying both the net and gross kWh and kW impacts by the marginal costs to produce *monetized* net and gross impacts. However, before the net and gross kWh and kW impacts could be multiplied by the marginal energy and capacity costs, these net and gross kWh and kW impacts had to be allocated to the various costing periods presented in Tables 6-3 and 6-4. Once the net and gross kWh and kW impacts were allocated to costing periods, they were then multiplied by the marginal cost associated with each costing period. Appropriate marginal costs were obtained from Edison's "C" Table, which contains data needed to support its earnings claims. Tables 6-5 and 6-6 present the 1996 marginal kWh and kW costs by time of day and season.

Once calculated, these monetized net and gross kWh and kW impacts could then be summed within each end-use and sector. Finally, within each end-use and sector, the net monetized impacts were divided by the gross monetized impacts. These calculations yielded the overall end-use and sector-level NTGRs.

Table 6-3. Costing Period Allocations for Energy

	Summer On Peak	Summer Partial Peak	Summer Off Peak	Winter Partial Peak	Winter Off Peak
Industrial Process	.18	.16	.14	.36	.16
Indoor Lighting	.11	.13	.11	.50	.15
Outdoor Lighting	0	.06	.24	.07	.63
Led Lamps	.06	.10	.19	.25	.40
HVAC	.18	.20	.16	.28	.18
Motors/Pump System Controls	.18	.16	.14	.36	.16

Table 6-4. Costing Period Allocations for Capacity

	Summer On Peak	Summer Partial Peak	Summer Off Peak	Winter Partial Peak	Winter Off Peak
Industrial Process	1	.95	.43	.80	.34
Indoor Lighting	1	1	.76	1	.90
Outdoor Lighting	0	.71	1	.73	1
Led Lamps	1	1	1	1	1
HVAC	1	.96	.60	.65	.45
Motors/Pump System Controls	1	.95	.43	.80	.34

Table 6-5. 1996 Marginal Energy Costs

Costing Period	$/kWh
Summer On Peak	.05174
Summer Partial Peak	.03371
Summer Off Peak	.03191
Winter Partial Peak	.04717
Winter Off Peak	.03997

Table 6-6. 1996 Marginal Capacity Costs

Costing Period	$/kW
Summer On Peak	19.61
Summer Partial Peak	5.35
Summer Off Peak	1.2
Winter Partial Peak	7.54
Winter Off Peak	1.14

6.4.2 NTGR Confidence Intervals

Both the 80 percent and 90 percent confidence intervals for the final, Custom NTGRs were calculated for both kWh and kW within each end use, for the end use as a whole, and for each sector. These confidence intervals were calculated in two steps. First, the variance of the NTGR was estimated using the following equation:

$$v(\hat{R}) = \frac{(1-f)}{n\bar{x}^2}(s_y^2 + \hat{R}^2 s_x^2 - 2\hat{R}s_{yx}) \qquad (3)$$

where

$v(\hat{R})$ = Variance of the NTGR

$\hat{R} = \frac{\bar{y}}{\bar{x}}$,the NTGR

f = Sampling fraction

n = Size of sample

$\bar{x}$ = Mean of gross impacts

$\bar{y}$ = Mean of net impacts

s_x^2 = Variance of the gross impacts

s_y^2 = Variance of the net impacts

s_{yx} = Covariance of the gross and net impacts

Once the variance of $\hat{R}$ was estimated, then the following equation was used to estimate the 80 percent and 90 percent confidence intervals:

$$\hat{R} = \pm z\sqrt{v(\hat{R})} \qquad (4)$$

where z = the critical values for the 80% and 90% levels of confidence, i.e., 1.28 and 1.64.

Confidence intervals for the measure-level NTGR was calculated using the following formula:

$$\overline{NTGR} \pm ts \qquad (5)$$

where t = the critical value from the t distribution
s = the standard error of the mean NTGR.

The critical values for the 80% and 90% levels of confidence are 1.28 and 1.64 respectively.

7 Results of Net-To-Gross Ratio Analysis

In this section, the NTGRs for kWh and kW for the commercial and industrial sectors will first be presented at the measure, the end-use, and the sector levels. Next, the overall end-use NTGRs across both kWh and kW will be presented. Finally, the overall sector NTGRs across both kWh and kW *and* end uses will be presented.

The results of the Standard NTGR analysis will be presented first followed by the results of the Custom NTGR analysis.

7.2 Standard NTGR Results

7.2.1 Measure-Level Standard NTGRs

For the 252 measures, the Standard NTGR was calculated by sector. The Standard NTGR was based *only* on the responses to the core questions in the decision-maker survey. The unweighted, overall commercial NTGR based on information for all 197 measures is .691

with a standard deviation of .26. The NTGR for the industrial sector based on information for all 55 measures is .867 with a standard deviation of .12.

7.2.2 End-Use Level Standard NTGR Results

The Standard NTGR, weighted by savings, was calculated for kWh, kW, and overall for each end use. Also included are the confidence intervals at the 80% and 90% confidence levels. Table 7-1 presents these results for commercial HVAC and Lighting end uses. Table 7-2 presents the results for industrial HVAC and Lighting end uses. Table 7-3 presents the results for industrial Motors and Process end uses.

Table 7-1. Standard Commercial NTGRs
For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Standard NTGR	0.565	0.520	0.562	0.617	0.625	0.618
80% Confidence	+/- .011	+/- .011	+/- .011	+/- .015	+/- .012	+/- .014
90% Confidence	+/- .015	+/- .015	+/- .015	+/- .019	+/- .016	+/- .018

Table 7-2. Standard Industrial NTGRs
For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Standard NTGR	0.918	1.0	0.923	0.833	0.836	0.833
80% Confidence	+/- .065	+/- .108	+/- .065	+/- .031	+/- .029	+/- .030
90% Confidence	+/- .083	+/- .138	+/- .083	+/- .039	+/- .037	+/- .039

Table 7-3. Standard Industrial NTGRs
For Motors and Process by kWh, kW, and Overall End Use

	Motors kWh	Motors kW	Motors Overall	Process kWh	Process kW	Process Overall
Standard NTGR	1.0	1.0	1.0	0.889	0.948	0.891
80% Confidence	+/- .221	+/- .254	+/- .223	+/- .053	+/- .049	+/- .052
90% Confidence	+/- .283	+/- .325	+/- .286	+/- .067	+/- .062	+/- .067

7.2.3 Sector-Level Standard NTGR Results

Across the Lighting and HVAC end uses for the commercial sector and across the Lighting, HVAC, Motors, and Process end uses for the industrial sector, the Standard NTGRs for kWh, kW, and the overall sector, weighted by savings, are presented in

Tables 7-4 and 7-5. The 80 percent and 90 percent confidence intervals are also presented.

Table 7-4. Standard Commercial NTGRs by kWh, kW, and Overall Sector

	All Commercial kWh	All Commercial kW	All Commercial Overall
Standard NTGR	.605	0.605	0.605
80% Confidence	+/-.011	+/- .010	+/- .011
90% Confidence	+/-.014	+/- .013	+/- .014

Table 7-5. Standard Industrial NTGRs by kWh, kW, and Overall Sector

	Industrial kWh	Industrial kW	Industrial Overall
Standard NTGR	.843	0.849	0.844
80% Confidence	+/-.021	+/- .022	+/- .022
90% Confidence	+/-.027	+/- .028	+/- .028

7.3 Custom NTGR Results

Finally, the NTGR was adjusted further by taking into account additional information so that a more complete picture of the conditions surrounding the installation of the efficient equipment could be gained. The case studies for each of the completed questionnaires are presented in Appendix C. This qualitative information was then used to *modify* the Standard NTGRs or *support* them.

7.3.1 Measure-Level Custom NTGRs

In the custom analysis of the 197 commercial measures examined, the Standard unweighted NTGR was modified for 196 measures. Of these 196 modifications, 80 were decreases and 116 were increases. The average decrease was .150 while the average increase was .516. These changes produced by the custom analysis produced an overall increase in the commercial, standard, unweighted NTGR of .244, yielding a Custom NTGR of .935 with a standard deviation of .09. For the remaining one commercial measure and the 55 industrial measures, the Standard NTGR did not change since any information identified provided insufficient grounds for *changing* the Standard NTGR or served only to *confirm* the Standard NTGR.

7.3.2 End-Use Level Custom NTGRs

The Custom NTGR was calculated for kWh, kW, and overall for each end use. Also included are the confidence intervals at the 80% and 90% confidence levels. Table 7-6 presents these results for commercial HVAC and Lighting end uses. Table 7-7 presents

the results for industrial HVAC, Lighting end uses. Table 7-8 presents the results for industrial Motors and Process end uses.

Table 7-6. Custom Commercial NTGRs
For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Custom NTGR	0.985	1.0	0.987	0.952	0.954	0.952
80% Confidence	+/- .019	+/- .014	+/- .017	+/- .017	+/- .022	+/- .019
90% Confidence	+/- .024	+/- .018	+/- .022	+/- .021	+/- .028	+/- .024

Table 7-7. Custom Industrial NTGRs
For HVAC and Lighting by kWh, kW, and Overall End Use

	HVAC kWh	HVAC kW	HVAC Overall	Lighting kWh	Lighting kW	Lighting Overall
Custom NTGR	0.918	1.0	0.923	0.833	0.836	0.833
80% Confidence	+/- .065	+/- .108	+/- .065	+/- .031	+/- .029	+/- .030
90% Confidence	+/- .083	+/- .138	+/- .083	+/- .039	+/- .037	+/- .039

Table 7-8. Custom Industrial NTGRs
For Motors and Process by kWh, kW, and Overall End Use

	Motors kWh	Motors kW	Motors Overall	Process kWh	Process kW	Process Overall
Custom NTGR	1.0	1.0	1.0	0.889	0.948	0.891
80% Confidence	+/- .221	+/- .254	+/- .223	+/- .053	+/- .049	+/- .052
90% Confidence	+/- .283	+/- .325	+/- .286	+/- .067	+/- .062	+/- .067

7.3.3 Sector-Level Custom NTGRs

Across the Lighting and HVAC end uses for the commercial sector and across the Lighting, HVAC, Motors, and Process end uses for the industrial sector, the Custom NTGRs for kWh and kW are presented in Tables 7-9 and 7-10. Also presented in these tables are the NTGRs for each sector across end uses *and* kWh and kW. The 80 percent and 90 percent confidence intervals are also presented.

Table 7-9. Custom Commercial NTGRs by kWh and kW and Overall Sector

	All Commercial kWh	All Commercial kW	All Commercial Overall
Custom NTGR	.961	0.960	0.962
80% Confidence	+/-.013	+/- .011	+/- .013
90% Confidence	+/-.016	+/- .014	+/- .016

Table 7-10. Custom Industrial NTGRs by kWh and kW and Overall Sector

	All Industrial kWh	All Industrial kW	All Industrial Overall
Custom NTGR	.843	0.849	0.844
80% Confidence	+/-.021	+/- .022	+/- .022
90% Confidence	+/-.027	+/- .028	+/- .028