Appendix A

E3 Calculations and Related Reference Information

(Original Version Using 2010-2012 E3 Calculator)

Program Summary		Nominal		Present Value
Proposer Name		0		
Program Name		0		
Total Program Budget ($)	$	861,781		741,436
Net Participant Cost ($)	$	3,256,929	$	2,285,601

Avoided Cost Version
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Program Impacts	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net Jul-Sept Pk (kW)	Net Dec-Feb Pk (kW)	User Entered kW
2010-2012	-	-	-	-	-	-	-
2013-2016	3,687,674	50,849,636	345,697	4,443,422	1,385	931	1,253
2017-2020	-	-	-	-	-	-	-

Cost Effectiveness (Lifecycle Present Value Dollars)			Benefits			Benefit - Cost		
		Cost	Electric	Gas	Incentives	NPV	B/C Ratio	Notes
Program TRC ($)	$	3,027,037	$2,777,299	$2,207,571	NA	$1,957,832	1.65	*1
Program PAC ($)	$	741,436	$2,777,299	$2,207,571	NA	$4,243,433	6.72	*1,2
Program RIM ($)	$	11,599,434	$2,777,299	$2,207,571	NA	($6,614,564)	0.43	*1

*1 B/C Ratio is an approximation because any supply cost increases are treated as negative benefits rather than as a cost as in the Standard Practice Manual

*2 PAC benefits include environmental costs. This is to be consistent with the TRC benefits, but is not strictly consistent with the Standard Practice Manual.

Levelized Cost and Benefit (All Measures Installed through 2020)	Discounted Savings							Benefit - Cost
	kWh	Therms		Cost		Benefits		NPV
TRC ($/kWh)	21,548,014		$	0.0909	$	0.1289	$	0.0380
PAC ($/kWh)	21,548,014		$	0.0207	$	0.1289	$	0.1082
RIM ($/kWh)	21,548,014		$	0.2999	$	0.1289	$	(0.1710)
TRC ($/therm)		1,982,572	$	0.19	$	1.11	$	0.9258
PAC ($/therm)		1,982,572	$	0.12	$	1.11	$	0.9971
RIM ($/therm)		1,982,572	$	2.59	$	1.11	$	(1.4775)

Emissions Reductions	Electric Reductions			Gas Reductions	
Annual Reductions	CO2 (tons)	NOX (lbs)	PM-10 (lbs)	CO2 (tons)	NOX (lbs)
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
2013	1,080	284	140	1,112	1,749
2014	956	251	124	910	1,432
2015	-	-	-	-	-
2016	-	-	-	-	-
2017	-	-	-	-	-
2018	-	-	-	-	-
2019	-	-	-	-	-
2020	-	-	-	-	-
Total Annual	2,036	534	263	2,022	3,180
Lifecycle Reductions					
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
2013	14,940	3,932	1,933	14,359	22,582
2014	13,215	3,480	1,709	11,635	18,298
2015	-	-	-	-	-
2016	-	-	-	-	-
2017	-	-	-	-	-
2018	-	-	-	-	-
2019	-	-	-	-	-
2020	-	-	-	-	-

* annual reductions are the units implemented in the year, times the annual emission reduction for the measure.

Program Summary		Nominal	Present Value
Proposer Name		0	
Program Name		0	
Total Program Budget ($)	$	861,781	741,436
Net Participant Cost ($)	$	3,256,929	$ 2,285,601

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Total Lifecycle	28,154	7,412	3,642	25,994	40,879

Reductions based on total annual installations

	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)	User Entered kW	Net Annual NCP (kW)
2010	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-
2013	1,956,988	26,989,150	190,075	2,454,554	721	485	651.94	645
2014	1,730,685	23,860,486	155,622	1,988,868	663	446	600.66	856
2015	-	-	-	-	-	-	-	362
2016	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	-
2018	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-
Total	3,687,674	50,849,636	345,697	4,443,422	1,385	931	1,253	1,863

Net Impacts by Sector (All Measures Installed through 2020)

	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	3,687,674	50,849,636	345,697	4,443,422	1,385	931		1,253	1,997,832
RES	338,960	6,101,280	-	-	211	5		123	(22,934)
NON_RES	-	-	-	-	-	-		-	-
Residential	1,621,453	22,436,641	166,816	1,973,640	483	382		439	1,163,116
Res_New_Construction	-	-	-	-	-	-		-	-
COMMERCIAL	1,727,260	22,311,715	178,881	2,469,782	690	543		690	860,030
INDUSTRIAL	-	-	-	-	-	-		-	-
AGRICULTURAL	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
Other and upspecified	-	-	-	-	-	-	-	-	(2,379)

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by CPUC End Use Categories (All Measures Installed through 2020)

	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb Pk (kW)	User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	3,687,674	50,849,636	345,697	4,443,422	1,385	931	1,253	1,957,832

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 861,781	741,436
Net Participant Cost ($)	$ 3,256,929	$ 2,285,601

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Clothes Dryer	20,148	362,664	-	-	8	1		4	(12,521)
Clothes Washer	-	-	-	-	-	-		-	-
Consumer Electronics	-	-	-	-	-	-		-	-
Cooking	-	-	-	-	-	-		-	-
Dishwasher	-	-	-	-	-	-		-	-
Other Appliance	-	-	-	-	-	-		-	-
Office Equipment	-	-	-	-	-	-		-	-
Building shell	-	-	-	-	-	-		-	(34,368)
Space Cooling	1,008,018	15,350,928	330,796	4,310,052	471	25		98	1,928,011
Space Heating	-	-	-	-	-	-		-	-
Ventilation	-	-	-	-	-	-		-	-
Interior Lighting	1,589,690	18,095,546	-	-	740	779		964	439,562
Exterior Lighting	-	-	-	-	-	-		-	(573,304)
Daylighting	-	-	-	-	-	-		-	-
Motors	63,840	957,600	-	-	1	1		1	3,659
Process	179,550	1,795,500	8,645	86,450	18	27		18	59,649
Compressed Air	-	-	-	-	-	-		-	-
Food Processor	-	-	-	-	-	-		-	-
Refrigeration	770,399	13,867,188	-	-	138	89		162	242,804
Freezers	-	-	-	-	-	-		-	-
Pumps	-	-	-	-	-	-		-	-
Pool Pump	-	-	-	-	-	-		-	-
Domestic Hot Water	-	-	-	-	-	-		-	-
Water Heating	56,028	420,210	6,256	46,920	8	10		7	(53,279)
Other or unspecified	-	-	-	-	-	-	-	-	(42,379)

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by Climate Zone (All Measures Installed through 2020)

	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net dec-Feb Pk (kW)	User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	3,687,674	50,849,636	345,697	4,443,422	1,385	931	1,253	1,997,832
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3A	3,687,674	50,849,636	345,697	4,443,422	1,385	931	1,253	1,997,832
3B	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
System	-	-	-	-	-	-	-	-

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Persistent reductions in the summer (3rd Qtr) or winter (4th Qtr) of each year

	Net July-Sept Peak (kW)	Net Annual Dec-Feb (kW)
2010	-	-
2011	-	-
2012	-	-
2013	348	485
2014	1,098	931
2015	1,385	931
2016	1,385	931

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 861,781	741,436
Net Participant Cost ($)	$ 3,256,929	$ 2,285,601

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2017	1,385	931
2018	1,385	931
2019	1,385	931
2020	1,385	927
2021	1,374	887

Monthly Impacts

First Year for Impact Table: 2010

	Quarter	Monthly Five Hour Avg or TOU Peak	Net Monthly NCP (kW)	Monthly Net kWh	Monthly Net Therms
January-10	1	-	-	-	-
February-10	1	-	-	-	-
March-10	1	-	-	-	-
April-10	2	-	-	-	-
May-10	2	-	-	-	-
June-10	2	-	-	-	-
July-10	3	-	-	-	-
August-10	3	-	-	-	-
September-10	3	-	-	-	-
October-10	4	-	-	-	-
November-10	4	-	-	-	-
December-10	4	-	-	-	-
January-11	5	-	-	-	-
February-11	5	-	-	-	-
March-11	5	-	-	-	-
April-11	6	-	-	-	-
May-11	6	-	-	-	-
June-11	6	-	-	-	-
July-11	7	-	-	-	-
August-11	7	-	-	-	-
September-11	7	-	-	-	-
October-11	8	-	-	-	-
November-11	8	-	-	-	-
December-11	8	-	-	-	-
January-12	9	-	-	-	-
February-12	9	-	-	-	-
March-12	9	-	-	-	-
April-12	10	-	-	-	-
May-12	10	-	-	-	-
June-12	10	-	-	-	-
July-12	11	-	-	-	-
August-12	11	-	-	-	-
September-12	11	-	-	-	-
October-12	12	-	-	-	-
November-12	12	-	-	-	-
December-12	12	-	-	-	-
January-13	13	-	-	-	-
February-13	13	-	-	-	-
March-13	13	-	-	-	-
April-13	14	127	150	30,042	3,447
May-13	14	130	155	31,153	3,447
June-13	14	149	171	33,023	3,447

Program Summary		Nominal	Present Value
Proposer Name		0	
Program Name		0	
Total Program Budget ($)		$ 861,781	741,436
Net Participant Cost ($)		$ 3,256,929	$ 2,285,601

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July-13	15	351	422	80,499	7,788
August-13	15	352	395	80,282	7,788
September-13	15	341	468	77,722	7,788
October-13	16	466	645	111,572	12,130
November-13	16	366	391	130,736	12,130
December-13	16	368	400	134,744	12,130
January-14	17	486	524	177,428	15,840
February-14	17	484	517	173,443	15,840
March-14	17	484	517	172,518	15,840
April-14	18	767	904	174,205	18,824
May-14	18	781	937	180,915	18,824
June-14	18	897	1,032	192,213	18,824
July-14	19	1,106	1,332	247,534	22,774
August-14	19	1,111	1,245	246,848	22,774
September-14	19	1,076	1,477	238,756	22,774
October-14	20	1,083	1,501	253,250	26,483
November-14	20	851	910	297,364	26,483
December-14	20	854	929	306,700	26,483
January-15	21	932	1,005	334,759	28,808
February-15	21	929	993	327,099	28,808
March-15	21	928	992	325,320	28,808
April-15	22	1,180	1,392	267,515	28,808
May-15	22	1,202	1,442	277,835	28,808
June-15	22	1,380	1,587	295,210	28,808
July-15	23	1,396	1,680	312,561	28,808
August-15	23	1,401	1,571	311,698	28,808
September-15	23	1,358	1,863	301,503	28,808
October-15	24	1,179	1,634	275,729	28,808
November-15	24	927	991	324,144	28,808
December-15	24	931	1,012	334,300	28,808
January-16	25	932	1,005	334,759	28,808
February-16	25	929	993	327,099	28,808
March-16	25	928	992	325,320	28,808
April-16	26	1,180	1,392	267,515	28,808
May-16	26	1,202	1,442	277,835	28,808
June-16	26	1,380	1,587	295,210	28,808
July-16	27	1,396	1,680	312,561	28,808
August-16	27	1,401	1,571	311,698	28,808
September-16	27	1,358	1,863	301,503	28,808
October-16	28	1,179	1,634	275,729	28,808
November-16	28	927	991	324,144	28,808
December-16	28	931	1,012	334,300	28,808

ENERGY EFFICIENCY OPPORTUNITIES FOR TENANT – OCCUPIED SPACES	
BUNDLE_01: FAN, LIGHTING AND CONTROLS	
L-01	Energy Star Rated Ceiling Fan with LED lighting
L-02	Super T8 Fluorescent Lighting in Kitchens
L-03	EnergyStar Labeled Dimmable LED Replacement
L-04	5 watts
L-05	10 watts
L-06	15 watts
L-07	20 watts
L-08	Occupancy Sensor
L-09	Energy Star® Labeled LED Torchiere
BUNDLE_02: HVAC	
AC-01	Digital thermostat allowing automatic setback after override and (one of the following):
AC-02	Energy-Efficient Package Terminal Air Conditioners and Heat Pumps
AC-03	EnergyStar® Labeled Room Air Conditioners
AC-04	EnergyStar® Labeled Portable Electric Heaters
BUNDLE_03: APPLIANCES	
APP-01	EnergyStar® Labeled Refrigerators
APP-02	EnergyStar® Labeled Dryer
APP-03	EnergyStar® Labeled Cloth Washer Tier 1
APP-04	EnergyStar® Labeled Cloth Washer Tier 2
APP-05	EnergyStar® Labeled Cloth Washer Tier 3
APP-06	EnergyStar® Labeled Dishwasher Tier 1
APP-07	EnergyStar® Labeled Dishwasher Tier 2
APP-08	EnergyStar® Labeled Smart Electric Strip (one per unit)
BUNDLE_04: ENVELOPE	
ENV-01	Seal cracks on floors, wall, and ceilings
ENV-02	Weather-stripping windows and doors. Door sweepers
ENV-03	Insulate hot water piping inside occupied unit
ENV-04	Window films where allowed by code
BUNDLE_05: WATER	
W-01	Low flow shower heads
W-02	Faucet aerators
BUNDLE_06: ENERGY EDUCATION	
EE-01	Educate tenants in how to conserve energy and water

ENERGY EFFICIENCY OPPORTUNITIES FOR COMMON AREAS	
LIGHTING:	
L-10	Exterior lighting retrofits with LED and /or induction technologies
L-11	High efficient exit signs
L-12	Outdoor lighting controls (photocells / dual-level lighting controls)
L-13	Super T8 Fluorescent Lighting
L-14	EnergyStar Labeled Dimmable LED Replacement
L-15	5 watts
L-16	10 watts
L-17	15 watts
L-18	20 watts
L-19	Occupancy Sensor
L-20	Bi-level sensor on stair-wells
ENVELOPE:	
ENV-05	High performance dual pane windows
ENV-06	Attic, Ceiling, Roof, and Wall insulation
ENV-07	Cool roof - flat roof
ENV-08	Cool roof - steep slope
ENV-09	Window films where allowed by code
HVAC:	
AC-05	Central heating and cooling cleaning and tune ups
AC-06	High efficiency hot water boilers (condensing)
AC-07	Heating pipe insulation
AC-08	Heating control installation, including energy management systems, boiler reset controls, and optimization control strategies
AC-09	High efficiency central forced air furnace heating systems
AC-10	Premium efficiency motors for pumps and fans (central equipment / or common areas systems)
AC-11	Central A/C Tier 3
AC-12	Central A/C Tier 4
AC-13	Packaged Terminal AC & HP
APPLIANCES:	
APP-09	Clothes washers (coin-op) Tier 1
APP-10	Clothes washers (coin-op) Tier 1
APP-11	Clothes washers (coin-op) Tier 1
APP-12	ENERGY EDUCATION:
APP-13	Train personnel in how to conserve water and energy

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 1,380,024	1,172,405
Net Participant Cost ($)	$ 5,734,599	$ 4,167,482

Avoided Cost Version
5/4/2010
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Base Year
2010
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Program Impacts	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net Jul-Sept Pk (kW)	Net Dec-Feb Pk (kW)	User Entered kW
2010-2012	-	-	-	-	-	-	#VALUE!
2013-2016	9,177,970	154,269,579	175,064	3,527,928	1,526	1,149	#VALUE!
2017-2020	-	-	-	-	-	-	#VALUE!

Cost Effectiveness (Lifecycle Present Value Dollars)		Benefits					
	Cost	Electric	Gas	Incentives	Benefit - Cost NPV	B/C Ratio	Notes
Program TRC ($)	$ 5,339,887	$8,947,712	$0	NA	$3,607,825	1.68	*1
Program PAC ($)	$ 1,172,405	$8,947,712	$0	NA	$7,775,307	7.63	*1,2
Program RIM ($)	$ 21,332,335	$8,947,712	$0	NA	($12,384,623)	0.42	*1

*1 B/C Ratio is an approximation because any supply cost increases are treated as negative benefits rather than as a cost as in the Standard Practice Manual
*2 PAC benefits include environmental costs. This is to be consistent with the TRC benefits, but is not strictly consistent with the Standard Practice Manual.

Levelized Cost and Benefit (All Measures Installed through 2020)	Discounted Savings				
	kWh	Therms	Cost	Benefits	Benefit - Cost NPV
TRC ($/kWh)	39,504,269		$ 0.1277	$ 0.2265	$ 0.0988
PAC ($/kWh)	39,504,269		$ 0.0294	$ 0.2265	$ 0.1971
RIM ($/kWh)	39,504,269		$ 0.5400	$ 0.2265	$ (0.3135)
TRC ($/therm)		1,329,043	$ -	$ -	$ -
PAC ($/therm)		1,329,043	$ -	$ -	$ -
RIM ($/therm)		1,329,043	$ -	$ -	$ -

Emissions Reductions	Electric Reductions			Gas Reductions		
Annual Reductions	CO2 (tons)	NOX (lbs)	PM-10 (lbs)	CO2 (tons)	NOX (lbs)	
2010	-	-	-	-	-	* annual reductions are the units
2011	-	-	-	-	-	implemented in the year, times
2012	-	-	-	-	-	the annual emission reduction
2013	2,572	667	334	512	805	for the measure.
2014	2,419	627	314	512	806	
2015	-	-	-	-	-	
2016	-	-	-	-	-	
2017	-	-	-	-	-	
2018	-	-	-	-	-	
2019	-	-	-	-	-	
2020	-	-	-	-	-	
Total Annual	4,991	1,294	648	1,024	1,611	
Lifecycle Reductions						
2010	-	-	-	-	-	
2011	-	-	-	-	-	
2012	-	-	-	-	-	
2013	44,035	11,488	5,709	10,320	16,229	
2014	40,439	10,541	5,244	10,319	16,227	
2015	-	-	-	-	-	
2016	-	-	-	-	-	
2017	-	-	-	-	-	
2018	-	-	-	-	-	
2019	-	-	-	-	-	
2020	-	-	-	-	-	

Program Summary		Nominal		Present Value
Proposer Name		0		
Program Name		0		
Total Program Budget ($)	$	1,380,024		1,172,405
Net Participant Cost ($)	$	5,734,599	$	4,167,482

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Total Lifecycle	84,474	22,029	10,953	20,638	32,457

Reductions based on total annual installations	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)	User Entered kW	Net Annual NCP (kW)
2010	-	-	-	-	-	-	#VALUE!	-
2011	-	-	-	-	-	-	#VALUE!	-
2012	-	-	-	-	-	-	#VALUE!	-
2013	4,727,466	80,380,811	87,486	1,764,072	808	608	#VALUE!	811
2014	4,450,504	73,888,767	87,578	1,763,856	719	540	#VALUE!	1,261
2015	-	-	-	-	-	-	#VALUE!	82
2016	-	-	-	-	-	-	#VALUE!	(110)
2017	-	-	-	-	-	-	#VALUE!	-
2018	-	-	-	-	-	-	#VALUE!	-
2019	-	-	-	-	-	-	#VALUE!	-
2020	-	-	-	-	-	-	#VALUE!	-
Total	9,177,970	154,269,579	175,064	3,527,928	1,526	1,149	#VALUE!	2,043

Net Impacts by Sector (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	9,177,970	154,269,579	175,064	3,527,928	1,526	1,149		#VALUE!	3,886,219
RES	-	-	-	-	-	-		-	-
NON_RES	-	-	-	-	-	-		-	-
Residential	-	-	-	-	-	-		-	-
Res_New_Construction	-	-	-	-	-	-		-	-
COMMERCIAL	14,936,414	207,519,888	1,091,297	2,788,464	2,318	1,807		1,734	3,910,206
INDUSTRIAL	-	-	-	-	-	-		-	-
AGRICULTURAL	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
Other and upspecified	(5,758,444)	(53,250,309)	(916,233)	739,464	(792)	(659)	-	#VALUE!	(23,987)

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by CPUC End Use Categories (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb Pk (kW)	User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	9,177,970	154,269,579	175,064	3,527,928	1,526	1,149	#VALUE!	3,607,825

Program Summary	Nominal		Present Value
Proposer Name		0	
Program Name		0	
Total Program Budget ($)	$	1,380,024	1,172,405
Net Participant Cost ($)	$	5,734,599	$ 4,167,482

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Clothes Dryer	-	-	-	-	-	-		-	-
Clothes Washer	-	-	-	-	-	-		-	-
Consumer Electronics	-	-	-	-	-	-		-	-
Cooking	-	-	-	-	-	-		-	-
Dishwasher	-	-	-	-	-	-		-	-
Other Appliance	-	-	-	-	-	-		-	-
Office Equipment	-	-	-	-	-	-		-	-
Building shell	-	-	-	-	-	-		-	-
Space Cooling	2,396,736	35,225,280	-	-	(39)	(20)		51	1,255,815
Space Heating	-	-	-	-	-	-		-	-
Ventilation	-	-	-	-	-	-		-	-
Interior Lighting	10,484,589	153,874,435	995,825	879,024	2,323	1,789		1,522	2,832,112
Exterior Lighting	1,739,657	13,087,469	-	-	29	35		-	496,078
Daylighting	-	-	-	-	-	-		-	-
Motors	-	-	-	-	-	-		-	-
Process	-	-	-	-	-	-		-	-
Compressed Air	-	-	-	-	-	-		-	-
Food Processor	-	-	-	-	-	-		-	-
Refrigeration	315,432	5,332,704	95,472	1,909,440	5	3		161	(673,799)
Freezers	-	-	-	-	-	-		-	-
Pumps	-	-	-	-	-	-		-	-
Pool Pump	-	-	-	-	-	-		-	-
Domestic Hot Water	-	-	-	-	-	-		-	-
Water Heating	-	-	-	-	-	-		-	-
Other or unspecified	(5,758,444)	(53,250,309)	(916,233)	739,464	(792)	(659)	-	#VALUE!	(302,381)

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by Climate Zone (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net dec-Feb Pk (kW)	User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	14,936,414	207,519,888	1,091,297	2,788,464	2,318	1,807	1,734	3,886,219
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3A	14,936,384	207,519,149	1,086,634	2,671,872	2,318	1,807	1,594	4,782,079
3B	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-
System	30	739	4,664	116,592	-	-	140	(895,860)

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Persistent reductions in the summer (3rd Qtr) or winter (4th Qtr) of each year	Net July-Sept Peak (kW)	Net Annual Dec-Feb (kW)
2010	-	-
2011	-	-
2012	-	-
2013	490	911
2014	1,779	1,680
2015	2,070	1,566
2016	2,021	1,566

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 1,380,024	1,172,405
Net Participant Cost ($)	$ 5,734,599	$ 4,167,482

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2017	2,021	1,566
2018	2,021	1,566
2019	2,021	1,566
2020	2,021	1,566
2021	2,013	1,551

Monthly Impacts

First Year for Impact Table: 2010

	Quarter	Monthly Five Hour Avg or TOU Peak	Net Monthly NCP (kW)	Monthly Net kWh	Monthly Net Therms
January-10	1	-	-	-	-
February-10	1	-	-	-	-
March-10	1	-	-	-	-
April-10	2	-	-	-	-
May-10	2	-	-	-	-
June-10	2	-	-	-	-
July-10	3	-	-	-	-
August-10	3	-	-	-	-
September-10	3	-	-	-	-
October-10	4	-	-	-	-
November-10	4	-	-	-	-
December-10	4	-	-	-	-
January-11	5	-	-	-	-
February-11	5	-	-	-	-
March-11	5	-	-	-	-
April-11	6	-	-	-	-
May-11	6	-	-	-	-
June-11	6	-	-	-	-
July-11	7	-	-	-	-
August-11	7	-	-	-	-
September-11	7	-	-	-	-
October-11	8	-	-	-	-
November-11	8	-	-	-	-
December-11	8	-	-	-	-
January-12	9	-	-	-	-
February-12	9	-	-	-	-
March-12	9	-	-	-	-
April-12	10	-	-	-	-
May-12	10	-	-	-	-
June-12	10	-	-	-	-
July-12	11	-	-	-	-
August-12	11	-	-	-	-
September-12	11	-	-	-	-
October-12	12	-	-	-	-
November-12	12	-	-	-	-
December-12	12	-	-	-	-
January-13	13	-	-	-	-
February-13	13	-	-	-	-
March-13	13	-	-	-	-
April-13	14	203	210	103,084	-
May-13	14	203	210	103,084	-
June-13	14	203	210	103,084	-

Program Summary		Nominal	Present Value			Avoided Cost Version
Proposer Name		0				5/4/2010
Program Name		0				8/16/2010
Total Program Budget ($)		$ 1,380,024	1,172,405			Base Year
						2010
Net Participant Cost ($)		$ 5,734,599	$ 4,167,482			MAE - SB PROGRAM

July-13	15	490	505	244,989	-
August-13	15	490	505	244,989	-
September-13	15	490	505	244,989	-
October-13	16	786	811	391,122	61,311
November-13	16	613	627	466,602	61,311
December-13	16	613	627	466,602	61,311
January-14	17	911	931	692,183	90,988
February-14	17	911	931	692,183	90,988
March-14	17	911	931	692,183	90,988
April-14	18	1,518	1,561	737,696	-
May-14	18	1,518	1,561	737,696	-
June-14	18	1,518	1,561	737,696	-
July-14	19	1,779	1,826	844,378	-
August-14	19	1,779	1,826	844,378	-
September-14	19	1,779	1,826	844,378	-
October-14	20	2,022	2,071	943,827	109,675
November-14	20	1,573	1,597	1,125,120	109,675
December-14	20	1,573	1,597	1,125,120	109,675
January-15	21	1,680	1,700	1,175,147	98,888
February-15	21	1,680	1,700	1,175,147	98,888
March-15	21	1,680	1,700	1,175,147	98,888
April-15	22	2,114	2,153	933,256	-
May-15	22	2,114	2,153	933,256	-
June-15	22	2,114	2,153	933,256	-
July-15	23	2,070	2,103	890,799	-
August-15	23	2,070	2,103	890,799	-
September-15	23	2,070	2,103	890,799	-
October-15	24	2,036	2,062	851,348	30,878
November-15	24	1,578	1,582	1,014,197	30,878
December-15	24	1,578	1,582	1,014,197	30,878
January-16	25	1,566	1,566	983,271	14,683
February-16	25	1,566	1,566	983,271	14,683
March-16	25	1,566	1,566	983,271	14,683
April-16	26	2,021	2,043	825,519	-
May-16	26	2,021	2,043	825,519	-
June-16	26	2,021	2,043	825,519	-
July-16	27	2,021	2,043	825,519	-
August-16	27	2,021	2,043	825,519	-
September-16	27	2,021	2,043	825,519	-
October-16	28	2,021	2,043	825,519	14,683
November-16	28	1,566	1,566	983,271	14,683
December-16	28	1,566	1,566	983,271	14,683

ENERGY EFFICIENCY OPPORTUNITIES - SMALL BUSINESS		
BENCHMARKING & ENERGY AUDITS		
EE-01	Benchmarking (Energy Star Portfolio)	
EE-02	Free energy audits	
LIGHTING AND LIGHTING CONTROLS		
L-01	Energy Star Rated Ceiling Fan with LED lighting	
L-02	Delamp 3-L fixture T12/T8 to 2-L/EB/Reflector	
L-03	Replace T8-32watt lamps with 25 watt T8	
L-04	EnergyStar Labeled Dimmable LED Replacement	
L-05		5 watts
L-06		10 watts
L-07		15 watts
L-08		20 watts
L-09	LED case lighting and motion sensors - T12/T8 to LED	
L-10	Exterior high wattage HID fixture to reduce LED - canopy	
L-11	Exterior high wattage HID fixture to reduce LED - Parking Lighting	
L-12	Exterior high wattage HID fixture to reduce LED - Perimeter lighting	
L-13	Exterior high wattage HID fixture to reduce LED - Parking Lighting Bi-level/Motion Sensor	
L-14	LED Exits signs	
L-15	Occupancy sensor in private offices, conference rooms and copy rooms	
L-16	Motion sensor in bathrooms to control lighting and exhaust fan	
L-17	Motion sensor in offices, store rooms, and mechanical rooms.	
L-18	Photocells to control outdoor lighting	
L-19	Bi-level sensor on stair-wells	
L-20	Energy Star® Labeled LED Torchiere	
HVAC		
AC-01	Digital thermostat allowing automatic setback after override and (one of the following):	
AC-02	Central heating and cooling cleaning and tune ups	
AC-03	Air balance foe central HVAC system	
AC-04	Repair air side economizers	
AC-05	High efficiency hot water boilers (condensing)	
AC-06	Heating pipe insulation	
AC-07	DDC control installation, including energy management systems, boiler reset controls, and optimization control strategies	
AC-08	High efficiency central forced air furnace heating systems	
AC-09	Premium efficiency motors for pumps and fans (central equipment / or common areas systems)	
AC-10	Central A/C Tier 3	
AC-11	Central A/C Tier 4	
AC-12	Variable Frequency Drive (VFD) for HVAC Fan	
AC-13	Add Energy Management System to control lighting, HVAC, and refrigeration.	
AC-14	Energy-Efficient Package Terminal Air Conditioners and Heat Pumps	
AC-15	EnergyStar® Labeled Room Air Conditioners	
AC-16	EnergyStar® Labeled Portable Electric Heaters	
REFRIGERATION		
R-01	Anti-Sweat Heater (ASH) Controls	
R-02	Auto-Closers for Walk-In Coolers or Freezer Doors	
R-03	Efficient Evaporative Fan Motor	
R-04	Evaporative Fan Controller for Walk-In Coolers and Freezers	
R-05	New High Efficiency Refrigeration Display Cases with Special Doors (Low Temperature)	

R-06	New Refrigeration Display Cases with Doors
R-07	Night Covers for Open Vertical and Horizontal Display Cases
R-08	Special Doors with Low/No Anti-Sweat Heat on Low Temperature Display Cases
R-09	Strip Curtains
R-10	Vending Machine Controller
R-11	Insulation for Bare Suction Lines
APPLIANCES	
APP-01	EnergyStar® Labeled Refrigerators and freezers
APP-02	EnergyStar® Labeled ice machines
APP-03	Convection ovens
APP-04	Strip courtins
APP-05	Clothes washers (coin-op) Tier 1
APP-06	Clothes washers (coin-op) Tier 1
APP-07	Clothes washers (coin-op) Tier 1
APP-08	EnergyStar® Labeled Dishwasher Tier 1
APP-09	EnergyStar® Labeled Dishwasher Tier 2
APP-10	EnergyStar® Labeled Smart Electric Strip (one per unit)
ENVELOPE	
ENV-01	Seal cracks on floors, wall, and ceilings
ENV-02	Weather-stripping windows and doors. Door sweepers
ENV-03	Insulate hot water piping inside occupied unit
ENV-04	Attic and Roof/Ceiling Insulation
ENV-05	High performance dual pane windows
ENV-06	Cool roof - flat roof
ENV-07	Cool roof - steep slope
ENV-08	Window films where allowed by code
WATER AND ENERGY EFFICIENCY (WATERGY)	
W-01	Low flow shower heads
W-02	Low flow toylets
W-03	Faucet aerators
W-04	Weahter controlled irrigation system
W-05	High efficiency pumps and pump motors
W-06	Optimized water distribution systems
ENERGY EDUCATION	
EE-03	Educate tenants in how to conserve energy and water

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 581,400	581,400
Net Participant Cost ($)	$ 2,280,156	$ 1,594,919

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Program Impacts	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net Jul-Sept Pk (kW)	Net Dec-Feb Pk (kW)	User Entered kW
2010-2012	-	-	-	-	-	-	-
2013-2016	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734	3,678
2017-2020	-	-	-	-	-	-	-

Cost Effectiveness (Lifecycle Present Value Dollars)		Benefits			Benefit - Cost		
	Cost	Electric	Gas	Incentives	NPV	B/C Ratio	Notes
Program TRC ($)	$ 2,176,319	$2,527,906	$1,303,349	NA	$1,654,936	1.76	*1
Program PAC ($)	$ 581,400	$2,527,906	$1,303,349	NA	$3,249,855	6.59	*1,2
Program RIM ($)	$ 9,764,958	$2,527,906	$1,303,349	NA	($5,933,703)	0.39	*1

*1 B/C Ratio is an approximation because any supply cost increases are treated as negative benefits rather than as a cost as in the Standard Practice Manual
*2 PAC benefits include environmental costs. This is to be consistent with the TRC benefits, but is not strictly consistent with the Standard Practice Manual.

Levelized Cost and Benefit (All Measures Installed through 2020)	Discounted Savings				Benefit - Cost
	kWh	Therms	Cost	Benefits	NPV
TRC ($/kWh)	21,823,734		$ 0.0738	$ 0.1158	$ 0.0421
PAC ($/kWh)	21,823,734		$ 0.0176	$ 0.1158	$ 0.0983
RIM ($/kWh)	21,823,734		$ 0.2952	$ 0.1158	$ (0.1794)
TRC ($/therm)		1,328,655	$ 0.43	$ 0.98	$ 0.5547
PAC ($/therm)		1,328,655	$ 0.15	$ 0.98	$ 0.8321
RIM ($/therm)		1,328,655	$ 2.50	$ 0.98	$ (1.5193)

Emissions Reductions	Electric Reductions			Gas Reductions		
Annual Reductions	CO2 (tons)	NOX (lbs)	PM-10 (lbs)	CO2 (tons)	NOX (lbs)	
2010	-	-	-	-	-	* annual reductions are the units
2011	-	-	-	-	-	implemented in the year, times
2012	-	-	-	-	-	the annual emission reduction
2013	3,175	847	409	2,010	3,161	for the measure.
2014	3,175	847	409	2,010	3,161	
2015	-	-	-	-	-	
2016	-	-	-	-	-	
2017	-	-	-	-	-	
2018	-	-	-	-	-	
2019	-	-	-	-	-	
2020	-	-	-	-	-	
Total Annual	6,351	1,695	819	4,020	6,322	
Lifecycle Reductions						
2010	-	-	-	-	-	
2011	-	-	-	-	-	
2012	-	-	-	-	-	
2013	9,526	2,542	1,228	6,030	9,483	
2014	9,526	2,542	1,228	6,030	9,483	
2015	-	-	-	-	-	
2016	-	-	-	-	-	
2017	-	-	-	-	-	
2018	-	-	-	-	-	
2019	-	-	-	-	-	
2020	-	-	-	-	-	

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 581,400	581,400
Net Participant Cost ($)	$ 2,280,156	$ 1,594,919

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Total Lifecycle	19,053	5,084	2,456	12,060	18,967

Reductions based on total annual installations	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)		User Entered kW	Net Annual NCP (kW)
2010	-	-	-	-	-	-		-	-
2011	-	-	-	-	-	-		-	-
2012	-	-	-	-	-	-		-	-
2013	5,643,725	16,931,174	343,597	1,030,790	1,011	1,367		1,839.14	1,025
2014	5,643,725	16,931,174	343,597	1,030,790	1,011	1,367		1,839.14	1,367
2015	-	-	-	-	-	-		-	342
2016	-	-	-	-	-	-		-	-
2017	-	-	-	-	-	-		-	(1,367)
2018	-	-	-	-	-	-		-	(1,367)
2019	-	-	-	-	-	-		-	-
2020	-	-	-	-	-	-		-	-
Total	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734		3,678	-

Net Impacts by Sector (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734		3,678	1,654,936
RES	-	-	-	-	-	-		-	-
NON_RES	-	-	-	-	-	-		-	-
Residential	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734		3,678	1,654,936
Res_New_Construction	-	-	-	-	-	-		-	-
COMMERCIAL	-	-	-	-	-	-		-	-
INDUSTRIAL	-	-	-	-	-	-		-	-
AGRICULTURAL	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
Other and upspecified	-	-	-	-	-	-	-	-	-

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by CPUC End Use Categories (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb Pk (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734		3,678	1,654,936

Program Summary	Nominal		Present Value
Proposer Name		0	
Program Name		0	
Total Program Budget ($)	$	581,400	581,400
Net Participant Cost ($)	$	2,280,156	$ 1,594,919

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Clothes Dryer	-	-	-	-	-	-		-	-
Clothes Washer	-	-	-	-	-	-		-	-
Consumer Electronics	-	-	-	-	-	-		-	-
Cooking	-	-	-	-	-	-		-	-
Dishwasher	-	-	-	-	-	-		-	-
Other Appliance	-	-	-	-	-	-		-	-
Office Equipment	-	-	-	-	-	-		-	-
Building shell	-	-	-	-	-	-		-	-
Space Cooling	-	-	-	-	-	-		-	-
Space Heating	-	-	-	-	-	-		-	-
Ventilation	-	-	-	-	-	-		-	-
Interior Lighting	-	-	-	-	-	-		-	-
Exterior Lighting	-	-	-	-	-	-		-	-
Daylighting	-	-	-	-	-	-		-	-
Motors	-	-	-	-	-	-		-	-
Process	-	-	-	-	-	-		-	-
Compressed Air	-	-	-	-	-	-		-	-
Food Processor	-	-	-	-	-	-		-	-
Refrigeration	-	-	-	-	-	-		-	-
Freezers	-	-	-	-	-	-		-	-
Pumps	-	-	-	-	-	-		-	-
Pool Pump	-	-	-	-	-	-		-	-
Domestic Hot Water	-	-	-	-	-	-		-	-
Water Heating	687,194	2,061,581	687,194	2,061,581	104	126		-	817,242
Other or unspecified	10,600,256	31,800,768	-	-	1,919	2,608	-	3,678	837,695

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by Climate Zone (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net dec-Feb Pk (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734		3,678	1,654,936
1	-	-	-	-	-	-		-	-
2	-	-	-	-	-	-		-	-
3A	11,287,450	33,862,349	687,194	2,061,581	2,023	2,734		3,678	1,654,936
3B	-	-	-	-	-	-		-	-
4	-	-	-	-	-	-		-	-
5	-	-	-	-	-	-		-	-
11	-	-	-	-	-	-		-	-
12	-	-	-	-	-	-		-	-
13	-	-	-	-	-	-		-	-
16	-	-	-	-	-	-		-	-
System	-	-	-	-	-	-		-	-

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Persistent reductions in the summer (3rd Qtr) or winter (4th Qtr) of each year	Net July-Sept Peak (kW)	Net Annual Dec-Feb (kW)
2010	-	-
2011	-	-
2012	-	-
2013	506	1,367
2014	1,517	2,734
2015	2,023	2,734
2016	1,517	1,367

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 581,400	581,400
Net Participant Cost ($)	$ 2,280,156	$ 1,594,919

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2017	506	-
2018	-	-
2019	-	-
2020	-	-
2021	-	-

Monthly Impacts

First Year for Impact Table: 2010

	Quarter	Monthly Five Hour Avg or TOU Peak	Net Monthly NCP (kW)	Monthly Net kWh	Monthly Net Therms
January-10	1	-	-	-	-
February-10	1	-	-	-	-
March-10	1	-	-	-	-
April-10	2	-	-	-	-
May-10	2	-	-	-	-
June-10	2	-	-	-	-
July-10	3	-	-	-	-
August-10	3	-	-	-	-
September-10	3	-	-	-	-
October-10	4	-	-	-	-
November-10	4	-	-	-	-
December-10	4	-	-	-	-
January-11	5	-	-	-	-
February-11	5	-	-	-	-
March-11	5	-	-	-	-
April-11	6	-	-	-	-
May-11	6	-	-	-	-
June-11	6	-	-	-	-
July-11	7	-	-	-	-
August-11	7	-	-	-	-
September-11	7	-	-	-	-
October-11	8	-	-	-	-
November-11	8	-	-	-	-
December-11	8	-	-	-	-
January-12	9	-	-	-	-
February-12	9	-	-	-	-
March-12	9	-	-	-	-
April-12	10	-	-	-	-
May-12	10	-	-	-	-
June-12	10	-	-	-	-
July-12	11	-	-	-	-
August-12	11	-	-	-	-
September-12	11	-	-	-	-
October-12	12	-	-	-	-
November-12	12	-	-	-	-
December-12	12	-	-	-	-
January-13	13	-	-	-	-
February-13	13	-	-	-	-
March-13	13	-	-	-	-
April-13	14	253	253	85,385	7,158
May-13	14	253	253	85,385	7,158
June-13	14	253	253	85,385	7,158

Program Summary		Nominal	Present Value
Proposer Name		0	
Program Name		0	
Total Program Budget ($)		$ 581,400	581,400
Net Participant Cost ($)		$ 2,280,156	$ 1,594,919

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July-13	15	506	506	170,770	14,317
August-13	15	506	506	170,770	14,317
September-13	15	506	506	170,770	14,317
October-13	16	758	758	256,154	21,475
November-13	16	1,025	1,025	487,942	21,475
December-13	16	1,025	1,025	487,942	21,475
January-14	17	1,367	1,367	650,590	28,633
February-14	17	1,367	1,367	650,590	28,633
March-14	17	1,367	1,367	650,590	28,633
April-14	18	1,264	1,264	426,924	35,791
May-14	18	1,264	1,264	426,924	35,791
June-14	18	1,264	1,264	426,924	35,791
July-14	19	1,517	1,517	512,309	42,950
August-14	19	1,517	1,517	512,309	42,950
September-14	19	1,517	1,517	512,309	42,950
October-14	20	1,770	1,770	597,694	50,108
November-14	20	2,392	2,392	1,138,532	50,108
December-14	20	2,392	2,392	1,138,532	50,108
January-15	21	2,734	2,734	1,301,180	57,266
February-15	21	2,734	2,734	1,301,180	57,266
March-15	21	2,734	2,734	1,301,180	57,266
April-15	22	2,023	2,023	683,079	57,266
May-15	22	2,023	2,023	683,079	57,266
June-15	22	2,023	2,023	683,079	57,266
July-15	23	2,023	2,023	683,079	57,266
August-15	23	2,023	2,023	683,079	57,266
September-15	23	2,023	2,023	683,079	57,266
October-15	24	2,023	2,023	683,079	57,266
November-15	24	2,734	2,734	1,301,180	57,266
December-15	24	2,734	2,734	1,301,180	57,266
January-16	25	2,734	2,734	1,301,180	57,266
February-16	25	2,734	2,734	1,301,180	57,266
March-16	25	2,734	2,734	1,301,180	57,266
April-16	26	1,770	1,770	597,694	50,108
May-16	26	1,770	1,770	597,694	50,108
June-16	26	1,770	1,770	597,694	50,108
July-16	27	1,517	1,517	512,309	42,950
August-16	27	1,517	1,517	512,309	42,950
September-16	27	1,517	1,517	512,309	42,950
October-16	28	1,264	1,264	426,924	35,791
November-16	28	1,709	1,709	813,237	35,791
December-16	28	1,709	1,709	813,237	35,791

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 4,015,205	3,272,361
Net Participant Cost ($)	$ 2,289,002	$ 1,601,106

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Program Impacts	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net Jul-Sept Pk (kW)	Net Dec-Feb Pk (kW)	User Entered kW
2010-2012	-	-	-	-	-	-	-
2013-2016	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320	6,032
2017-2020	-	-	-	-	-	-	-

Cost Effectiveness (Lifecycle Present Value Dollars)		Benefits			Benefit - Cost		
	Cost	Electric	Gas	Incentives	NPV	B/C Ratio	Notes
Program TRC ($)	$ 4,873,467	$4,910,179	$2,093,504	NA	$2,130,216	1.44	*1
Program PAC ($)	$ 3,272,361	$4,910,179	$2,093,504	NA	$3,731,322	2.14	*1,2
Program RIM ($)	$ 20,189,198	$4,910,179	$2,093,504	NA	($13,185,515)	0.35	*1

*1 B/C Ratio is an approximation because any supply cost increases are treated as negative benefits rather than as a cost as in the Standard Practice Manual

*2 PAC benefits include environmental costs. This is to be consistent with the TRC benefits, but is not strictly consistent with the Standard Practice Manual.

Levelized Cost and Benefit (All Measures Installed through 2020)	Discounted Savings				Benefit - Cost
	kWh	Therms	Cost	Benefits	NPV
TRC ($/kWh)	42,352,896		$ 0.0902	$ 0.1159	$ 0.0257
PAC ($/kWh)	42,352,896		$ 0.0664	$ 0.1159	$ 0.0496
RIM ($/kWh)	42,352,896		$ 0.3342	$ 0.1159	$ (0.2183)
TRC ($/therm)		2,134,152	$ 0.49	$ 0.98	$ 0.4874
PAC ($/therm)		2,134,152	$ 0.22	$ 0.98	$ 0.7648
RIM ($/therm)		2,134,152	$ 2.83	$ 0.98	$ (1.8468)

Emissions Reductions	Electric Reductions			Gas Reductions	
Annual Reductions	CO2 (tons)	NOX (lbs)	PM-10 (lbs)	CO2 (tons)	NOX (lbs)
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
2013	6,166	1,646	795	3,229	5,077
2014	6,166	1,646	795	3,229	5,077
2015	-	-	-	-	-
2016	-	-	-	-	-
2017	-	-	-	-	-
2018	-	-	-	-	-
2019	-	-	-	-	-
2020	-	-	-	-	-
Total Annual	12,332	3,292	1,589	6,457	10,155
Lifecycle Reductions					
2010	-	-	-	-	-
2011	-	-	-	-	-
2012	-	-	-	-	-
2013	18,498	4,938	2,384	9,686	15,232
2014	18,498	4,938	2,384	9,686	15,232
2015	-	-	-	-	-
2016	-	-	-	-	-
2017	-	-	-	-	-
2018	-	-	-	-	-
2019	-	-	-	-	-

* annual reductions are the units implemented in the year, times the annual emission reduction for the measure.

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 4,015,205	3,272,361
Net Participant Cost ($)	$ 2,289,002	$ 1,601,106

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2020	-	-	-	-	-
Total Lifecycle	36,995	9,875	4,768	19,372	30,465

Reductions based on total annual installations

	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)	User Entered kW	Net Annual NCP (kW)
2010	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-
2013	10,952,667	32,858,001	551,902	1,655,706	1,966	2,660	3,016.22	1,995
2014	10,952,667	32,858,001	551,902	1,655,706	1,966	2,660	3,016.22	2,660
2015	-	-	-	-	-	-	-	665
2016	-	-	-	-	-	-	-	-
2017	-	-	-	-	-	-	-	(2,660)
2018	-	-	-	-	-	-	-	(2,660)
2019	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-
Total	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320	6,032	-

Net Impacts by Sector (All Measures Installed through 2020)

	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320		6,032	2,130,216
RES	-	-	-	-	-	-		-	-
NON_RES	-	-	-	-	-	-		-	-
Residential	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320		6,032	2,130,216
Res_New_Construction	-	-	-	-	-	-		-	-
COMMERCIAL	-	-	-	-	-	-		-	-
INDUSTRIAL	-	-	-	-	-	-		-	-
AGRICULTURAL	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-		-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
0	-	-	-	-	-	-	-	-	-
Other and upspecified	-	-	-	-	-	-	-	-	-

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by CPUC End Use Categories (All Measures Installed through 2020)

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 4,015,205	3,272,361
Net Participant Cost ($)	$ 2,289,002	$ 1,601,106

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	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net Dec-Feb Pk (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320		6,032	2,130,216
Clothes Dryer	-	-	-	-	-	-		-	-
Clothes Washer	-	-	-	-	-	-		-	-
Consumer Electronics	-	-	-	-	-	-		-	-
Cooking	-	-	-	-	-	-		-	-
Dishwasher	-	-	-	-	-	-		-	-
Other Appliance	-	-	-	-	-	-		-	-
Office Equipment	-	-	-	-	-	-		-	-
Building shell	-	-	-	-	-	-		-	-
Space Cooling	-	-	-	-	-	-		-	-
Space Heating	-	-	-	-	-	-		-	-
Ventilation	-	-	-	-	-	-		-	-
Interior Lighting	-	-	-	-	-	-		-	-
Exterior Lighting	-	-	-	-	-	-		-	-
Daylighting	-	-	-	-	-	-		-	-
Motors	-	-	-	-	-	-		-	-
Process	-	-	-	-	-	-		-	-
Compressed Air	-	-	-	-	-	-		-	-
Food Processor	-	-	-	-	-	-		-	-
Refrigeration	-	-	-	-	-	-		-	-
Freezers	-	-	-	-	-	-		-	-
Pumps	-	-	-	-	-	-		-	-
Pool Pump	-	-	-	-	-	-		-	-
Domestic Hot Water	-	-	-	-	-	-		-	-
Water Heating	1,103,804	3,311,413	1,103,804	3,311,413	167	203		-	1,153,431
Other or unspecified	20,801,530	62,404,589	-	-	3,765	5,117	-	6,032	976,785

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Net Impacts by Climate Zone (All Measures Installed through 2020)	Annual Net kWh	Lifecycle Net kWh	Annual Net Therms	Lifecycle Net Therms	Net July-Sept Peak (kW)	Net dec-Feb Pk (kW)		User Entered kW	TRC Lifecycle Net Benefits* ($)
Total	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320		6,032	2,130,216
1	-	-	-	-	-	-		-	-
2	-	-	-	-	-	-		-	-
3A	21,905,334	65,716,002	1,103,804	3,311,413	3,932	5,320		6,032	2,130,216
3B	-	-	-	-	-	-		-	-
4	-	-	-	-	-	-		-	-
5	-	-	-	-	-	-		-	-
11	-	-	-	-	-	-		-	-
12	-	-	-	-	-	-		-	-
13	-	-	-	-	-	-		-	-
16	-	-	-	-	-	-		-	-
System	-	-	-	-	-	-		-	-

** Include program-level and admin costs allocated based to total gas and electric programs at the measure level.*

Persistent reductions in the summer (3rd Qtr) or winter (4th Qtr) of each year	Net July-Sept Peak (kW)	Net Annual Dec-Feb (kW)
2010	-	-
2011	-	-
2012	-	-

Program Summary		Nominal	Present Value
Proposer Name		0	
Program Name		0	
Total Program Budget ($)	$	4,015,205	3,272,361
Net Participant Cost ($)	$	2,289,002	$ 1,601,106

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2013	983	2,660
2014	2,949	5,320
2015	3,932	5,320
2016	2,949	2,660
2017	983	-
2018	-	-
2019	-	-
2020	-	-
2021	-	-

Monthly Impacts

First Year for Impact Table: 2010

	Quarter	Monthly Five Hour Avg or TOU	Net Monthly NCP (kW)	Monthly Net kWh	Monthly Net Therms
January-10	1	-	-	-	-
February-10	1	-	-	-	-
March-10	1	-	-	-	-
April-10	2	-	-	-	-
May-10	2	-	-	-	-
June-10	2	-	-	-	-
July-10	3	-	-	-	-
August-10	3	-	-	-	-
September-10	3	-	-	-	-
October-10	4	-	-	-	-
November-10	4	-	-	-	-
December-10	4	-	-	-	-
January-11	5	-	-	-	-
February-11	5	-	-	-	-
March-11	5	-	-	-	-
April-11	6	-	-	-	-
May-11	6	-	-	-	-
June-11	6	-	-	-	-
July-11	7	-	-	-	-
August-11	7	-	-	-	-
September-11	7	-	-	-	-
October-11	8	-	-	-	-
November-11	8	-	-	-	-
December-11	8	-	-	-	-
January-12	9	-	-	-	-
February-12	9	-	-	-	-
March-12	9	-	-	-	-
April-12	10	-	-	-	-
May-12	10	-	-	-	-
June-12	10	-	-	-	-
July-12	11	-	-	-	-
August-12	11	-	-	-	-
September-12	11	-	-	-	-
October-12	12	-	-	-	-
November-12	12	-	-	-	-
December-12	12	-	-	-	-
January-13	13	-	-	-	-
February-13	13	-	-	-	-

Program Summary	Nominal	Present Value
Proposer Name	0	
Program Name	0	
Total Program Budget ($)	$ 4,015,205	3,272,361
Net Participant Cost ($)	$ 2,289,002	$ 1,601,106

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March-13	13	-	-	-	-
April-13	14	491	491	166,000	11,498
May-13	14	491	491	166,000	11,498
June-13	14	491	491	166,000	11,498
July-13	15	983	983	332,000	22,996
August-13	15	983	983	332,000	22,996
September-13	15	983	983	332,000	22,996
October-13	16	1,474	1,474	498,000	34,494
November-13	16	1,995	1,995	945,699	34,494
December-13	16	1,995	1,995	945,699	34,494
January-14	17	2,660	2,660	1,260,932	45,992
February-14	17	2,660	2,660	1,260,932	45,992
March-14	17	2,660	2,660	1,260,932	45,992
April-14	18	2,457	2,457	830,001	57,490
May-14	18	2,457	2,457	830,001	57,490
June-14	18	2,457	2,457	830,001	57,490
July-14	19	2,949	2,949	996,001	68,988
August-14	19	2,949	2,949	996,001	68,988
September-14	19	2,949	2,949	996,001	68,988
October-14	20	3,440	3,440	1,162,001	80,486
November-14	20	4,655	4,655	2,206,632	80,486
December-14	20	4,655	4,655	2,206,632	80,486
January-15	21	5,320	5,320	2,521,865	91,984
February-15	21	5,320	5,320	2,521,865	91,984
March-15	21	5,320	5,320	2,521,865	91,984
April-15	22	3,932	3,932	1,328,001	91,984
May-15	22	3,932	3,932	1,328,001	91,984
June-15	22	3,932	3,932	1,328,001	91,984
July-15	23	3,932	3,932	1,328,001	91,984
August-15	23	3,932	3,932	1,328,001	91,984
September-15	23	3,932	3,932	1,328,001	91,984
October-15	24	3,932	3,932	1,328,001	91,984
November-15	24	5,320	5,320	2,521,865	91,984
December-15	24	5,320	5,320	2,521,865	91,984
January-16	25	5,320	5,320	2,521,865	91,984
February-16	25	5,320	5,320	2,521,865	91,984
March-16	25	5,320	5,320	2,521,865	91,984
April-16	26	3,440	3,440	1,162,001	80,486
May-16	26	3,440	3,440	1,162,001	80,486
June-16	26	3,440	3,440	1,162,001	80,486
July-16	27	2,949	2,949	996,001	68,988
August-16	27	2,949	2,949	996,001	68,988
September-16	27	2,949	2,949	996,001	68,988
October-16	28	2,457	2,457	830,001	57,490
November-16	28	3,325	3,325	1,576,166	57,490
December-16	28	3,325	3,325	1,576,166	57,490

Sub-Program MEA - Projected Demand Reduction

Basic Assumptions

			Groups/Types of Home (based on average monthly home energy bill [1])			
			<$100/mth	$100-$300/mth	>$300/mth	
Households		87,000	43,500	25,230	18,270	
			50%	29%	21%	
Av Demand/HH/Yr[1]	Electricity (kWh/HH/Yr)	6,396	3,416	6,874	12,832	
	Gas (Therms/HH/Yr)	612	450	650	946	
Total Demand/Yr	Electricity (kWh/Yr)	556,467,660	148,596,000	173,431,020	234,440,640	
	Gas (Therms/Yr)	53,256,093	19,575,000	16,399,500	17,281,593	

'Economically Positive'[2] Demand Reduction Potential

Average Demand Reduction Potential, per Marin HH						(some demand reduction allocated to BayREN; impact of appliance, etc. retrofits retained,
Electricity[1] (kWh)	Eliminate By Behavioural Changes	881	200	1,100	2,200	impact of HVAC, insulate, etc. retrofits allocated to BayREN)
	Eliminate By Efficiency Retrofits	645	476	714	952	reduced 15%
	Eliminate By Solar Generation	1,680	0	2,100	5,100	
	Sum: Electricity Red'n Pot'l/HH/Yr	3,206	676	3,914	8,252	
Gas[1] (Therms)	Eliminate By Behavioural Changes	79	50	100	120	
	Eliminate By Efficiency Retrofits	10	0	0	46	reduced 66%
	Sum: Gas Red'n Pot'l/HH/Yr	89	50	100	166	

Total Demand Reduction Potential, Marin					
	Electricity Reduced by Behavior (k\	76,647,000	8,700,000	27,753,000	40,194,000
	Electricity (kWh)	278,920,260	29,406,000	98,750,220	150,764,040
	Gas Reduced by Behavior (kWh)	6,890,400	2,175,000	2,523,000	2,192,400
	Gas (Therms)	7,728,993	2,175,000	2,523,000	3,030,993

Expected Demand Reduction (2013-2014)

Action Rates[1]	Proportion HHs Undertaking Action	13%	11.5%	11.5%	20.0%	
	Proportion Energy Saved per HH	32%	20.0%	25.0%	70.0%	
Energy Saved	Electricity Behavior (kWh)	6,625,159	200,100	797,899	5,627,160	
	Electricity (kWh)	24,622,372	676,338	2,839,069	21,106,966	
	% of total demand	4.4%	0.5%	1.6%	9.0%	
	Gas Behavior (Therms)	429,497	50,025	72,536	306,936	
	Gas (Therms)	546,900	50,025	72,536	424,339	
	% of total demand	1.0%	0.3%	0.4%	2.5%	
Carbon Red'n (lbs)	From Electricity	146,154,216	15,408,744	51,745,115	79,000,357	0.52 lbs/kWh
	From Gas	103,924,040	29,245,050	33,924,258	40,754,732	13.45 lbs/Therm
		250,078,256	44,653,794	85,669,373	119,755,089	

Expected Peak Reduction (at end 2014)

Peak Red'n Pot'l/HH	Behavior (kW)	0.6	0.1	0.4	0.8	0.00034
	Efficiency (kW)	0.2	0.1	0.1	0.2	0.00020
	Solar (kW)	1.8	0.0	1.0	2.3	0.00046
Peak Demand Red'n	Behavior (MW)	2.3	0.1	0.3	1.9	
	Efficiency (MW)	0.7	0.1	0.1	0.5	
	Solar (MW)	6.7	0.0	0.7	6.0	
	Total (MW)	9.6	0.2	1.1	8.4	

[1]Based on 2010 Sonoma County study
[2]Demand that may be eliminated in a way that has an economically positive outcome for the consumer
Source: PlanetEcosystems Analysis

MAE ENERGY EFFICIENCY PROGRAMS

SMALL BUSINESS

AND

MULTIFAMILY

ASSUMPTIONS AND CALCULATIONS USED IN E3

LIST OF TABLES

TABLE 1: TOTAL ENERGY USAGE BY COMMERCIAL BUILDINGS IN MARIN COUNTY AND CITY OF RICHMOND

	[1]Annual Energy Usage, kWh	As of % of Total
Utility Type	IOU	
Utility Name	PG&E	
Year	2010	
Ag & Water Pump	5,002,477,010	5.92%
Commercial Building	30,857,579,566	36.51%
Commercial Other	4,091,010,390	4.84%
Industry	10,745,893,667	12.71%
Mining & Construction	2,339,875,857	2.77%
Residential	**31,021,133,413**	**36.70%**
Streetlight	465,914,309	0.55%
Total Usage	**84,523,884,212**	
RESIDENTIAL	**31,021,133,413**	**36.70%**
NON-RESIDENTIAL	**53,502,750,799**	**63.30%**
Population Served		15,000,000
[5]Contra Costa County Population		1,049,025
[5]Marin County Population		252,409
Population served by PG&E in both counties		8.68%

County	Sector	2010 Energy Usage[1]	Residential Usage - Richmond [2]	No. Business % Marin&Richmond [3]	Total Business Energy Usage, kWh/yr.	[5]Total Number of Business	[5]Total Number of Small Business	Total Energy Usage by Small Business, kWh/yr.	Potential Savings, kWh/yr.	2013 Available Savings[4]	2014 Available Savings[4]
CONTRA COSTA	Non-Residential	6,468,205,233		32.81%	2,122,084,846	6,744	6,407	2,015,980,604	1.00%	10,079,903	10,079,903
CONTRA COSTA	Residential	2,746,965,700	9.89%								
MARIN	Non-Residential	716,663,499		96.00%	687,996,959	8,899	8,543	660,477,081	1.00%	3,302,385	3,302,385
MARIN	Residential	705,542,035									
					2,810,081,805	15,643	14,950	2,676,457,684		13,382,288	13,382,288

1. Data from ECDMS (Energy Consumption Data Management System) http://www.ecdms.energy.ca.gov/elecbyutil.aspx
2. Based is Richmond population divided by the total Contra Costa County population (data from the 2010 census)
3. % Based on the number of small business as publish by Commercial Buildings Energy Consumption Survey (CBECS)
4. Market penetration goals = 25% over three years
5. Data from 2010 US Census (http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t)

TABLE 2: CONTRA COSTA COUNTY NAICS CODES

COUNTY DESCRIPTION	NAICS CODE	NAICS DESCRIPTION	INITIAL YEAR			
			NUMBER OF ESTABLISHMENTS	EMPLOYMENT	NOISE FLAG	EMPLOYMENT RANGE FLAG
Contra Costa	11	Agriculture, forestry, fishing and hunting	16	0	S	B
Contra Costa	21	Mining, quarrying, and oil and gas extraction	7	114	G	
Contra Costa	22	Utilities	23	1,979	H	
Contra Costa	23	Construction	2,106	28,755	G	
Contra Costa	31-33	Manufacturing	555	18,216	G	
Contra Costa	42	Wholesale trade	914	9,638	G	
Contra Costa	44-45	Retail trade	2,514	45,782	G	
Contra Costa	48-49	Transportation and warehousing	344	6,630	G	
Contra Costa	51	Information	391	15,720	H	
Contra Costa	52	Finance and insurance	1,755	25,980	G	
Contra Costa	53	Real estate and rental and leasing	1,133	7,426	G	
Contra Costa	54	Professional, scientific, and technical services	2,847	27,840	G	
Contra Costa	55	Management of companies and enterprises	204	13,420	H	
Contra Costa	56	Administrative and support and waste management and remediation services	1,214	24,435	G	
Contra Costa	61	Educational services	332	6,736	G	
Contra Costa	62	Health care and social assistance	2,559	45,991	G	
Contra Costa	71	Arts, entertainment, and recreation	300	7,177	G	
Contra Costa	72	Accommodation and food services	1,621	28,498	G	
Contra Costa	81	Other services (except public administration)	1,695	13,816	G	
Contra Costa	99	Industries not classified	26	0	S	B
Contra Costa		**Total**	**20,556**	**328,248**	**G**	

TABLE 3: MARIN COUNTY NAICS CODES

COUNTY DESCRIPTION	NAICS CODE	NAICS DESCRIPTION	INITIAL YEAR			
			NUMBER OF ESTABLISHMENTS	EMPLOYMENT	NOISE FLAG	EMPLOYMENT RANGE FLAG
Marin	11	Agriculture, forestry, fishing and hunting	4	0	S	A
Marin	21	Mining, quarrying, and oil and gas extraction	1	0	D	B
Marin	22	Utilities	6	236	H	
Marin	23	Construction	945	8,640	G	
Marin	31-33	Manufacturing	217	2,060	G	
Marin	42	Wholesale trade	441	3,794	G	
Marin	44-45	Retail trade	1,036	14,869	G	
Marin	48-49	Transportation and warehousing	104	1,354	G	
Marin	51	Information	249	5,107	H	
Marin	52	Finance and insurance	644	7,163	G	
Marin	53	Real estate and rental and leasing	556	3,065	G	
Marin	54	Professional, scientific, and technical services	1,516	9,267	G	
Marin	55	Management of companies and enterprises	68	1,770	G	
Marin	56	Administrative and support and waste management and remediation services	467	7,628	G	
Marin	61	Educational services	153	3,742	G	
Marin	62	Health care and social assistance	972	14,423	G	
Marin	71	Arts, entertainment, and recreation	215	3,536	G	
Marin	72	Accommodation and food services	646	11,275	G	
Marin	81	Other services (except public administration)	643	4,947	G	
Marin	99	Industries not classified	16	0	S	B
Marin		**Total**	**8,899**	**102,978**	**G**	

TABLE 4: CITY OF RICHMOND CENSUS 2010 DATA

People Quick Facts	Richmond	California
Population, 2011 estimate	NA	37,691,912
Population, 2010	103,701	37,253,956
Population, percent change, 2000 to 2010	4.50%	10.00%
Population, 2000	99,216	33,871,648
Housing units, 2010	39,328	13,680,081
Homeownership rate, 2006-2010	54.00%	57.40%
Housing units in multi-unit structures, percent, 2006-2010	37.20%	30.70%
Median value of owner-occupied housing units, 2006-2010	$408,200	$458,500
Households, 2006-2010	35,570	12,392,852
Persons per household, 2006-2010	2.82	2.89
Business Quick Facts	Richmond	California
Total number of firms, 2007	6,744	3,425,510
Black-owned firms, percent, 2007	16.50%	4.00%
American Indian- and Alaska Native-owned firms, percent, 2007	2.20%	1.30%
Asian-owned firms, percent, 2007	17.80%	14.90%
Native Hawaiian and Other Pacific Islander-owned firms, percent, 2007	F	0.30%
Hispanic-owned firms, percent, 2007	S	16.50%
Women-owned firms, percent, 2007	37.00%	30.30%
Geography Quick Facts	Richmond	California
Land area in square miles, 2010	30.07	155,779.22
Persons per square mile, 2010	3,448.90	239.1
FIPS Code	60620	6
Counties	Contra Costa County	

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
FN: Footnote on this item for this area in place of data
NA: Not available
D: Suppressed to avoid disclosure of confidential information
X: Not applicable
S: Suppressed; does not meet publication standards
Z: Value greater than zero but less than half unit of measure shown
F: Fewer than 100 firms
Source: US Census Bureau State & County Quick Facts

TABLE 5: NON-DEER ENERGY MEASURES ASSUMPTIONS

	hrs./year	Existing KW	Proposed kW	Savings kW	Savings kWh
Energy Star Rated Ceiling Fan with LED lighting	800	0.24	0.04	0.2	160
Energy Star Labeled Dimmable LED Replacement					
5 watts	1200	0.06	0.005	0.055	66
10 watts	1200	0.06	0.001	0.059	70.8
15 watts	1200	0.1	0.0015	0.0985	118.2
20 watts	1200	0.1	0.002	0.098	117.6
Occupancy Sensor	1200	0.5			150
Energy Star® Labeled LED Torchiere	1200	0.1	0.002	0.098	117.6
Portable heaters	600	0.5		0.5	75
Energy Star® Labeled Dryer				0	
Energy Star® Labeled Cloth Washer Tier 1				0	
Energy Star® Labeled Dishwasher Tier 1				0	
Bi-level sensor on stair-wells	8760	0.06	0.06	0	289.08
Clothes washers (coin-op) Tier 1				0	
Exterior lighting retrofits with LED and /or induction technologies				0	
Outdoor lighting controls (photocells / dual-level lighting controls)				0	
Delamp 3-L fixture T12/T8 to 2-L/EB/Reflector	4032	0.09	0.06	0.03	120.96
LED case lighting and motion sensors - T12/T8 to LED	8760	0.06	0.025	0.035	383.25
Exterior high wattage HID fixture to reduce LED - canopy	4015	0.356	0.2	0.156	626.34
Exterior high wattage HID fixture to reduce LED - Parking Lighting	4015	0.456	0.2	0.256	1027.84
Exterior high wattage HID fixture to reduce LED - Perimeter lighting	4015	0.054	0.01	0.044	176.66
Exterior high wattage HID fixture to reduce LED - Parking Lighting Bi-level/Motion Sensor	4015	0.456	0.2	0.256	1284.8
Motion sensor in bathrooms to control lighting and exhaust fan	8760	0.165	0.165	0	361.35
Motion sensor in offices, store rooms, and mechanical rooms.	5110	0.025	0.025	0	31.9375
Photocells to control outdoor lighting	4032	2.736	2.736	0	2757.888
Cool roof - flat roof				0	0.0333
Cool roof - steep slope				0	0.0333
Auto-Closers for Walk-In Coolers or Freezer Doors	2890.8	3.73	3.73	0	808.7013
Efficient Evaporative Fan Motor	2890.8	0.135	0.1275	0.0075	21.681

TABLE 6: Typical Operating Costs of Electric Household Appliances

Appliance	Typical Wattage	Estimated Hours	Estimated Monthly	Cost Per Month@0.078
Air Conditioner (12,000 BTU)	1500	200	300	$23.40
Air Conditioner (36,000 BTU)	4500	200	900	70.2
Auto Engine Heater	600	40	24	1.87
Battery Charger (Car)	150	15	2.3	0.18
Blender	385	2	0.8	0.06
Bug Zapper	40	300	12	0.94
CD, Tape, Radio, Receiver System	250	60	15	1.17
Clock	3	730	2.2	0.17
Clothes Dryer	5000	17	85	6.63
Coffee Maker (Auto Drip)	1165	4	4.7	0.37
Compactor	400	10	4	0.31
Computer (With Monitor and Printer)	365	75	27.4	2.14
Convection Oven	1500	8	12	0.94
Curling Iron	1500	5	7.2	0.56
Dehumidifier (20 Pints, Summer)	450	360	162	12.64
Dishwasher (Dry Cycle)	1200	25	30	2.34
Dishwasher (Wash Cycle)	200	25	5	0.39
Disposal	420	60	25.2	1.97
Electric Blanket	175	180	31.5	2.46
Electric Heat (Baseboard, Furnace, Heat Pump)	Call Cornhusker Power for a heating estimate.			
Fan (Attic)	400	71	28.4	2.22
Fan (Ceiling)	80	150	12	0.94
Freezer (Automatic Defrost 15 cu. ft.)	440	334	147	11.47
Freezer (Manual Defrost, 15 cu. ft.)	350	292	102.2	7.97
Fry Pan	1200	10	12	0.94
Garage Door Opener	350	3	1.1	0.09
Hair Dryer (Hand Held)	1000	10	10	0.78
Heat Lamp	250	5	1.3	0.1
Heat Tape (30ft., Winter)	180	720	129.6	10.11
Heater (Auto Engine, Winter)	1000	180	180	14.04
Heater (Portable)	1500	40	60	4.68
Heating System (Warm Air Fan)	312	288	89.9	7.01
Humidifier (Winter)	177	230	40.7	3.17
Iron	1000	5	5	0.39
Jacuzzi (Maintain Temperature, 2 Person)	1500	93	139.5	10.88
Lighting (Incandescent)	75	100	7.5	0.59
Lighting (Fluorescent)	40	100	4	0.31
Lighting (Compact Fluorescent)	18	100	1.8	0.14
Lighting (Outdoor Floor)	120	90	10.8	0.84
Microwave Oven	1500	11	16.5	1.29
Mixer, Hand	100	10	1	0.08
Motor (1 HP)	1000	20	20	1.56
Power Tools (Circular Saw)	1800	1	1.8	0.14
Radio	71	101	7.2	0.56
Range (Oven)	2660	8	21.3	1.66
Range (Self Cleaning Cycle)	2500	3	7.5	0.59
Refrigerator/Freezer (Frostfree,17.5cu.ft.)	450	333	149.9	11.69
Satellite Dish (Includes Receiver)	360	183	65.9	5.14
Sump Pump (1/2 HP)	500	20	10	0.78
Television (Color, Solid State)	200	183	36.6	2.85
Toaster	1400	3	4.2	0.33
Vacuum Cleaner	1560	6	9.4	0.73
VCR/DVD	21	12	2.5	0.02
Waffle Iron	1200	4	4.8	0.37
Washer	512	17	8.7	0.68
Waterbed Heater (Queen Size)	375	256	96	7.49
Water Heater (Quick Recovery)	4500	89	400.5	31.24
Water Pump (1/2 HP)	460	41	18.9	1.47

TABLE 7: ACTUAL SMALL BUSINESS AND MULTIFAMILY COUNT

DESCRIPTION	[1]MARIN COUNTY	[2]CITY OF RICHMOND	SUBTOTAL	MARKET PENETRATION GOAL (10%)
GROCERS	176	639	815	82
RESTAURANTS	676	202	878	88
APARTMENTS / MULTIFAMILY	155	302	457	46
GAS STATIONS	67	43	110	11
TOTAL	**1074**	**1186**	**2260**	**227**

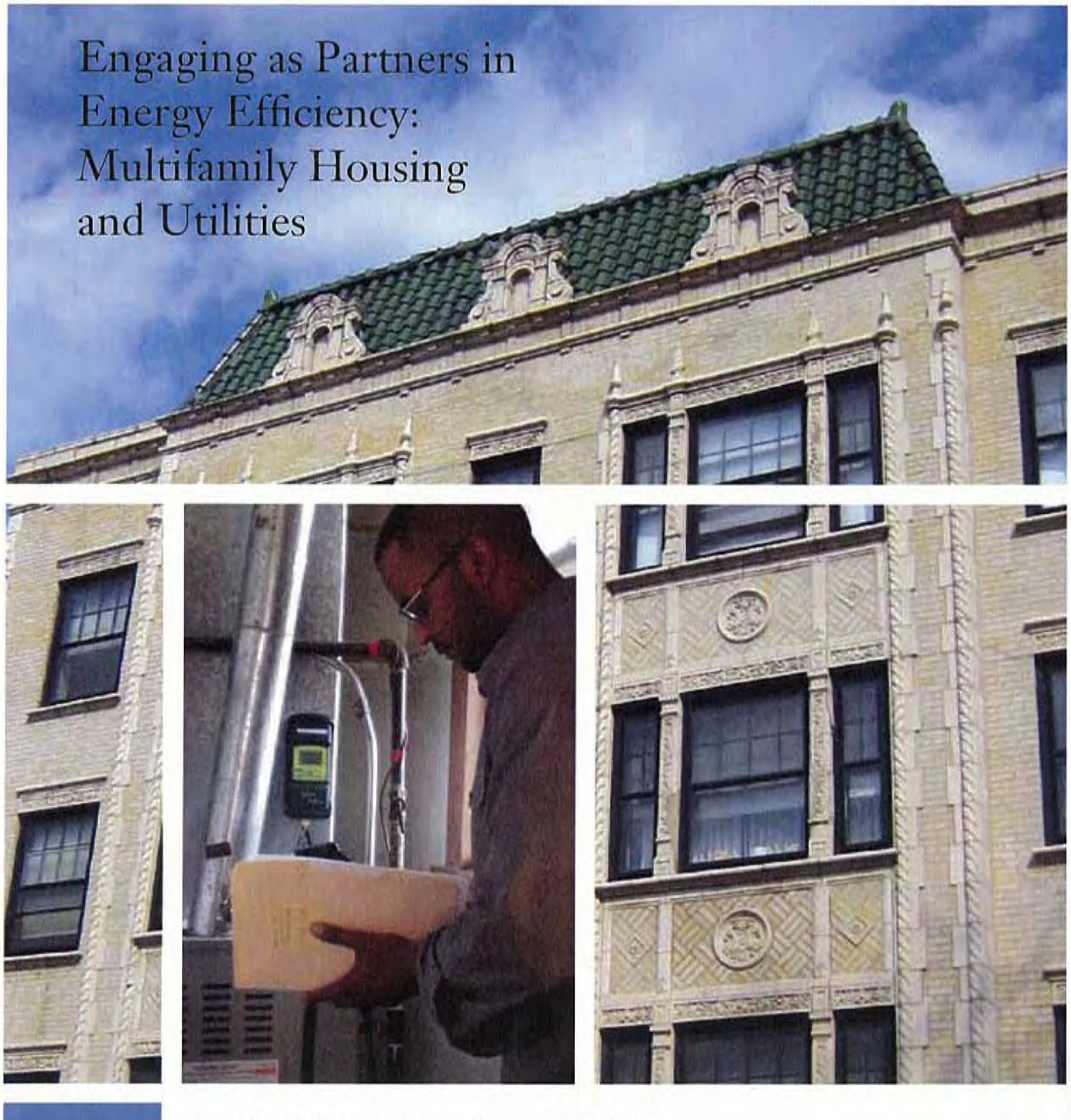
NOTES:

1. Data from Marin Telly website; http://www.telli.com/marin/
2. Data from website http://www.manta.com/

CNTenergy

ACEEE American Council for an Energy-Efficient Economy

Engaging as Partners in Energy Efficiency: Multifamily Housing and Utilities



JANUARY 2012

Anne McKibbin and Anne Evens, CNT Energy
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CNT Energy

CNT Energy (www.cntenergy.org) is a division of the Center for Neighborhood Technology. Since 1978, the Center for Neighborhood Technology (CNT) has been a leader in promoting urban sustainability—the more effective use of existing resources and community assets to improve the health of natural systems and the wealth of people, today and in the future. CNT Energy combines rigorous research with effective solutions to help consumers and communities control energy costs and become more energy efficient.

CNT Energy helps reduce energy costs in households, buildings and communities. CNT Energy invented and now administers the largest residential real-time pricing program, helping households in Illinois control energy costs by providing them tools, information, and pricing programs that reduce peak energy load and energy costs for everyone. CNT Energy helps reduce operating costs and preserve affordable housing by providing a one-stop energy efficiency shop that combines technical and financial assistance to make it easy for building owners to retrofit their buildings. CNT Energy also coordinates Energy Impact Illinois, an alliance of utilities, local government, and others, with the mission of removing barriers and unleashing demand for energy efficiency in Northern Illinois.

American Council for an Energy-Efficient Economy

American Council for an Energy-Efficient Economy (ACEEE)

The American Council for an Energy-Efficient Economy (www.aceee.org) is a nonprofit organization founded in 1980 that acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. ACEEE carries out its mission by:

- Conducting in-depth technical and policy analyses
- Advising policymakers and program managers
- Working collaboratively with businesses, government officials, public interest groups, and other organizations
- Convening conferences and workshops,
- Assisting and encouraging the media to cover energy efficiency policy and technology issues
- Educating businesses and consumers through our reports, books, conference proceedings, media outreach, and Web site

ACEEE Report No. A122

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Executive Summary

Energy use in multifamily buildings can be reduced substantially, with many cost-effective upgrades achieving savings of 15–30% in buildings with five or more residential units. At 2010 national average energy prices, the full expansion of these efficiency upgrade programs would translate into annual utility bill cost savings of almost $3.4 billion for the multifamily sector, nationwide.

Multifamily building owners are among the first to feel the squeeze of rising energy prices. As energy bills rise, upward pressure is put on rents, financial institutions become increasingly concerned about risk to their loan portfolios, and tenants continue to demand comfortable homes. Energy efficiency upgrades provide a solution by improving the bottom line for multifamily building owners, decreasing pressure on rents, decreasing financial risk and improving tenant comfort. Consequently, building owners nationwide are looking for ways to improve the efficiency of their buildings.

Building owners may have difficulty finding technical assistance, financing, or qualified contractors to upgrade their buildings. Building owners often need financial incentives to adopt new technologies or equipment with higher up-front costs. Despite this, studies have documented that affordable housing, often multifamily, receives a disproportionately small share of available energy efficiency funding. Our analysis confirms that states vary widely in their commitment of utility energy efficiency program resources to multifamily housing.

Public utilities represent a vast, largely untapped opportunity for engagement and leveraging of resources for improved energy efficiency. But historically, utility business models and regulation discouraged energy efficiency. Consequently, public policy intervention is needed to make strong engagement in energy efficiency compatible with utility business models.

Utility business models vary dramatically, and utilities are regulated primarily at the state level, with each state taking a different approach to the utilities' business and energy efficiency. These circumstances dictate current energy efficiency investment and the appropriate policy intervention to encourage utilities to partner for effective and comprehensive multifamily energy efficiency retrofit programs. As one example of the local details that can affect multifamily programs, some states classify multifamily housing as residential, some classify it as commercial, and some states have no consistent classification. As a result, it may be unclear whether multifamily housing qualifies a specific energy efficiency program, or any program at all.

Consequently, to align utility incentives with the multifamily industry's needs, building owners and other housing industry players must become partners with utilities, engaging with them directly and in local and state regulatory proceedings. No single strategy will work nationwide, but by joining existing efforts at the state and local levels, housing industry players can work with utilities to increase and improve the use of utility energy efficiency investments in multifamily housing.

This paper outlines the opportunity and strategies for the multifamily housing sector to engage electric and natural gas utilities* in order to expand resources available for energy efficiency retrofits and improve the use of these investments. Every state holds opportunities to improve the energy efficiency of our buildings. And our analysis shows that some states, particularly the District of Columbia, Florida, Illinois, and Texas, are particularly fertile ground for improving energy efficiency policy toward multifamily buildings. We also provide case

* Water utilities and propane gas and heating oil providers are also important potential partners in energy efficiency programs. However, their business models and regulatory oversight differ significantly from the electricity and natural gas industries. Consequently, they are outside the scope of this paper.

studies of numerous successful programs to illustrate the range of approaches that can be used by utilities to improve the energy efficiency of multifamily buildings.

Partnering with Utilities on Energy Efficiency: The Opportunity

Utilities are major players in the energy efficiency arena, having contributed $4.3 billion to electric and natural gas efficiency programs in 2009, and an expected $7.5–12 billion annually by 2020.[1] While investments are becoming more widespread, almost 80% of utilities' contribution occurred in just 10 states as recently as 2008.[2] Regardless of the concentration, this investment is substantial even when compared to the federal government's contribution through the American Recovery and Reinvestment Act of 2009, which made a one-time investment of approximately $17 billion in energy efficiency.[3]

Utility efficiency programs for multifamily buildings vary significantly and range from simple incentives to use energy efficient light bulbs and reduce hot water consumption to comprehensive energy efficiency improvement programs that combine energy audits, contractor selection and oversight, financing from multiple sources, and post-retrofit review of actual energy savings. These comprehensive programs combine building envelope, HVAC, systems, and maintenance and operations improvements and, over the long run, garner the greatest savings per dollar. But utilities only have incentive to participate in these programs where they see opportunities for financial benefit or are subject to government mandates. Even then, successful program delivery requires buy-in from this important and powerful stakeholder.

In 2005, U.S. energy bills in multifamily buildings* totalled approximately $18.03 billion. Of this energy 42% was used to heat and cool buildings while the remainder was used for lighting, water heating, refrigeration, appliances, and other equipment such as pumps and elevators.[4] These multifamily building expenditures have continued to increase as residential energy expenditures increased by 10.6% between 2005 and 2009.[5] Fortunately, much can be done to reduce this use and associated costs. As shown in the case studies throughout this paper, many owners have reduced their energy use and energy bills by 20% or more, improving cash flow and profits and freeing up money to pay for other building improvements.

Homes where low to moderate families live can benefit from energy efficiency as well. Some of this housing is subsidized by the government, but most of it consists of privately owned buildings. Studies have documented that affordable housing, often multifamily, receives a disproportionately small share of available energy efficiency funding.[6] A study by Charlie Harak of the National Consumer Law Center describes the issues confronting affordable housing and the tremendous cost burden that outdated and inefficient units and buildings present to the federal government and residents alike. Harak estimates that HUD spends upwards of $5 billion on energy costs for public housing and "privately owned housing where the owner or tenant receives rental assistance from HUD."[7] However, in 2007, HUD only shaved $^2/_3$ of 1% off of that bill with energy efficiency.[8] Despite the need for greater efficiency in these properties, they also get a disproportionately small share of utility incentive dollars in some states. While the affordable housing market (and policies to increase energy efficiency in that market, differs from the rest of the multifamily sector) it contributes to the substantial potential for savings from energy efficiency.

When scaled to the community and national levels, taking advantage of the available efficiency opportunities can yield very large savings.

* In this report, multifamily buildings are defined as having five or more units, except where noted.

Low Income Renovation: Pearl Brook Apartments, Lunenburg, Massachusetts

- **48-unit residential complex.**
- **The project received energy efficiency services valued at over $43,000 from Unitil and is estimated to save an additional 3,157 therms a year as a result of the improvements, which in turn will provide approximately $133,487 in lifetime savings.**
- **46 13-cubic foot ENERGY STAR refrigerators for a lifetime savings of over $129,000.**

The Pearl Brook apartment complex in Lunenberg is a 48-unit residential complex for income-eligible people over the age of 60 and disabled citizens. As part of a major renovation project in 2010 that included significant heating system retrofits, the Leominster Housing Authority, as development project manager for the Lunenburg Housing Authority, teamed up with the local electric and natural gas utility, Unitil, to explore what energy efficiency services and rebates were available to further augment their project. The Mass Save Low-Income Multifamily Energy Retrofit Program conducted a full energy assessment of the complex, and found a host of energy and cost-saving opportunities to add value and comfort to residents' units. Recommendations included replacement of old light fixtures with ENERGY STAR fixtures, insulation in the attic and basement, and air sealing throughout the building to prevent energy loss. The project received energy efficiency services valued at over $43,000 from Unitil and is estimated to save an additional 3,157 therms a year as a result of the improvements, which in turn will provide approximately $133,487 in lifetime savings.

Unitil also delivered 46 13-cubic foot ENERGY STAR refrigerators valued at $12,000 on December 21, just days before Christmas. The residents received quieter, more efficient refrigerators to replace the older, energy-hog models in their units. The Housing Authority will now save an estimated additional 45,448 kilowatt-hours annually, for a lifetime savings of over $129,000.

Aside from enjoying a new fridge, residents in the complex were pleased about the idea of cutting down on energy usage, saving money, and reducing pollution. "Anything that helps the environment, I'm for," Barbara Berry, a seven-year Pearl Brook resident, told the Fitchburg *Sentinel* and *Enterprise*. "We have to leave something for our grandchildren."

Source: Massachusetts Energy Efficiency Advisory Council and Massachusetts Department of Energy Resources

For example, if the energy savings from Energy Savers, a multifamily building energy efficiency retrofit program that has improved over 7,500 units in the Chicago area since 2007, is aggregated to all 854,000 multifamily units in Chicago, it would reduce energy bills by approximately $269 million each year.*

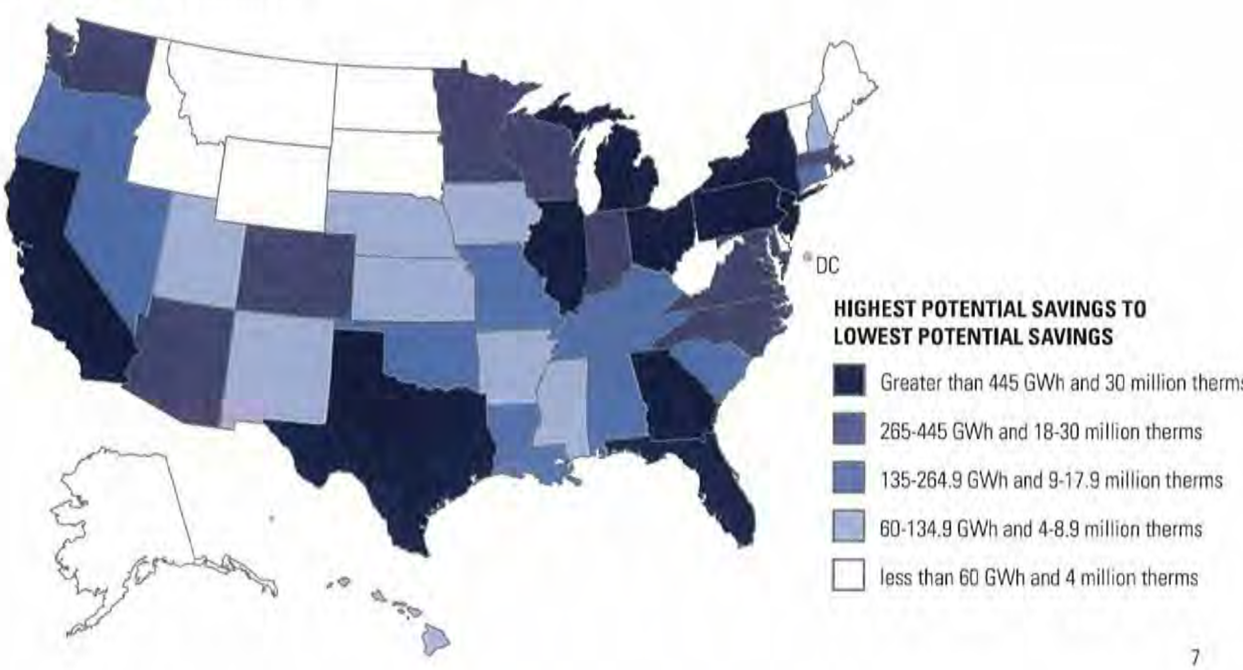
In addition, we can estimate the potential impact of applying quality multifamily energy efficiency programs to every multifamily building in the country. At the national level, and with 2010 national average residential energy prices, energy efficiency improvements of 15% for electricity and 30% for natural gas in all multifamily buildings would create annual utility bill savings of approximately $2.03 billion on electricity and $1.34 billion on natural gas.[9] Thus, the potential for energy efficiency savings from enrolling the entire multifamily sector in a quality program is over $3.4 billion. Even if we adjust these figures by removing the 25.52% of U.S. buildings built after 1990, the potential for energy efficiency savings is immense. These savings levels are consistent with savings reached by quality multifamily energy efficiency programs, including those found in the multifamily energy efficiency programs discussed below in Case Studies of Effective Programs and Partnerships. This level of savings is also consistent with a 2007 report surveying energy efficiency opportunities in multifamily housing.[10] Figure 1 shows the savings potential for each state based on the number of housing units in buildings of five or more units and the national average electricity and natural gas consumption per unit of multifamily housing.

Public utilities represent an enormous opportunity for engagement and leveraging of resources for improved energy efficiency. Utilities have

* On average, Energy Savers saves 650 kWh and 240 therms per unit annually. This is a 12% savings from the national average electricity use in a multifamily unit and just under 31% savings from the actual natural gas consumption for the improved buildings. At average Chicago energy prices, utility bills are reduced by $75 for electricity and $240 for natural gas annually per unit.

FIGURE 1

ANNUAL SAVINGS BY STATE WITH 15% ELECTRIC AND 30% NATURAL GAS EFFICIENCY IMPROVEMENT IN MULTIFAMILY BUILDINGS



NYSERDA Energy $mart Multifamily Performance Program: 135 Broadway, Saranac Lake, NY

The beautiful, well-preserved buildings of Saranac Lake offer timeless charm. Unfortunately, that often comes with a negative side effect: energy inefficiency. The building at 135 Broadway was a perfect example of this predicament. The 90-plus-year-old building offered its first-floor commercial tenant and the occupants of its 13 residential units a classic downtown space in which to live and work. But the building was drafty and relied on dated, inefficient equipment. Its energy consumption soared during icy North Country winters, driving utility bills up along with it.

- **Today, the building saves its owners and occupants a combined total of $6,495 each year. Expected total savings during the life of the improvements are $41,913, and the project will have paid for itself in just under seven years.**


135 Broadway, **Saranac Lake, NY**

With energy costs continuing to rise, TSB Development, LLC, the owner of the building, decided to make some changes. With implementation of the recommended improvements complete, 135 Broadway serves as proof that an older building can reduce its energy use and operating expenses, increase comfort, improve safety for occupants, and stay affordable—all while maintaining its classic charm.

With incentives and support from NYSERDA's Multifamily Performance Program and logistical assistance from an MPP Partner, TSB completed a full selection of energy efficiency improvements. The company replaced an aging boiler, adding new temperature controls. It swapped inefficient windows and appliances with better-performing models, upgraded lighting, added a new domestic hot water heating system, and installed carbon monoxide and smoke detectors.

The improved 135 Broadway was a groundbreaking success. It achieved energy savings of 27%, and was the first MPP project to earn New York's Energy $mart label and plaque. Since its renovation, 135 Broadway has been a key inspiration for the dozens of projects that have followed in its footsteps. Today, the building saves its owners and occupants a combined total of $6,495 each year. Expected total savings during the life of the improvements are $41,913, and the project will have paid for itself in just under seven years.

Source: Michael Colgrove, NYSERDA

"Energy efficiency improvements of 15% for electricity and 30% for natural gas in all multifamily buildings would create annual utility bill savings of approximately $2.03 billion on electricity and $1.34 billion on natural gas."

longstanding, energy–centered relationships with building owners, as well as unique access to customer usage data that can be used to design and target effective, comprehensive energy efficiency retrofit programs. But because utility incentives regarding energy efficiency vary dramatically, no single policy will encourage them to partner for effective efficiency programs. Instead, building owners must engage utilities based on each utility's regulatory circumstances and the local markets to align utility incentives with effective, comprehensive energy efficiency retrofit programs.

To achieve the greatest benefit from energy efficiency, building owners and utilities must work together to jointly fund comprehensive multifamily efficiency improvement programs in ways that meet building owners' needs. Building owners must find ways for utilities to share data with program delivery providers so that these providers can assess energy costs, prioritize buildings for improvement, and secure financing. Regulators, legislators, and building owners must work to align utility incentives with comprehensive efficiency improvement programs and responsible data sharing.

Aligning Utility Business Models and Energy Efficiency: Policy Intervention Required

UTILITY AND REGULATOR MOTIVATIONS

There are four major types of electric and natural gas utilities, each with their own unique business model: (1) publicly owned utilities, (2) rural electric cooperatives, (3) investor-owned utilities (IOUs), and (4) competitive electric and natural gas providers. Each of these types of utilities is discussed in more detail in Appendix B: Types of Utilities and Their Investments in Energy Efficiency. Absent intervening public policy that encourages efficiency, each utility type faces different financial incentives and regulatory and legal requirements regarding energy efficiency.

Historically, the main business of electric and natural gas utilities was to sell electricity or natural gas, and energy efficiency directly contradicted this business model. Public policy has altered this situation, often with the support and leadership of forward-thinking utilities, by mandating utility participation in energy efficiency programs or providing an incentive to do so. But even today, energy efficiency affects utility financial goals in varying ways.

When seeking to obtain utility and regulator support for investments in multifamily building retrofits, it is important to understand the issues that motivate and constrain decision-making. Multifamily buildings tend to be concentrated in metropolitan areas and the vast majority of metropolitan areas are served by investor-owned utilities. Mechanisms to align utility financial incentives with multifamily energy efficiency are discussed in the next section, "The Multifamily Housing Industry and Energy Efficiency in the States."

Utilities also care about promoting a strong economy in their service territory, as their sales depend in part on the local economy, and unlike some companies, utilities cannot move to the Sun Belt or overseas. Many utilities, for example, partner with local economic development agencies to promote their regions, include economic development information on their websites, and employ economic development staff to assist potential customers.[11] Thus, utilities may be responsive to arguments that multifamily retrofits can strengthen neighborhoods and local economies.

In addition, as regulated monopolies, utilities care about the opinions of their regulators. Regulators in turn are elected or appointed by governors and care about protecting public health and safety while also keeping energy bills in check. Energy efficiency addresses these issues by reducing emissions from power plants, reducing the need for expensive new power plants, and, in some cases, allowing old, dirty power plants (often located in urban areas) to be retired.* Energy efficiency also reduces energy bills by lowering energy consumption and typically slows, but does not eliminate, rate increases since, as shown in Figure 2, energy-efficiency is less expensive than building new power plants.

* For example, Pacific Gas & Electric used energy efficiency as part of its strategy to retire the Hunters Point Power Plant in San Francisco.

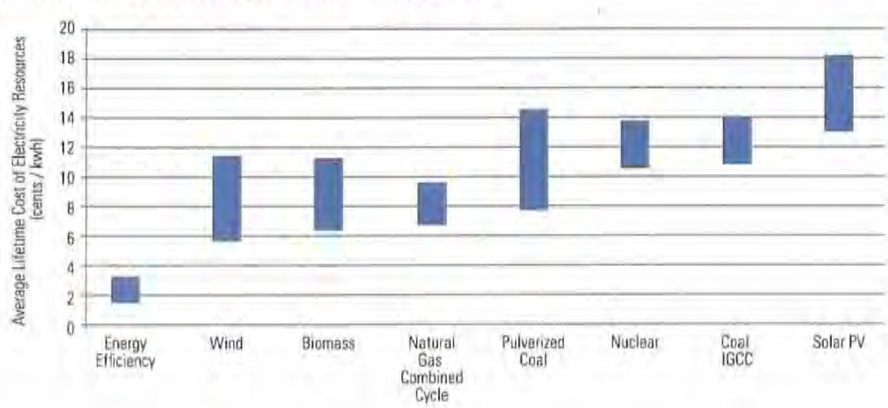
UTILITY REGULATION

Electric and natural gas utilities are regulated primarily at the state level, but there is also some regulation at the federal and local levels. In addition, electric utilities may participate in regional wholesale electric markets. Each of these levels of regulation effects utility incentives and energy efficiency investments. This section will briefly describe the mechanisms that federal, regional, state, and local entities use to regulate utilities. Each of these mechanisms provides an opportunity for housing industry stakeholders to increase and improve utility energy efficiency investments.

CONSIDERATIONS FOR ENGAGING WITH REGULATORS		
	Pros	Cons
Federal	Nationwide reach of policy change	No jurisdiction over utility efficiency programs
Regional	May encourage energy efficiency through planning processes and market mechanisms	No jurisdiction over utility efficiency programs
State	Full jurisdiction over utility energy efficiency programs	Must engage in every state
Local	Existing building owner relationships with local government	Little jurisdiction over utility energy efficiency programs

FIGURE 2

AVERAGE LIFETIME UTILITY COST OF ELECTRICITY RESOURCES[12]



State Regulation

State regulatory commissions implement state electricity and natural gas–related laws, and typically consist of three to five elected or appointed commissioners and a multidisciplinary staff of attorneys, judges, economists, accountants, and engineers. Each state commission's authority differs according to its authorizing statute and willingness to interpret that statute for efficiency. Some commissions are cautious in their interpretation, rarely taking steps that are not explicit in legislation, while others interpret broader public interest obligations as giving authority to regulate more widely.[13] Most state regulatory commissions:

- determine utility rates;
- approve comprehensive generation resource plans;
- authorize (or reject) merger proposals;
- approve the entry of competitive suppliers into the state's market; and
- approve cost recovery for utility investments, including energy efficiency programs.

The National Association of Regulated Utility Commissioners (NARUC) is also an excellent forum for the sharing of ideas among commissioners, although it has no regulatory authority itself. NARUC's Committee on Consumer Affairs has recently adopted a resolution supporting fair expenditure of energy efficiency funds in all customer sectors, and pays particular attention to the needs of multifamily housing.[14] The National Association of State Utility Consumer Advocates (NASUCA) has adopted a similar resolution.[15]

Regulatory commissions enact most IOU and competitive provider regulation and invite stakeholder input. Legislatures are also active in creating utility laws around energy efficiency. State legislators shape regulation by specifying state regulatory commissions' duties and the state's industry structure. In addition, most major energy efficiency portfolio standards and public benefits funds result from state legislation. Because the governing boards of rural electric cooperatives and publicly owned utilities are, at least in theory, directly answerable to their customers and residents, these utilities are less often subject to state regulation.

Federal Regulation

The Federal Energy Regulatory Commission (FERC) does not have authority to regulate the in-state operations of electric and natural gas utilities. Consequently, it does not have jurisdiction over utility energy efficiency programs. The commission, however, has stated its policy to encourage energy efficiency and price-related programs that encourage energy efficiency.[16] As such, the FERC has ordered that regional electric transmission planning processes take all types of resources, including energy efficiency, into account.[17]

Local Regulation

The relationship between local governments and IOUs, rural electric cooperatives, and, to a lesser extent, competitive energy suppliers is governed by a patchwork of informal relationships and formal contractual agreements. These may include franchise agreements and municipal aggregation statutes. These agreements may present opportunities to negotiate increased energy efficiency program cooperation and resources.

Utilities are often subject to franchise agreements with municipalities or other governments within their territory. These long-term agreements often include compensation for work on public streets, requirements for the construction and location of utility facilities, tree-trimming authority, and a mechanism for the municipality to buy utility assets, if desired.[18]

A 2010 U.S. EPA study reviewing electricity and natural gas franchise agreements from 55 Midwestern municipalities found that, with the exception of Ann Arbor, Michigan, no franchise agreement "offered any recognition of the importance of, nor mandates for, energy efficiency, renewable portfolio standards, greenhouse gas emission reductions, or the decoupling of energy sales from utility revenues."[19]

Some restructured states allow municipalities to choose competitive electric and natural gas providers for their residents through municipal aggregation statutes.[20] The threat of losing (or gaining) so many residential customers at once may motivate IOUs and competitive providers to negotiate increased energy efficiency to satisfy municipalities, residents, and businesses.

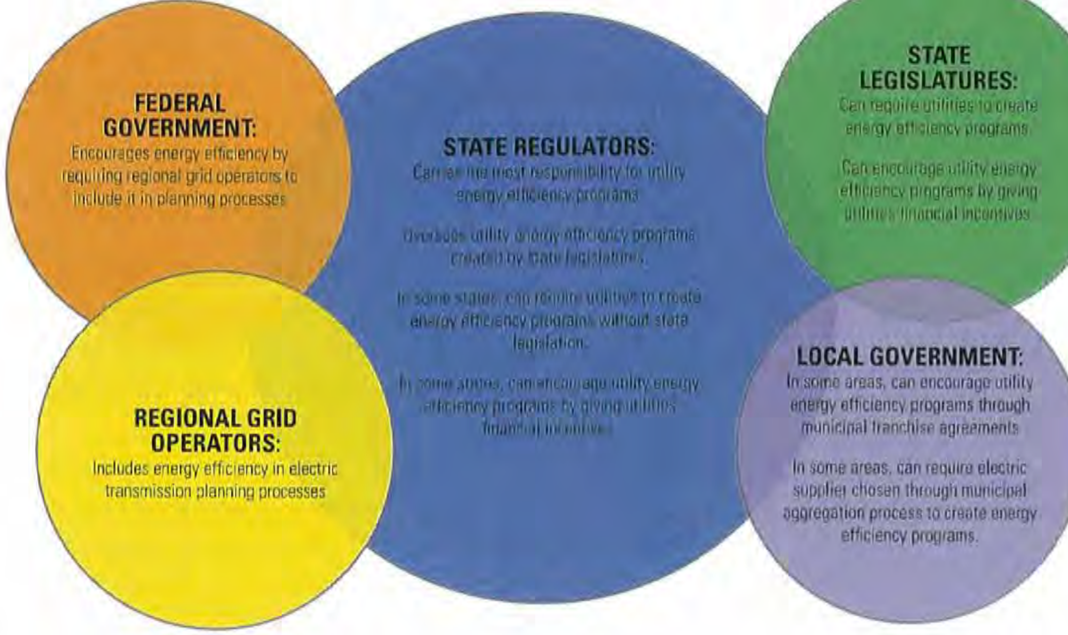
Regional Regulation

In some parts of the country, regional grid operators, also known as independent system operators, control the electric grid and regional wholesale electric markets. They determine when, and which, power plants place electricity on the grid and ensure that it flows where needed. They also plan transmission infrastructure. Where there is no wholesale market, utilities manage the transmission grid themselves.[21]

Wholesale markets in areas with significant transmission constraints have an incentive to encourage energy efficiency as a way of alleviating these constraints, which result in higher electricity prices. Transmission constraints can occur where electricity demand growth has outpaced the building of new electric transmission lines, where geologic features make it difficult to site new lines, or where new electric generation resources, such as wind farms, have filled the capacity of existing transmission lines. These constraints may affect a single town or county, or can cover large areas, such as the wind generating regions of the Dakotas and West Texas. Regional wholesale markets that choose to encourage energy efficiency may do so by including energy efficiency in their transmission

FIGURE 3

ROLES OF GOVERNMENT AND REGIONAL GRID OPERATORS IN ENERGY EFFICIENCY



planning processes and allowing energy efficiency resources to bid into capacity market auctions.[22] However, each system operates independently, and so their planning processes vary significantly from region to region.

Utility Circumstances Dictate Energy Efficiency Investment in Multifamily Housing

The U.S. electric and natural gas utility industries are heavily regulated, decentralized, and complex. Consequently, no single strategy for aligning utility and building owner incentives will work nationwide. Even policies that are appropriate nationwide must be applied at the local or state levels because of the industries' regulatory structures. This section outlines the types of legal rules that govern utility energy efficiency programs. Each of these rules create opportunities for efficiency and barriers that can be overcome, if improved upon by engaged and active stakeholders.

Two types of statutory regimes promote utility energy efficiency programs in the states. First, energy efficiency portfolio standards (EEPS) and public benefits funds (PBF) set targets for efficiency savings and program funding by utilities. An EEPS is a state law or regulation that requires utilities to institute energy efficiency programs that save a specified amount of energy. Similarly, PBFs require utilities to collect funding from customers that must be used for energy efficiency programs, often administered by a third party. Second, procurement processes require utilities to plan or pay for efficiency programs.

The details of these laws have a profound effect on utilities' willingness to collaborate on robust energy efficiency programs. In addition, rules governing the use of customer-energy use data play an important role in the ability of advanced efficiency providers to design and implement comprehensive energy efficiency retrofit programs.

ENERGY EFFICIENCY PORTFOLIO STANDARDS AND PUBLIC BENEFITS FUNDS

EEPS and PBFs have been the strongest drivers of utility energy efficiency investments in the past decade. EEPS have been adopted in 26 states[23] and PBFs add several more. In addition, quite a few states have requirements for Integrated Resource Planning (IRP), sometimes called Least-Cost Planning, thatsometimes drives significant utility efficiency investments. In 2009, EEPS and PBFs spurred utilities to invest more than $4.3 billion in electric and natural gas efficiency programs nationwide.[24] EEPS, PBFs, and IRPs are not, however, without their limitations. If improperly configured, their terms can encourage utilities to invest in cheap, short-term programs that result in lower overall savings than would be achieved by more comprehensive programs. This section describes typical EEPS and PBF terms and their effect on energy efficiency programs. The next section, The Multifamily Housing Industry and Energy Efficiency Efforts in the States, contains strategies for aligning these terms with utility incentives to promote energy efficiency.

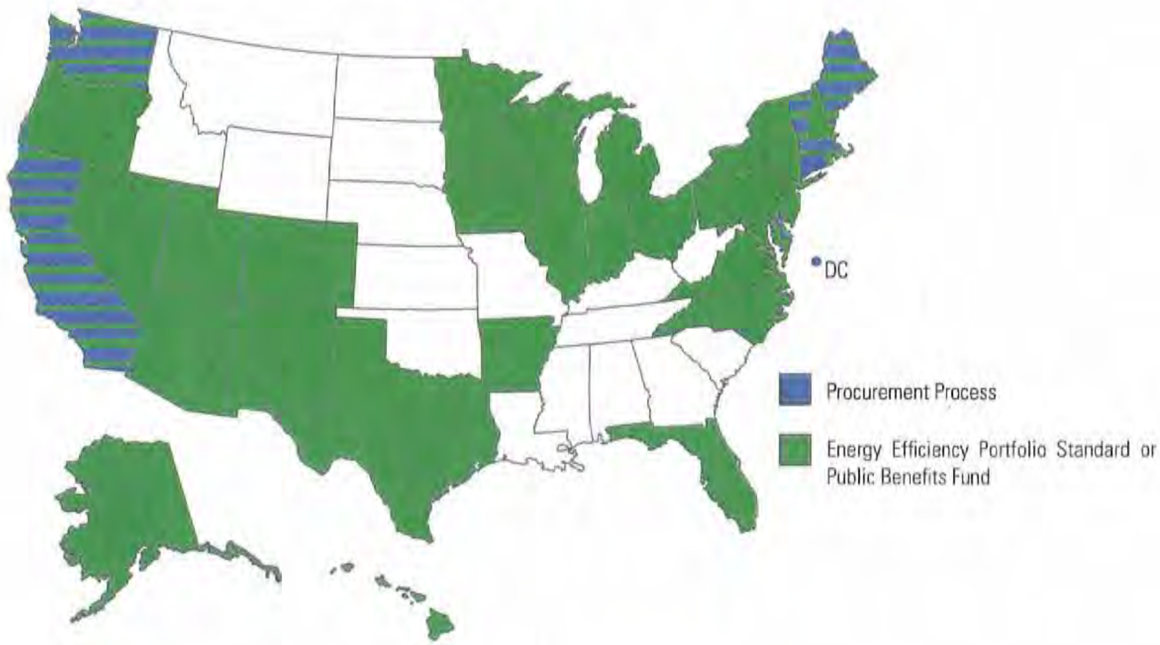
Energy Savings and Funding Targets

EEPS energy savings targets are most often expressed as a percentage of previous years' electricity or natural gas sales. This target usually starts at a low level and ramps up over time, often up to 1–2% of annual sales. In contrast, PBFs include targets for efficiency program funding. Without additional safeguards, funding targets can provide incentives for spending without ensuring significant energy savings.

Cost-Benefit Tests

EEPS and PBFs typically require the application of cost-benefit tests to ensure that energy efficiency programs are cost effective. Cost-benefit tests can be applied across the entire portfolio of energy efficiency programs, across individual programs (such as a multifamily retrofit program), or across the smaller efficiency measures that make up each

FIGURE 4
RULES THAT GUIDE UTILITY ENERGY EFFICIENCY INVESTMENT[25]



program (such as the installation of compact fluorescent light bulbs (CFLs) as part of a multifamily retrofit program). The application of cost-benefit tests plays a significant role in determining utility incentives. Cost-benefit tests are designed and implemented in many different ways, significantly impacting the type of program that can be considered in each state.

Cost Recovery and Financial Incentives

Every EEPS and PBF provides a method for utilities to recover the cost of energy efficiency programs. However, some regulators also employ financial incentives that allow utilities to earn a return on efficiency investments, share proven savings with customers, or obtain a bonus payment for exceeding performance targets. States that use these types of incentives tend to exceed the national average energy savings.[26]

Spending Caps

Illinois, Michigan, North Carolina, and Pennsylvania cap utility spending on energy efficiency programs. In these states, regulators may excuse utilities who meet the spending cap from their obligation to meet savings targets.[27] While these caps are typically intended as a consumer protection measure, they ignore the fact that, if the utility does not implement energy efficiency, it must buy or generate electricity, which is often more expensive than energy efficiency, as shown in Figure 2. Thus, in addition to reducing the availability of efficiency programs, the cost caps may actually increase customer utility bills.

Administration

Under an EEPS, utilities may be allowed to administer energy efficiency programs themselves or may be required to hire or pay for an independent, third-party administrator. In Vermont, for example, every utility program is administered by a single administrator chosen by the Public Service Board. Unlike an EEPS, PBFs are most often administered by a non-utility program administrator or state agency. Unfortunately, funds housed at government agencies may be vulnerable to raids by state government officials in times of budget crisis. Connecticut, the District of Columbia, and New Jersey have approved plans to raid energy efficiency funds in recent years.[28]

Measuring Savings

Compliance with an EEPS is measured by independent evaluators. However, evaluation criteria vary by utility, by state, and over time. Consequently, utilities that plan their programs before evaluation criteria are settled or when criteria are changing face the risk that their programs will miss their EEPS savings targets when they are implemented, triggering financial or other penalties. Utilities in this situation may hesitate to undertake new, more complex types of efficiency programs such as comprehensive building efficiency retrofits.

PROCUREMENT PROCESSES

The second type of statutory regime used by states to promote energy efficiency is the procurement process. California, Connecticut, Delaware, Maine, Massachusetts, Rhode Island, Vermont, and Washington have adopted a process, called a "loading order," to guide their regulatory decisions regarding energy.[29] In California, the order prioritizes energy efficiency, requiring California utilities to "optimize all strategies for increasing conservation and energy efficiency" before they procure electricity or natural gas from other sources.[30] To implement this policy, the California Energy Commission estimates the maximum achievable savings from energy efficiency programs. The California Public Service Commission uses these savings to set energy savings goals and determine the funding required to meet them. California's utilities then submit efficiency plans that meet these goals.[31]

Many vertically integrated states undergo integrated resource planning processes to estimate future electricity demand and plan for the power plants or other resources needed to meet that demand at the lowest cost. However, few of these states have explicitly prioritized energy efficiency or put that prioritization into practice.

Illinois' system for making energy resource decisions is unique and requires a state agency, the Illinois Power Agency, to buy electricity for its IOUs. Unfortunately, the agency's requests for regulatory approval to purchase verifiable energy efficiency savings in lieu of energy have been denied. Efforts are underway to pass legislation to clarify the agency's authority.

DATA-SHARING RULES

In addition to EEPS, PBFs, and procurement processes that encourage energy efficiency, states also create rules to govern the use of customer energy use data. These rules play an important role in the ability of advanced efficiency providers to design and implement comprehensive energy efficiency programs.

Sophisticated energy efficiency providers can use customer-specific energy use data to design, target, and continuously improve advanced energy efficiency programs. Utilities, which have a responsibility to protect customer information, are loath to share data for fear of backlash from privacy groups and worries about losing competitive advantages in restructured markets. Unfortunately, few states have addressed these barriers to comprehensive energy efficiency retrofit programs in any coordinated way.

One common method of protecting customer data, removing or hiding addresses and account numbers, can make the data unusable for some efficiency-related purposes. This "scrubbed" data does not allow efficiency providers to identify homes most in need of efficiency upgrades or to compare homes with groups of nearby homes or homes with similar building type.

California's Public Utilities Code allows energy efficiency providers to access customer energy use data to implement their programs, if the utility and efficiency program delivery provider have a contract requiring reasonable security procedures and practices.[32] While the law ensures that customer-identifying information can be used for successful program implementation, it requires the utility to hide customer addresses when the information is being used to design new programs by parties that are not contracted with utilities.[33]

In Vermont, the Public Service Board oversees the state's energy efficiency programs, which are administered by a non-utility administrator. The Public Service Board's contract with the third-party administrator provides for sharing of customer-specific data between the energy efficiency administrator and the state's utilities, and it requires the administrator to put privacy safeguards in place.[34]

In addition, building owners may not have access to tenant energy use data in a format that allows them to use whole-building labelling programs such as Energy Star. Where data is available, it is often in a form that is time consuming and expensive for building owners to manage at scale. A few utilities are working with commercial building owners to facilitate the provision of tenant data. ComEd, in northern Illinois, is a leading provider of free automated benchmarking services for its customers. According to the Institute for Market Transformation, ComEd's program has "resulted in the benchmarking of thousands of commercial buildings in Chicago in just a few years."[35]

ON-BILL FINANCE

Currently, 14 states have utilities that offer on-bill finance programs to their customers, and more are considering such programs. On-bill finance programs allow utility customers to choose and install energy efficiency measures, often from a list of approved measures, and repay the cost of those measures over time through an additional charge on their utility bill. The programs can be structured to appeal to residential, commercial, or industrial customers, and to apply to multifamily common areas and individual tenant units. While this paper does not address the details of these programs, interested readers should consult *On-Bill Financing for Energy Efficiency Improvements: A Review of Current Program Challenges, Opportunities, and Best Practices*, a December 2011 Research Report by the American Council for an Energy Efficient Economy (ACEEE).

COMMON UTILITY ENERGY EFFICIENCY PROGRAMS

Utility efficiency portfolios include programs for residential, commercial, and industrial customers. Utilities that are new to energy efficiency typically include a heavy dose of residential and commercial lighting programs, which are inexpensive, simple to administer, and achieve significant savings.

In the residential sector, utilities often include lighting and appliance rebates, weatherization programs and so-called "direct install" programs. Weatherization programs seek to improve insulation, heating and cooling systems and reduce leaks of conditioned air to the outside. They can range from rebates for attic insulation to comprehensive retrofit programs in which many opportunities to reduce energy use are examined and a comprehensive package of efficiency improvements are assembled and financed. Direct install programs involve a home visit to install energy efficiency products, which typically include CFLs, basic weather-stripping, and faucet aerators to reduce hot water use. The better direct install programs also seek to sign owners up for an energy audit and feed customers into comprehensive programs.

While lighting and appliance rebates are inexpensive and easy to administer, their savings are not as significant or long lasting as those of comprehensive energy efficiency retrofit programs. Consequently, EEPS and PBF policies must be carefully crafted to encourage comprehensive efficiency programs.

ROLE OF MULTIFAMILY BUILDINGS IN ENERGY EFFICIENCY PROGRAMS

Multifamily building residents and owners are generally eligible for lighting and appliance programs. And multifamily buildings may be eligible for weatherization programs that are primarily designed to serve single-family homes. Some utilities have special programs targeting the unique needs of multifamily buildings and devote significant resources to this sector.

To provide a snapshot of program accomplishments and multifamily programs' status within overall residential energy efficiency spending, we reviewed six established statewide multifamily program portfolios. Residential energy efficiency programs in most states can be categorized into three broad categories: multifamily (typically buildings with five or more units, but sometimes extended to buildings of two or more units), single-family (one unit homes, sometimes including duplexes or other small buildings with more than one unit), and cross-cutting (residential efficiency improvements that apply to all housing types such as appliances, lighting, heating and air conditioning). Table 1 provides a summary of the multifamily energy efficiency program budgets for Arizona[36], California[37], Colorado[38], Illinois[39], Massachusetts,[40] and New York.[41]

A comparison of multifamily efficiency program budgets in these states and the actual distribution of housing units shows that while multifamily programs are funded in keeping with their portion of housing in leading states (California, Massachusetts, and New York), they are relatively underfunded in the other states reviewed. These other states (Arizona, Colorado, and Illinois) are more typical of multifamily program status in the majority of U.S. states, with the important caveat that many states have no multifamily programs at all. In each leading state, the portion of the combined single-family and multifamily budgets (disregarding cross-cutting funds available to both residential building types, which creates a more accurate comparison) allocated to multifamily programs falls somewhere between the portion of housing units in buildings of two or more units and the portion in buildings of five or more units. By this measure, Massachusetts has the largest commitment to multifamily programs with 33% of its combined budget set aside for multifamily while 19.9% of its units are in buildings of five or more units. California, Massachusetts, and New York also allocate budgets large enough to reach a significant number of multifamily units: program funding per unit of multifamily housing in these leading states range from $8.96 to $58.63.

Arizona, Colorado, and Illinois have much poorer performance relative to these metrics. In Arizona, where 15.9% of housing units are in buildings of five units or more, only 0.12% of the combined multifamily and single family budget is devoted to multifamily units (these 2010 funds were used to plan a multifamily program expected to expand in the future). In Colorado 5% of the combined budget is allocated to multifamily, while five or more unit buildings provide nearly 20% of homes in the state. Illinois looks better, but this is mostly because the majority of its residential program budget is allocated to cross-cutting programs rather than housing-type-specific programs (multifamily programs represent 5.2% of the total residential budget, much lower than in the leading states). The state only provides $3.05 to multifamily programs for every multifamily unit in the state. Still, this is much better than Arizona or Colorado, which provide $0.03 and $1.14 respectively.

TABLE 1

MULTIFAMILY ENERGY EFFICIENCY PROGRAM BUDGETS AND SAVINGS GOALS COMPARED TO TOTAL RESIDENTIAL PROGRAM PORTFOLIOS

	Arizona	California	Colorado	Illinois	Massachusetts	New York
% of housing units in MF 5+ units	15.9%	22.5%	19.9%	20.2%	19.9%	32.4%
2010 Multifamily budget (gas and electric)	$14,053	$26,729,513	$479,073	$3,228,752	$31,830,246	$52,751,515
- as % of total residential budget	0.06%	12.5%	1.8%	5.2%	20.0%	28.3%
- as % of MF and SF combined budget	0.12%	29.2%	5.0%	47.3%	33.0%	34.0%
2010 Funding per unit of MF 5+	$0.03	$8.96	$1.14	$3.05	$58.63	$20.51

* Programs included in this comparison are: Arizona Public Service Company's Multifamily Energy Efficiency program (planning stage, numbers are actual spending and savings), California's Statewide Multifamily Energy Efficiency Rebate Program, Colorado's Low-Income Multifamily Weatherization, ComEd's Multifamily All Electric Sweep, Ameren's Multifamily In-Unit Efficiency Program and Common Area Lighting Programs, IL Department of Commerce and Economic Opportunity's Low Income Energy Efficiency Moderate Rehab program, Massachusetts' Multifamily Retrofit low income program, and NYSERDA's Multifamily Performance program and utility multifamily energy efficiency programs.

The Multifamily Housing Industry and Energy Efficiency Efforts in the States

Because of the utility industry's complexity, no single strategy for aligning utility and building owner incentives will work nationwide. Instead, multifamily housing stakeholders should join existing efforts to increase and improve the use of utility energy efficiency investments in the states. Building owners can identify their local utilities' circumstances and the appropriate strategies to align utility incentives with energy efficiency. Then, they must find an opportunity to put these strategies into play. This section identifies states that are most likely to benefit from improved multifamily energy efficiency policies, common forums in which to engage utilities, and strategies to align utility incentives with building owner needs. In addition, Appendix C introduces the non-utility parties who most frequently participate in state regulatory proceedings about energy efficiency.

REGIONS THAT WOULD BENEFIT FROM IMPROVED ENERGY EFFICIENCY POLICY

Opportunities to see significant savings from multifamily energy efficiency programs are not distributed evenly across the United States, and are determined by three factors: the size of the multifamily building market, the portion of multifamily building energy that comes from utilities, and existing energy efficiency policies. We applied these factors to create the map (Figure 5) which identifies states with a large share of multifamily housing units and utility-provided energy, where improvements in utility energy efficiency policy would significantly improve the state's energy efficiency resources. States identified as "High Multifamily" have more than 110% of the national average of multifamily units and utility-provided energy, and "Low Multifamily" states have less than 90% of the national average of these factors. We further used ACEEE's 2010 State Energy Efficiency Scorecard ratings for state energy efficiency policies to identify states with room for policy improvement. The states that would benefit most from improved energy efficiency policy toward multifamily buildings include the District of Columbia, Florida, Illinois, and

Texas. More information on these factors is located in Appendix F.

FORUMS FOR ENGAGING UTILITIES

Some utilities may simply be unaware of the savings created by comprehensive multifamily retrofit programs or of vendors who can administer these programs. Consequently, to increase the resources available to multifamily building owners for energy efficiency projects, a first step should be to engage the utility outside of any regulatory or legislative proceeding. While these proceedings provide unique opportunities, a more informal meeting can help assess the company's concerns regarding efficiency, confirm their circumstances, and find common ground. The recognition that multifamily buildings cut across the residential and commercial markets and therefore may not be adequately served by programs geared toward either sector, is often an important starting point for discussions. If issues remain after informal discussions, it may be useful to engage further in these more formal proceedings.

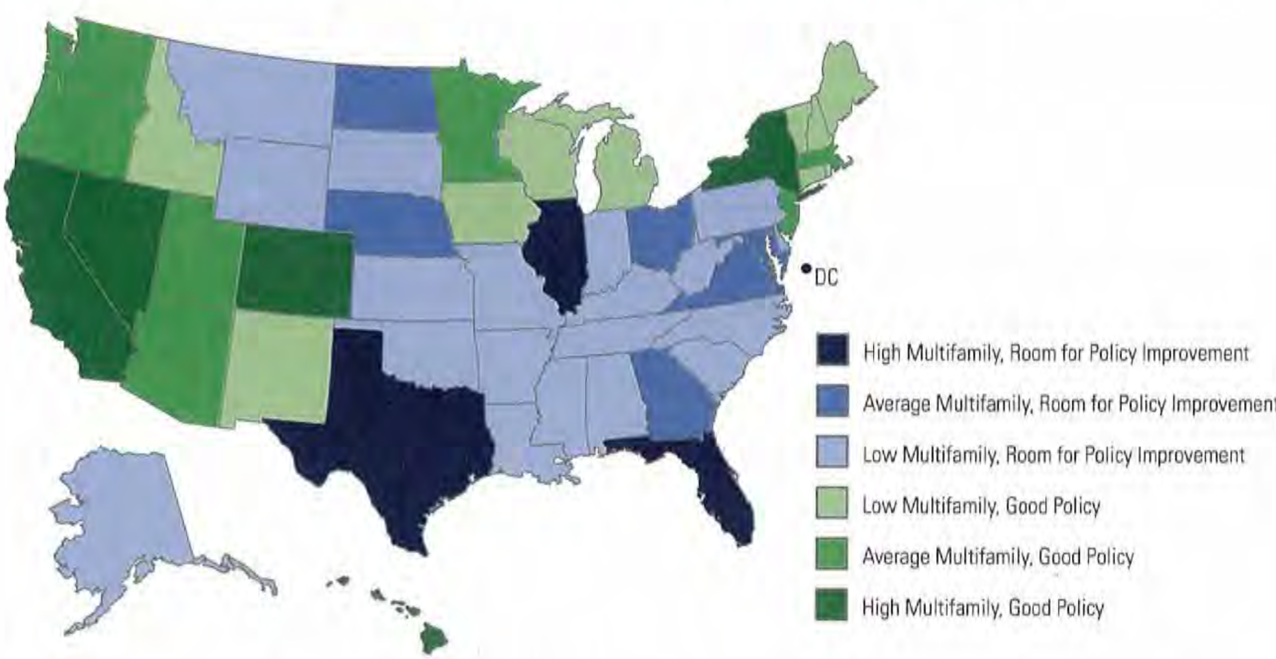
Discretionary Regulatory Actions

In jurisdictions where state regulatory commissions oversee utility efficiency programs or have authority to mandate efficiency programs and their terms, they have an opportunity to do the following:

- Require that utilities participate in comprehensive energy efficiency retrofit programs for multifamily housing.
- Ensure that comprehensive energy efficiency retrofit programs are funded appropriately.
- Insist on the use of cost-benefit tests that encourage comprehensive energy efficiency retrofit programs.
- Remove spending caps that encourage utilities to prioritize cheap, easy programs that do not create the greater long-run savings of comprehensive programs.

FIGURE 5

STATES THAT WOULD BENEFIT MOST FROM IMPROVED MULTIFAMILY ENERGY EFFICIENCY POLICY.



Most regulatory commissions allow public comment. In addition, full participation as an intervener to a contested regulatory proceeding allows a party to testify before a judge and negotiate for its interests in settlement talks. Procedural rules vary by state, but the regulatory commission or an experienced utilities attorney can provide details of how best to participate.

Utility Rate Cases

State regulatory commissions determine utility rates for IOUs and, sometimes, municipal utilities and rural electric cooperatives. In these proceedings, the regulator typically has authority to apportion the recovery of utility costs among customer sectors and usage levels.

Rate cases may be an appropriate time to advocate for mechanisms that allow utilities to earn financial rewards for effective energy efficiency programs. Rate cases are usually contested, trial-like proceedings that require an attorney and expert witnesses. Nevertheless, they may provide an excellent opportunity to align utility and building owner incentives.

Merger Approval Cases

State regulatory commissions must approve utility mergers. Approval proceedings provide utilities and other interested parties a chance to negotiate for energy efficiency programs, funding, and other resources. Parties may also agree to put a portion of the estimated savings from post-merger consolidated operations into a revolving loan fund or other mechanism to help finance efficiency improvements.

Franchise Agreement Negotiations

Franchise agreements are the result of negotiations between utilities and municipalities. These agreements are long-term, sometimes up to 50 years in length, but when they are renewed, they present an opportunity to negotiate for funding or other resources for energy efficiency for municipal residents and businesses. Building owners who are interested in franchise agreements should contact their municipal officials to express their concern and inquire about the ability to renegotiate these contracts.

Legislation

Legislated EEPS and PBFs have been extremely successful at increasing the resources available for multifamily residential energy efficiency. However, policymakers must take care to configure these policies to avoid the perverse incentives described in the previous section. Building owners who are interested in these policies may be able to align with the utilities or environmental and consumer advocates to support improved policies in their state legislatures.

National Leadership

National leadership can point the way for states to remove barriers to effective partnerships. The following are possible directions for action by federal agencies or national organizations such as the National Association of Regulatory Utility Commissioners (NARUC):

- Provide guidelines for allocating credit toward energy efficiency requirements to utilities that participate in jointly funded programs.
- Develop data-sharing agreements to be used by utilities and efficiency providers, and identify a third-party neutral data aggregator that can combine data from multiple utilities.
- Provide guidance to states that are establishing evaluation criteria, to help assure certainty over time and consistency across jurisdictions.

In recent years, Congress has considered, but not passed, a nationwide energy efficiency portfolio standard. Such a standard would set energy efficiency savings targets in each state. In the past, this standard has been included in bills to create a comprehensive system of regulating climate pollutants. Those bills have not, however, been successful, and the U.S. Senate's Committee on Energy and Natural Resources solicited comment from interested parties in April 2011 on a separate Clean Energy Standard.[42] To date, that standard has not been defined in legislation. Nationwide EEPS targets would boost efficiency in states without existing EEPS or PBFs. However, policymakers should take care to ensure that a nationwide standard does not undermine states with aggressive existing standards (e.g., permit states to exceed the federal standard) and avoid perverse incentives for utilities subject to the target.

STRATEGIES TO ALIGN UTILITY INCENTIVES WITH BUILDING-OWNER NEEDS

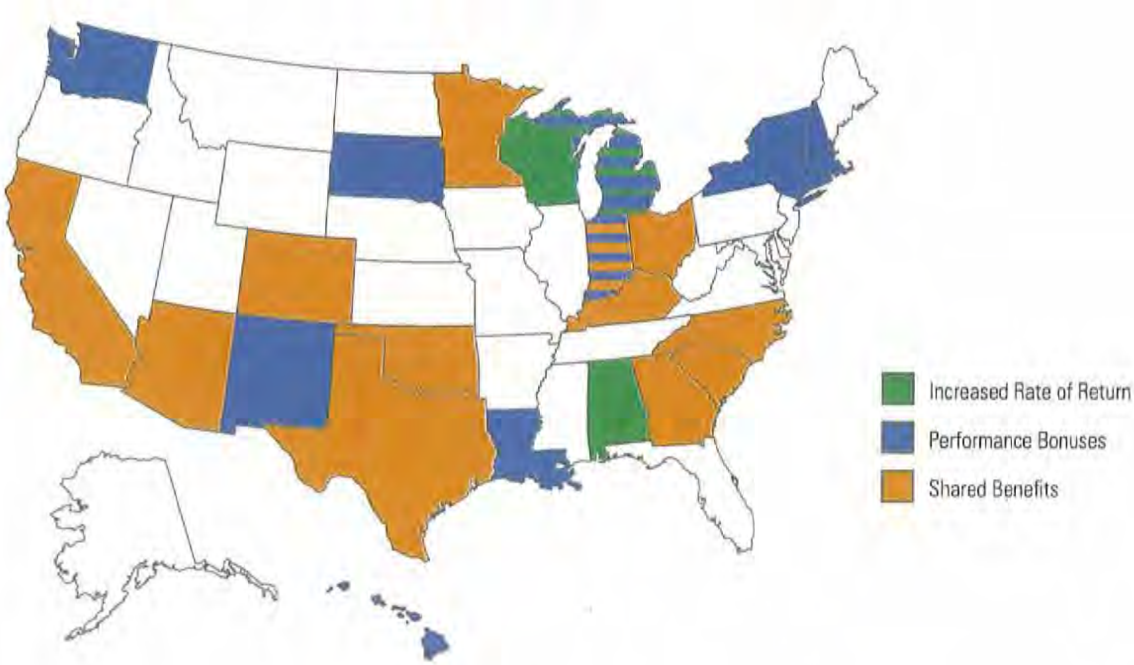
Utility incentives regarding energy efficiency vary dramatically by the type of utility, its regulators and stakeholders, and the rules that apply in each state. There is no single policy that will encourage utilities to collaborate for effective programs. Instead, building owners, interested finance organizations, and housing advocates can identify their utility's circumstances and work to align utility incentives with effective, comprehensive energy efficiency retrofit programs.

Comprehensive programs that install multiple, long-lasting energy efficiency measures to save both electricity and natural gas are, in the long run, most beneficial to building owners. Unfortunately, utility incentives and the details of state energy efficiency policies do not always encourage, and sometimes discourage, these types of programs. The following provides a guide to general patterns of incentives and strategies to align them with building owner needs.

Utility Risk Aversion and Compliance Focus

Heavily regulated utilities have a strong compliance culture. While this culture helps ensure that utilities abide by energy efficiency mandates, it also dampens interest in exceeding existing mandates. Without a profit incentive, any extra efficiency

FIGURE 6
STATE EFFICIENCY INCENTIVE MECHANISMS[43]



is seen as "using up" the efficiency resource, thus reducing the utility's ability to meet mandates in future years. Historically, technological change has consistently made additional efficiency gains possible, but utility risk aversion prevents use of this past trend to plan for the future.

To encourage utilities to exceed mandates, 18 states allow them to earn a rate of return on energy efficiency spending, earn performance bonuses, or share savings with customers. States that use these types of incentives tend to exceed the national average energy savings.[44]

Incentives to Oppose Non-Utility Efficiency Programs and Regional Coordination Efforts

Similarly, utilities may see non-utility efficiency programs as exhausting the efficiency resource and making it more difficult for them to meet efficiency mandates. Utilities may also oppose regional or statewide coordination efforts if that coordination supports non-utility programs. Creating comprehensive programs, however, often requires linking utility programs with other public sector resources.

To encourage utilities to collaborate in efficiency programs that are funded by non-utility sources and to support regional coordination, states should ensure that utility participation in these initiatives gains the utility credit toward its government-mandated savings targets. Attributing credit for all program savings to the utility will fully align utility incentives with effective, well-coordinated programs. California, Florida, Massachusetts, Michigan, Minnesota, and North Carolina apply this full-attribution rule to American Recovery and Reinvestment Act-funded projects that involve utilities.[45]

Shifting Regulatory Requirements Discourage Comprehensive Programs

Shifting regulatory criteria are seen as risky by utilities intent on meeting mandated energy savings targets. This uncertainty encourages use of cheaper, shorter-term efficiency programs, which result in lower energy savings in the end.

To encourage utilities to invest in comprehensive energy efficiency retrofit programs, states must create certainty around regulatory criteria over time. They must also create certainty that, if programs are designed under one set of criteria, their savings will be judged based on those criteria after the program is implemented.

Program Evaluation Details Can Discourage Multi-Fuel Programs

Where electric and natural gas EEPS are not well coordinated or where evaluators only allow the utility to count savings from its own fuel toward its efficiency goals, utilities may not undertake programs that save both fuels. In this instance, a utility may avoid programs that promote insulation, for example, in a home with natural gas heating and electric air conditioning.

To encourage utilities to invest in comprehensive, multi-fuel programs, states should encourage separate but geographically overlapping electric and natural gas utilities to collaborate on programs. States must ensure that their evaluation criteria fairly apportion savings from these programs to the utilities.

Program Evaluation Details Can Discourage the Use of Financial Leverage

Utilities focus their resources on measures that allow them to meet their energy savings targets. However, when utilities contribute to a program that leverages funds from multiple sources, they may only receive credit for savings proportional to their contribution to the larger funding pool. In some cases, where evaluation criteria require a direct connection between savings and the dollars contributed, they may receive credit for even less savings. Consequently, these utilities have little incentive to make the maximum use of financial leverage in their programs.

To encourage utilities to invest in comprehensive energy efficiency retrofit programs that leverage funds from multiple sources, evaluation criteria should allow utilities to fully or at least partially count savings from funds that they help leverage.

Cost-Benefit Tests May Discourage Comprehensive Programs

Policymakers generally require that utility energy efficiency programs pass a cost-benefit test. The details of these cost-benefit tests can influence utilities' flexibility in meeting savings targets and the kinds of efficiency programs that they offer. These cost-benefit tests may be applied at the portfolio, program, or measure level. At the portfolio level, the test is applied to all of the energy efficiency programs offered by the utility collectively. At the measure level, the test may be applied to each element of a program. For example, a home retrofit program may include elements such as air sealing, low-flow faucet installations, and insulation.

LEVEL OF EVALUATION	EXAMPLE
Portfolio of Programs	Evaluation of all residential programs offered by the utility
Individual Programs	Evaluation of a single program such as a comprehensive retrofit program
Specific Measure	Evaluation of specific energy efficiency measures such as insulation

If cost-benefit tests are applied to the utility's entire energy efficiency program portfolio, the utility may offset less cost-effective programs with more cost-effective programs. This allows a utility to implement experimental yet promising programs that may not be sufficiently successful in their early years to pass a cost-benefit test at the program level. Similarly, applying a cost-benefit test at the program rather than measure level facilitates comprehensive energy efficiency retrofit programs by allowing the utility to install every possible energy efficiency measure in one visit to the home or business. This increases savings and decreases program costs.

Furthermore, the details of cost-benefit tests can have a large impact on comprehensive programs. Two cost-benefit tests are commonly used: the utility-cost test and the total resource cost test. The utility-cost test looks at the cost of a program to the utility and compares this to the benefits of generating less power. The benefits of generating less power are based on the amount sales are reduced, and the marginal cost savings of generating one less kWh of electricity or delivering one less cubic foot of natural gas (marginal costs tend to be less than rates since some of the costs included in rates are fixed, and some variable). A well-designed comprehensive program will generally pass the utility-cost test.[46]

The total resource cost (TRC) includes not just utility costs and benefits, but also costs and benefits to program participants. So, if building owners help pay for improvements, the money they spend is included under costs. Energy saving benefits are still valued at the marginal cost to the utility. In addition, other benefits, if any, should be included. Examples of other benefits can include reduced bad debt, because when energy bills are lower, non-payment tends to decrease and the value of non-energy benefits to owners and tenants such as improved comfort, safety, or higher resale value.[47] These other benefits can be quantified but this is not easy to do.[48] Comprehensive energy efficiency retrofit programs may have difficulty passing the TRC test unless efforts are made to quantify some of these non-energy benefits.[49]

To encourage utilities to invest in comprehensive and forward-looking programs, states should provide flexibility in their cost-benefit tests for pilot programs and should primarily apply cost-benefit tests at the program and not the measure level. Such tests should either consider all costs and benefits, or should be calculated from just the utility perspective. In addition, to help utilities meet cost-benefit tests while still engaging in necessary program marketing and regional coordination efforts, states should leverage non-utility funding to pay for these shared expenses wherever possible.

EEPS Spending Caps Discourage Comprehensive Programs

Spending caps that are set too low may limit energy efficiency savings by preventing utilities from meeting savings targets. While policymakers may intend these caps to ensure economical programs, in fact, they may raise customer bills by limiting efficiency programs, which are less expensive than buying energy.

Ideally, states should support expenditures on any energy efficiency program that results in savings that cost less than an equivalent amount of energy. Strategies like California's loading order, or a well-administered integrated resource planning process, can ensure that a state is procuring as much efficiency as possible when its total cost is cheaper than the total cost of generating and delivering the energy it replaces. Alternatively, states with spending caps should review them periodically and ensure that they do not prevent utilities from procuring an optimal amount of energy efficiency savings.

Annual Savings Caps Discourage Comprehensive Programs

When utilities must meet annual savings targets and budgets are constrained, they have an incentive to choose measures with a high first-year savings, even when another measure may result in greater long-term savings at lower cost.

To encourage utilities to provide programs that save the most energy over the long term and at the lowest total cost, states should allow utilities who exceed their targets in one year to apply the excess savings to subsequent years' savings targets. These "banking" provisions allow for smoother program implementation, especially in the early years of utility programs. An alternative solution is to allow the utility to meet multiyear targets, for example, requiring compliance on a three-year timeframe.[50]

Providing a Strong Business Case for Utility Investments in Energy Efficiency

As previously discussed, some utilities' revenue is dependent on selling more units of energy, creating a disincentive to engage in effective energy efficiency programs. To address this problem, many utilities and energy efficiency advocates are supporting a "three-legged stool" approach to remove the disincentives and instead provide incentives for utility investments in energy efficiency. The three "legs of the stool" are:

1. Cost recovery for approved utility energy efficiency programs. Once the programs are approved by a state utility commission, the direct cost of the programs are incorporated into rates.
2. "Decouple" utility revenues from sales. Under traditional utility regulation, rate cases establish a revenue requirement and then divide it by expected sales to determine average rates. If sales are higher than expected (due, for example, to programs to build a utility's load), the utility receives extra revenue, if sales are lower than expected (due, for example, to energy efficiency), the utility loses revenue. Several different mechanisms have been used by states to address this problem.[51]
3. Provide positive financial incentives. Utility shareholders earn a rate of return on their power plant and distribution infrastructure investments, contributing to profits. A similar profit-making opportunity should be offered for energy efficiency programs. Three main mechanisms have been used by states:

a. Shared savings mechanisms calculate the net ratepayer benefits of utility energy efficiency programs (savings minus costs) and provide a small share of these benefits (typically around 10%) to shareholders. Ratepayers keep the rest. This is the most common approach as it is easier to understand, although the details of the calculations can be complicated.
b. Performance incentives provide specific goals for utilities to meet and an incentive payment if they meet it. For example, the goal might be to reduce annual electricity use by 50 million kWh through utility energy efficiency programs offered in a calendar year, and if the goal is met, the shareholders are paid $5 million out of rates. This approach requires more analysis up-front to set goals and incentives, but is easier to implement after the goals and incentives are set.
c. Rate of return mechanisms provide utilities with a return on their energy efficiency investments, just as they earn a return on their capital investments. This approach is rarely used, as utilities and financial analysts prefer that this approach be used only for hard assets, such as power plants that utilities own, and not for soft assets, such as investments in energy efficiency measures that customers own.

For more information on these approaches and how well they have worked, see Hayes et al. 2011.[52]

Data Privacy Concerns Prevent Sharing Data Needed for Comprehensive Programs

Utilities are justifiably concerned about the security of their customers' energy-use data. However, access to this data is critical to the design and implementation of the most cost-effective energy efficiency programs.

To assure customer privacy and data security, while allowing data access in order to design, improve, and target comprehensive energy efficiency retrofit programs, states should develop comprehensive systems, such as a neutral data aggregator, who can combine data from multiple utilities and other sources, such as tax assessor building characteristic databases, while assuring the data's privacy and security. At a minimum, states should create consistent data-sharing agreements for use by utilities, efficiency program designers and implementers, and research institutions. Alternatively, the federal government could create a neutral data aggregator for this purpose, based on the model presented in the Home Mortgage Disclosure Act (HMDA), which requires lending institutions to maintain mortgage loan information in a central registry. An HMDA-like system could allow energy-use data to be merged with address-identified tax assessor data for meaningful comparisons between homes by area or building type, while still ensuring the data's security and customer privacy. While a utility-data solution need not follow the HMDA template closely, its existence as a solution to data sharing concerns for sensitive mortgage data indicates that a solution to the utility data problem can be found. Data-sharing is a solveable problem that can have significant impact on promoting efficiency goals.

Case Studies of Effective Programs and Partnerships

Successful multifamily energy efficiency programs share several common themes. At their most basic level, multifamily efficiency programs provide technical assistance to help building owners assess their building's needs and financing and financial incentives to assist in implementing the recommended improvements. However, the best programs also integrate electric and natural gas efficiency measures, even when those fuels are provided by different utilities; provide standardized processes; assist building owners in finding qualified contractors to make the improvements; and oversee the quality of that work. In short, the best multifamily energy efficiency programs make it easy for building owners to squeeze the most efficiency from their buildings. Below, are five outstanding multifamily energy efficiency programs run by, or in partnership with, electric and natural gas utilities.

ENERGY SAVERS

Since 2008, the Energy Savers program has offered a one-stop shop that helps multifamily building owners in Chicago improve energy efficiency and reduce operating costs in their buildings. Energy Savers evaluates each building and helps owners identify the most cost-effective energy efficiency improvements for their building. Then they work with the building owner to assemble low-cost financing to implement the recommendations. The Energy Savers construction manager assists owners in choosing and supervising qualified contractors, and energy analysts review annual energy bills to create performance reports and guide the team in tuning up buildings that do not perform as anticipated. A typical participating multifamily owner with a 3-story, 24-unit masonry structure with 24,000 feet of heated space saves nearly $10,000 per year in energy costs, with a payback time of just over five years. From 2008 to 2011, Energy Savers upgraded over 7,500 units.

The program is a project of CNT Energy and the Community Investment Corporation. Other project partners include The John D. and Catherine T. MacArthur Foundation, the Chicagoland Natural Gas Savings Program, the Chicago Metropolitan Agency for Planning, the City of Chicago, Enterprise Community Partners, Grand Victoria Foundation, the Illinois Department of Commerce and Economic Opportunity (IL DCEO), the Office of the Illinois Attorney General, Peoples Gas, PNC Bank, Polk Bros. Foundation, and the Urban Land Institute.

The program's low-cost loans, with interest rates that are half of market rate, are provided by the Community Investment Corporation, using a fund established by several project partners. In addition, the program helps building owners take advantage of incentives and grants for energy efficiency measures provided by local utilities, the IL DCEO, and the Illinois Attorney General's office. Funds provided by local utilities and the IL DCEO are generated by the Illinois EEPS, and have varied substantially over time. Utilities and the program administrators have worked together to address data sharing, savings attributions toward EEPS targets, and other programmatic issues, and are currently working to establish the utilities' ability to claim EEPS credit from regional coordination efforts.[53]

EFFICIENCY VERMONT

Efficiency Vermont is a statewide energy efficiency utility, operated by a nonprofit corporation under a twelve-year franchise-like order of appointment from the Vermont Public Service Board.[54] Efficiency Vermont implements all energy efficiency programs for Vermont's utilities, except for the Burlington Electric Department. An energy efficiency charge on customers' electric bills funds most of the programs.[55] Efficiency Vermont is notable for two reasons: its structure avoids many of the utility disincentives discussed in this paper, and it leverages outside funding to create comprehensive, whole-home efficiency programs wherever possible. The scarcity of outside funds, however, creates a major challenge for the program and limits its ability to do comprehensive work.

Efficiency Vermont's structure avoids the perverse incentives that can occur with improperly configured EEPS or PBFs in several ways:

- The funding mechanism assures consistent funding, even if utilities have a financial incentive to prefer other investments.
- Separating the efficiency provider and the utility avoids disincentives to efficiency at utilities whose revenues depend on sales.
- Separating the efficiency provider and the utility even compares favorably to utilities whose revenues do not depend on sales, by ensuring that programs are provided by a company whose core competency is efficiency.
- A performance-based compensation structure ensures that the efficiency provider seeks the maximum available efficiency savings, instead of mere compliance with a savings target.
- The order of appointment includes a mechanism to ensure that customer energy usage data is shared by the utilities, stored and handled in a safe and secure manner, and used only for energy efficiency purposes.
- A three-year performance period, and a twelve-year order of appointment, gives Efficiency Vermont flexibility to fund more comprehensive programs with longer-term savings and to move funds from programs that do not deliver savings as expected.
- Oversight by the Vermont Public Service Board assures utilities that these mechanisms are carefully developed and reduces utility risk.

Most Vermonters heat their homes with fuel oil, propane, or wood. Because these fuels are unregulated, they do not fall under the Efficiency Vermont funding mechanism. Consequently, while Vermont's electric efficiency programs are robust, it faces a major challenge in funding efficiency for non-utility fuels. To address this problem, Efficiency Vermont leverages outside funds, such as revenues gained from the Regional Greenhouse Gas Initiative and New England ISO's Forward Capacity Market, to fund the heating fuel portions of these programs. This revenue is insufficient to meet the state's needs. Efficiency Vermont is pursuing a number of other policy options to encourage private capital to enter this market and help them save energy for Vermont residents and businesses.[56] However, Vermont has not yet created a funding mechanism for unregulated fuel efficiency that is comparable to its regulated fuel efficiency programs.

CALIFORNIA STATEWIDE MULTIFAMILY ENERGY EFFICIENCY REBATE PROGRAM[57]

The California Statewide Multifamily Energy Efficiency Rebate Program (MEERP) is a collaboration among California's four major IOUs: Pacific Gas and Electric Company, San Diego Gas and Electric Company, Southern California Gas Company, and Southern California Edison. Together, they promote energy efficiency and provide equipment rebates to owners and tenants of multifamily properties of five or more units, and residential apartment buildings, condominium complexes, and mobile home parks with two or more units. The program began in 2002 and each IOU administers the program in its own service territory.

The California IOUs have been very active in administering and promoting the program, and thus have developed substantial relationships within the multifamily market sector. The Multifamily Statewide Team meets on a regular basis to discuss program issues, coordinate energy efficiency messaging, and ensure consistency in program delivery throughout the state. Because of these regular meetings, the majority of improvements recommended by program evaluations have been implemented.

MEERP encourages the installation of qualifying energy-efficient products in tenant units and in common areas. The program offers multifamily property owners rebates up to $1,500 for energy efficiency products and improvements, including ENERGY STAR® interior and exterior hardwired fixtures and other permanently installed energy-efficient equipment and products.

Rebate offerings for measures associated with apartment dwelling units include: interior and exterior hardwired fixtures; T8 linear fluorescents; ceiling fans; CFLs; clothes washers; dishwashers; water heaters; natural gas central furnaces; and, attic and wall insulation. Rebate offerings for common areas include: LED exit signs, occupancy sensors, photocells, high-performance dual-paned windows, central water heaters, and boilers and boiler controls.

MEERP has achieved significant energy savings throughout its history. The program was renewed for the 2010 to 2012 planning period and has continued to achieve significant energy savings. In the 2004–05 and 2006 program years, for which we have data from all the implementing utilities, the program improved energy efficiency in over 410,000 housing units resulting in annual savings of over 141 million kWh of electricity and nearly 6 million therms of natural gas. Although we only have updated program results for 2007 to 2010 from PG&E and Southern California Gas, it is clear that their implementation of the program continues to get significant participation and energy savings each year.

The program overcomes the split-incentive barrier by providing incentives to property owners to invest in the installation of energy-efficient measures inside the tenant dwellings. Through the program's design and utilities' influence on market actors, the bulk of product installation has occurred in individually metered tenant dwelling units.

CALIFORNIA MULTIFAMILY STATEWIDE TEAM ACCOMPLISHMENTS					
2004–05	**INCENTIVES PAID**	**# OF SITES TREATED**	**UNITS**	**KWH SAVED**	**THERMS SAVED**
PG&E	$8,366,773	862	50,800	22,703,451	1,688,151
SCE	$11,262,000	967	93,000	43,904,000	N/A
SoCalGas	$4,267,681	1,058	52,900	N/A	2,349,935
SDG&E	$6,081,596	900	45,000	23,262,861	814,674
TOTAL	**$29,978,050**	**3,787**	**241,700**	**89,870,312**	**4,852,760**
2006					
PG&E	$8,822,359	1,117	47,637	20,694,196	182,664
SCE	$8,460,000	1,350	80,000	25,269,000	N/A
SoCalGas	$854,832	538	26,900	N/A	756,029
SDG&E	$2,545,418	280	14,000	5,333,695	133,785
TOTAL	**$20,702,609**	**3,285**	**168,537**	**51,296,891**	**1,072,478**
2007					
PG&E	$15,071,131	1,616	69,554	41,678,992	196,710
SoCalGas	$772,609	526	N/A	3	313,941
2008					
PG&E	$6,149,740	1,848	48,461	22,605,108	158,139
SoCalGas	$794,723	523	N/A	5	259,313
2009					
PG&E	$3,112,014	1,064	88,663	5,728,230	143,085
SoCalGas	$288,789	315	N/A	3	127,317
2010					
PG&E	$3,397,722	555	85,591	5,717,990	497,800
SoCalGas	$541,863	752	N/A	6,499	371,324

NATIONAL GRID'S ENERGYWISE, MULTI FAMILY RETROFIT, AND HOME ENERGY SOLUTIONS[58]

In 1992, National Grid first offered its Multifamily Retrofit Program in Massachusetts. The program has since expanded to Rhode Island, New Hampshire, and New York; been extended to natural gas customers; and seen several name changes. But it remains an energy efficiency success, achieving significant penetration of the multifamily market in New England, and showing high customer satisfaction.

The program serves public housing authorities, low-income, and market-rate multifamily facilities. Eligible structures include multifamily buildings with five or more units, as well as single family customers in Rhode Island and New Hampshire. In New York, the program serves customers in multifamily buildings with between five and fifty units.

The program is funded through a state legislated system benefit charge and had a budget of $15.9 million in 2010. The program is delivered by independent energy service providers selected through a competitive bidding process. Work completed by the program's energy service providers and their subcontractors must meet standards set by the Building Performance Institute. The program is marketed through direct contact with interested customers and homeowners, property owners' associations, bill inserts, customer newsletters, National Grid's website, home shows, and direct mail. National Grid often coordinates directly with public housing authorities and large volume property owners. Customers prioritize their facilities in terms of greatest need, ensuring that high energy-use facilities are served first.

At the initial site visit, customers receive a comprehensive energy assessment that includes, where appropriate, an evaluation of efficient lighting opportunities, diagnostic air leakage tests, duct leakage, heat pump testing, insulation levels, water heating equipment, and refrigerator efficiency. Customers receive energy education and the installation of low cost measures such as ENERGY STAR® light bulbs, hot water measures, and air sealing for electrically heated buildings at no direct cost. All reasonable measures—building envelope, mechanical equipment and systems and controls, lighting and appliances—are screened for cost-effectiveness in multifamily facilities. Major measures, such as lighting fixture, thermostat, and insulation upgrades; air sealing; and replacement of inefficient refrigerators are put out to competitive bid for facilities with more than twenty units. In some cases, improvements may be implemented by related National Grid programs.

The following table tracks savings since 1998. In that time, the electric program has delivered more than 189,000 MWH savings to more than 242,000 customers. In 2010, a natural gas program was started in Massachusetts and New York, serving over 5,000 households and saving more than 553,000 therms in its first year.

NATIONAL GRID NEW ENGLAND AND NEW YORK MULTIFAMILY PROGRAMS

	ELECTRIC PROGRAM		GAS PROGRAM	
	Annual MWh	Households	Annual Therms	Households
1998	13,656	13,723		
1999	12,198	14,812		
2000	20,976	22,286		
2001	22,601	22,702		
2002	12,581	18,637		
2003	10,766	21,182		
2004	10,722	11,818		
2005	13,967	17,517		
2006	12,776	18,093		
2007	13,779	16,451		
2008	12,722	15,200		
2009	14,834	20,819		
2010	18,094	29,237	553,350	5,376
TOTAL	**189,672**	**242,477**	**553,350**	**5,376**

NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA) MULTIFAMILY PERFORMANCE PROGRAM

The Multifamily Performance Program was created to consolidate NYSERDA's varied multifamily program offerings into one comprehensive program that would offer New York State's diverse multifamily market a user-friendly single point of entry to obtain both financial and technical assistance. The program serves both existing buildings and new construction projects and provides a standardized process for all projects. It also has incentive schedules that enable owners and developers to understand what level of incentives they are eligible to receive before applying to the program. The program relies on a market-based approach to technical service provision that allows owners and developers to choose their own energy service provider from a pre-approved group of energy consultants.

The initial version of NYSERDA's Multifamily Performance Program was launched in May 2007. The program was suspended temporarily from July 2009 until fall 2010 while the program was redesigned to meet the requirements of new funding sources. The current version of the program was launched in September 2010.

The Multifamily Performance Program challenges participants to reduce their energy usage by 15% (formerly 20% in the initial version of the program). In order to achieve this goal, building owners and developers choose from a group of pre-approved energy service providers that lead them through the process of performing a comprehensive energy audit, developing an Energy Reduction Plan, implementing that plan, and ensuring that energy conservation measures are properly installed.

Any residential building with 5 or more units that pays the state's systems benefits surcharge on their bill is eligible to participate. Projects that wish to receive affordable housing level incentives must supply adequate documentation of affordability.

The program is based on the idea that each project is different and gives project participants the flexibility to develop their own strategy for achieving the program's 15% reduction target. The Energy Reduction Plan that the participant works with their energy service provider to evaluate a comprehensive suite of energy conservation measures and determine which of those measures are the most cost-effective and practical to implement in each particular project. The program's only requirement is that the scope of work must meet NYSERDA's cost-effectiveness standards and that measure evaluation follows the program's rigorous technical standards.

The performance of the existing buildings component of the program from 2007 to 2011 is summarized in the table below:

NYSERDA MULTIFAMILY PERFORMANCE PROGRAM (MAY 2007 TO JULY 2011)

PROGRAM COMPONENT	PARTICIPATING UNITS	ELECTRICITY SAVINGS (KWH)	AVERAGE % ELECTRIC SAVINGS FROM BASELINE	FUEL SAVINGS (MMBTU)	AVERAGE % FUEL SAVINGS FROM BASELINE
Multifamily Performance Program total	113,810	171,706,079	20.60%	1,962,210	22.69%
MPP - Energy Reduction Plan (ERP) Only	16,014	58,608,595	49.96%	616,474	50.65%
MPP - ERP and Construction Phase	97,796	113,097,484	15.79%	1,345,736	18.11%

Notes: (1) Numbers listed as Energy Reduction Plan Only are those that have identified as potential savings through the program. ERP and Construction Phase numbers are for those measures that have been installed. (2) Data on average percentage savings from baseline are from best available data from on pre-participation consumption in participant units.

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Appendix B: Types of Utilities and Their Investments in Energy Efficiency

There are four major types of electric and natural gas utilities, each with their own unique financial incentive structure. Each is discussed below. While each type of utility is important, it should be noted that investor-owned utilities provide the majority of the U.S. electricity, particularly in urban areas with higher concentrations of multifamily housing.[59]

TYPE OF ELECTRIC UTILITY	PERCENT OF TOTAL U.S. ELECTRIC CONSUMPTION	REGULATORY OVERSIGHT
Publicly Owned	15%	Varies by State
Cooperative	10%	Varies by State
Investor Owned	66%	State Oversight
Competitive	9%	Varies by State

PUBLICLY OWNED UTILITIES

Publicly owned utilities include municipal utilities and utilities owned by states, special public utility districts, and joint municipal agencies. Public electric utilities serve 45 million customers, provide approximately 15% of electricity consumed in the United States, and are governed by elected boards or appointed boards that are accountable to elected officials.[60]

Energy efficiency investments by publicly owned utilities vary widely. Several municipal utilities such as the Sacramento Municipal Utilities District and Austin Energy are at the forefront of innovative efficiency programming, largely because of local interest in climate and environmental goals. On the other hand, many publicly owned utilities have little financial or political impetus, and no regulatory or statutory requirement, to invest in energy efficiency.

Some publicly owned electric utilities have invested heavily in energy efficiency as a way to delay expensive power plant investments.[61] However, many are small and have little institutional capacity to design and implement efficiency programs. In addition, publicly owned electric utilities may buy their electricity through long-term contracts with existing power plants. Utilities with inexpensive contracts have little incentive to institute efficiency programs, because savings from efficiency will be correspondingly low.

Natural gas utilities have faced declining energy sales over the past few decades, but must still recover the fixed costs of extensive underground mains. Consequently, natural gas utilities are under intense pressure to restructure rates so that their revenues are not wholly dependent on sales. Pending achievement of this goal, even municipally run utilities have incentives to keep natural gas sales high so they can cover their costs.[62] Electric utilities also face this incentive, though to a lesser extent because electricity use is increasing.

ELECTRIC COOPERATIVES

Electric cooperatives are customer-owned utilities, often governed by a customer-elected board. They provide 10 percent of U.S. electricity.[63] These cooperatives' incentives around energy efficiency are similar to the incentives of small publicly owned utilities. Like publicly owned utilities, electric cooperatives' interest in energy efficiency often mirrors the interests of its customers. While many electric cooperatives have little institutional capacity to design and implement their own custom-efficiency programs, the National Rural Electric Cooperative Association and state associations have helped overcome this barrier by developing energy efficiency programs that meet cooperatives' implementation constraints. In addition, electric cooperatives often buy their electricity through long-term contracts with existing power plants.

INVESTOR-OWNED UTILITIES

Investor-owned utilities include the major corporate providers of electricity and natural gas. They face different market conditions and regulatory regimes in each state. In addition, many IOUs serve both natural gas and electricity customers.

Several well-known utility holding companies, such as Duke Power and American Electric Power, own utilities in several states. These subsidiary utilities may be similar and have common beliefs about the value and implementation of energy efficiency. However, each utility's efficiency programs reflect the unique regulatory circumstances it encounters within each state.

Electric IOUs

IOUs provide 66 percent of U.S. electricity and fall into two categories: vertically integrated IOUs in traditionally regulated states, and the so-called "wires only" IOUs in states that have been restructured.[64] Vertically integrated utilities earn revenues by generating electricity and transporting it to customers or other utilities, while restructured utilities, who do not own power plants, earn revenues only from transmitting electricity to customers.

Vertically Integrated States

Traditional regulation governs all aspects of the relationship between a vertically integrated electric utility and its customers. Historically, all electric IOUs were organized as vertically integrated utilities and regulated by states to manage their natural monopoly power. Vertically integrated utilities perform four functions: (1) generate electricity at their own power plants, (2) sell generated electricity to retail customers and other utilities, (3) purchase electricity for distribution to retail customers, and (4) distribute electricity to retail and utility customers. However, regulators decide how the utility recovers its costs and its rate of return. Regulators may structure utility rates using per-unit fees, flat rates, or a combination of the two. Thus, a vertically integrated utility's incentives regarding energy efficiency largely depend on whether it generates more revenue through the sale or the transmission of electricity.

Aligning a vertically integrated utility's incentives with robust energy efficiency programs requires government efficiency mandates that make efficiency programs more attractive than electricity sales. Alternatively, regulators or legislators may create financial incentives to make efficiency more profitable than electricity sales, while retaining significant benefits for customers. In rare cases where a utility enjoys higher profit from selling electricity to other utilities than to its own retail customers, the utility may willingly undertake energy efficiency programs to allow it to sell more surplus electricity to other utilities. In addition, a utility may undertake energy efficiency programs to minimize the purchase of electricity at times when prices are extremely high.

In addition, vertically integrated utilities may see energy efficiency as a useful cost-saving device. If a vertically integrated utility is facing an imminent need for more power supply or transmission system improvements, it may choose to forego building a power plant or making expensive system upgrades through improved energy efficiency.[65]

Restructured States

In the late 1990s, new power plant technology changed the economics of electricity generation, persuading 15 states and the District of Columbia to restructure their electric industries, deregulating power plants while retaining regulated transmission and distribution utilities. Another seven states began restructuring, but then suspended it after the California energy crisis.

In restructured states, the local utility that provides electricity to multifamily housing does not own power plants. Thus, electric utilities in restructured states perform one function: buying electricity on the wholesale markets and distributing it to retail customers. The restructured utility's incentives regarding energy efficiency largely depend on its ability to generate revenue independent of transmitting more units of electricity.

As with vertically integrated utilities, aligning a restructured utility's incentives with robust energy efficiency programs requires government efficiency mandates or financial incentives that make efficiency more profitable than electricity sales. Restructured utilities' incentives to implement stringent energy efficiency programs vary with the method of cost recovery allowed for these programs, and with the level of separation between the transmission and distribution utility and its parent, if that parent company owns power plants. Utilities that receive financial incentives, over and above their costs, for example, have greater incentives to provide robust energy efficiency programs. However, a utility that is closely aligned with a parent company that holds power plants may have little incentive to provide robust energy efficiency savings, as doing so would reduce the market for its parent's plants' output.

Some restructured IOUs view energy efficiency programs as a way to connect with and provide service to their retail customers. Many of these utilities have historically been monopoly utilities with little customer contact, and energy efficiency programs help them reengage the customer.

FIGURE 7
ELECTRICITY RESTRUCTURING IN THE STATES[66]

FIGURE 8
NATURAL GAS COMPETITION IN THE STATES[67]

Natural Gas

Natural gas utilities also exhibit a patchwork of state restructuring, which causes their incentives regarding energy efficiency to vary widely.

Noncompetitive States

In 29 states, customers can purchase natural gas only from their traditionally regulated utility. Natural gas utilities in noncompetitive states are regulated much like electric utilities in vertically integrated states, and they perform two functions: (1) sell natural gas to retail customers, and (2) distribute the natural gas to their customers' homes and businesses. As with vertically integrated electric utilities, a natural gas utility's incentives regarding energy efficiency depend on whether efficiency reduces its overall revenue.

Like electric utilities in vertically integrated states, natural gas utilities require government mandates or a financial incentive to align with energy efficiency. As previously discussed, natural gas utilities have experienced declining energy sales, creating intense pressure to restructure rates so that revenues are not wholly dependent on sales. Until a natural gas utility achieves this goal, it has strong incentives to keep sales high.[68]

Competitive States

Twenty-one states and the District of Columbia allow customers to choose their natural gas supplier—a process called "retail choice"—at least as a pilot program. In 10 of these states, a majority of natural gas customers have access to competitive suppliers. Unlike with electric restructuring, natural gas utilities in competitive states retain both functions: selling natural gas to customers and distributing natural gas to customers' homes and businesses.

As with natural gas utilities in noncompetitive states, aligning utility incentives with robust energy efficiency programs requires either government efficiency mandates or a financial incentive to make efficiency more profitable than sales. As with electric utilities in restructured states, the incentives of natural gas utilities in competitive states regarding the adoption and implementation of stringent energy efficiency programs vary with method of cost recovery allowed for these programs, and with the level of separation between the utility and its parent company or affiliates, if the parent company owns a competitive natural gas supplier.

Like electric IOUs in restructured states, natural gas IOUs in competitive states view energy efficiency programs as a way to reengage and provide service to retail customers.

COMPETITIVE ELECTRIC AND NATURAL GAS PROVIDERS

All restructured and competitive states allow customers to buy electricity or natural gas from competitive suppliers, who are regulated, but not as heavily as utilities. These companies buy electricity and natural gas and then contract with the utility to deliver that energy over its distribution network. In areas where competitive suppliers have made significant inroads into the residential market, they may see the provision of energy efficiency programs as a way to distinguish themselves from the utility and other competitive providers. Energy efficiency portfolio standards have not been applied to competitive suppliers in the U.S. but have been applied to competitive suppliers in Europe.[69]

Appendix C: Participants in State Regulatory Proceedings

ATTORNEYS GENERAL AND CONSUMER ADVOCATES

Attorneys general and consumer advocates are often the most active stakeholders in the regulatory and legislative processes surrounding electric and natural gas utilities. Some states have dedicated state agencies that serve as the state's utility ratepayer advocate. These agencies' resources vary considerably and may be subject to political and budgetary pressure.

A few states, including California, Illinois, Oregon, and Wisconsin, have active nonprofit utility ratepayer consumer advocates.[70] These groups also vary in their resources, but their grassroots nature may give them disproportionate influence. In addition, their funding is often free of political influence, coming from private sources and court-cost reimbursement statutes.

Attorneys general and consumer advocates collaborate through the National Association of State Utility Consumer Advocates (NASUCA, www.nasuca.org), which meets regularly to discuss issues of importance to members and to adopt non-binding resolutions that guide the advocacy activities and programs of its members and NASUCA staff. NASUCA's organizational structure includes an electricity committee, a natural gas committee, and a consumer protection committee, among others. The consumer protection committee has passed a resolution, subsequently adopted by NASUCA's membership, urging an equitable expenditure of energy efficiency funds on affordable multifamily housing units.[71]

ENVIRONMENTAL ADVOCATES

In many states, environmental advocates are just beginning to make their presence felt at the regulatory agencies, as energy issues become a more important part of the environmental protection agenda. These advocates hire experienced regulatory attorneys and expert witnesses, and they are becoming an important force in utility regulation, particularly around energy efficiency and renewable energy.

INDUSTRIAL CONSUMER GROUPS

Industrial customers often band together to represent their interests before state commissions, legislatures, the Federal Energy Regulatory Commission (FERC), and regional wholesale market governance boards. While supporting energy efficiency in principle, these groups often work to exempt the industrial sector from utility-provided energy efficiency programs. Typically, they argue that the sector already dedicates significant resources to achieving energy efficiency and so should not be required to pay for additional energy efficiency programs.

HOUSING AND COMMERCIAL REAL ESTATE GROUPS

Housing and commercial real estate industry engagement of utilities around energy efficiency varies. At the federal level, and in several large cities, including New York and Boston, large community development corporations, housing developers, large rental apartment owners, and commercial building owners may engage around energy efficiency efforts. In other areas, however, these groups may interact around little beyond weatherization initiatives.[72] Participation by rental building owners also depends on whether the owner or the renter pays utility bills.

Appendix D: NARUC Resolution

Resolution Supporting Fair Expenditure of Energy Efficiency Funds in All Customer Sectors

WHEREAS, Natural gas and electric companies, along with other energy efficiency program administrators, expended more than $5 billion on energy efficiency programs in 2009, as estimated by the Consortium for Energy Efficiency; and

WHEREAS, Some States, in cooperation with their utilities, have already committed to substantially increasing their energy efficiency expenditures, with some States planning to double or triple those expenditures in the near future; and

WHEREAS, Energy efficiency program's for owners of, or tenants living in, multifamily affordable housing have in the past not always been well-designed for easy access; and

WHEREAS, It is important for all consumers to benefit from energy efficiency programs including low-income households, the elderly, those living on fixed incomes, and owners and tenants in multifamily affordable housing; and

WHEREAS, Multifamily affordable housing, including housing assisted by the federal Department of Housing and Urban Development and state housing finance agencies, or receiving assistance via the Low-Income Housing Tax Credit, provides critically needed housing for some of the poorest families in America; and

WHEREAS, This same multifamily affordable housing stock is, on average, older than the entire U.S. housing stock; contains older appliances; and is generally less energy efficient than other housing; and WHEREAS, Energy efficiency programs result in more affordable utility services for lowincome consumers in multifamily buildings and, therefore, reduce the number of customers disconnected for non-payment; and

WHEREAS, Utility companies could achieve significant cost-effective energy savings by investing more of their energy efficiency programs funds in affordable multifamily housing, while also helping to preserve that energy costs are as affordable for the tenants; now, therefore be it

RESOLVED, That the Board of Directors of the National Association of Regulatory Utility Commissioners, convened at its 2011 Summer Committee Meetings in Los Angeles, California, finds that utilities and other program administrators which expend energy efficiency funds collected via utility bills should consider spending a fair share of those funds in each of the customer sectors served, including, but not limited to, the affordable, multifamily housing sector; and be it further

RESOLVED, That utilities and other energy efficiency program administrators that deliver energy efficiency programs to affordable multifamily buildings should consider ensuring that such programs improve awareness of energy costs and the importance of energy efficiency among tenants and owners in rental properties, reasonably meet the needs of those owners and tenants, and offer the opportunity for "one-stop shopping"—that is, offer the owner of multifamily housing a simple, single point of entry to apply for utility-funded energy efficiency services, even if the owner's property includes a mix of individual (tenant-paid) meters and master meters, and/or a mix of building size and types (e.g., low-rise, high-rise, duplex, townhouse); and be it further

RESOLVED, That public utility commissions, in proceedings in which utility expenditures onenergy efficiency are being raised, should use their discretion when appropriate to investigate theextent to which the company's energy efficiency programs are fairly serving all customersectors, including but not limited to the affordable multifamily sector.

Sponsored by the Committees on Energy Resources and the Environment and Consumer Affairs

Adopted by the NARUC Board of Directors July 20, 2011

Appendix E: NASUCA Resolution

NATIONAL ASSOCIATION OF STATE UTILITY CONSUMER ADVOCATES

RESOLUTION 2011-14

URGING AN EQUITABLE EXPENDITURE OF ENERGY EFFICIENCY

FUNDS ON AFFORDABLE MULTIFAMILY HOUSING UNITS

Whereas, natural gas and electric companies, along with other energy efficiency program administrators, expended more than $5 billion on energy efficiency programs in 2009, as estimated by the Consortium for Energy Efficiency;* and

Whereas, many states have already committed to substantially increasing their energy efficiency expenditures over the next one to three years, with some states planning to double or triple those expenditures between 2009 and 2012; and

Whereas, energy efficiency programs have in the past not always been well-designed for easy access by owners of, or tenants living in, multifamily affordable housing; and

Whereas, multifamily affordable housing, especially housing assisted by the federal Department of Housing and Urban Development and state housing finance agencies, or receiving assistance via the Low-Income Housing Tax Credit, provides critically needed housing for some of the poorest families in America; and

Whereas, this same multifamily affordable housing stock is, on average, older than the entire U.S. housing stock; contains older appliances; and is generally less energy efficient than other housing; and

Whereas, energy efficiency programs and weatherization should result in more affordable utility services for low-income consumers in multifamily buildings and, therefore, reduce the number of customers disconnected for nonpayment; and

Whereas, utility companies could achieve significant cost-effective energy savings by investing more of their energy efficiency programs funds in affordable multifamily housing, while also helping to preserve that housing as affordable for the tenants;

Now, therefore, be it resolved, that NASUCA supports the following principles regarding the expenditure of energy efficiency funding:

1. That utilities and other program administrators that expend energy efficiency funds collected via utility bills should spend an equitable share of their available energy efficiency funds on cost-effective energy efficiency programs for the affordable, multifamily housing sector, giving just and due consideration to (a) the percentage of sales (kWh, therms, or ccf, as applicable) to multifamily buildings in the utility's service territory, in comparison to total sales, and (b) the percentage of any systems benefit charge, or other energy efficiency charge, that is collected from owners or tenants in affordable multifamily housing, in comparison to the total collected through the systems benefit charge, or other energy efficiency charge;

2. That utilities and other energy efficiency program administrators should specifically design cost-effective energy efficiency programs to improve awareness of energy costs in rental

* Nevius, M., R. Eldridge, and J. Krouk, "The State of the Efficiency Program Industry: Budgets, Expenditures, and Impacts 2009," Consortium for Energy Efficiency (March 2010), available at http://www.cee1.org/files/StateofEEIndustry2009.pdf.

facilities, meet the needs of the owners and tenants of affordable multifamily housing, and offer the opportunity for "one-stop shopping;"*

3. That such specifically designed programs should address these obstacles: (a) that affordable multifamily housing buildings often have a mix of master (owner-paid) and individual meters, which may result in the owner and tenants having to make multiple applications and/or apply to both "commercial" and "residential" programs, rather than being able to make a single application; (b) that a particular multifamily property may include a mix of building types, such as low-rise townhouse buildings and high-rise towers, which may result in the owner having to submit multiple applications and/or speak to different staff and departments at the utility company; and (c) that a utility may have existing programs that are well-designed for residential properties containing 1 to 4 units, and to commercial buildings and properties, but not have any program for larger residential buildings;

4. That utilities and other energy efficiency program administrators will best succeed in equitably meeting the energy efficiency needs of affordable multifamily housing by working in collaboration with a broad group of representative of the owners and tenants of that housing, including representatives from agencies that administer state and federal programs in support of affordable multifamily housing;

5. That public utility commissions, in utility proceedings in which utility expenditures on energy efficiency are or could be raised as an issue, should investigate the extent to which the company in question is expending an equitable portion of its energy efficiency budget on cost-effective energy efficiency programs for the affordable multifamily housing sector and making reasonable efforts to overcome any existing barriers to the participation by owners and tenants of affordable multifamily housing in the company's energy efficiency programs;

Be it further resolved, that NASUCA authorizes its Executive Committee to develop specific positions and take appropriate actions consistent with the terms of this resolution. The Executive Committee shall advise the membership of any proposed action prior to taking action if possible. In any event the Executive Committee shall notify the membership of any action pursuant to this resolution.

Submitted by Consumer Protection Committee
Approved June 28, 2011
San Antonio, Texas

* In this context, "one stop shopping" means offering the owner of multifamily housing a simple, single point of entry to apply for utility-funded energy efficiency services, even if the owner's property includes a mix of individual (tenant-paid) meters and master meters, of building size and types (e.g., low-rise, high-rise, duplex, townhouse), and of loads (gas and electric).

Appendix F: Potential to Increase Resources for Energy Efficiency by Improving State Policy

Opportunities for a state to save energy with multifamily energy efficiency programs are determined by three factors: the size of the multifamily building market, the portion of multifamily building energy that comes from utilities, and existing energy efficiency policies. In Figure 5, we used data on these variables to identify states with a large share of multifamily housing units and utility fuels and where improvements in utility energy efficiency policy would significantly improve the available energy efficiency resources.

To determine which states would most benefit from improved energy efficiency policy, we must consider each state's absolute and relative energy efficiency opportunity, as represented by multifamily housing's proportion of all residential units. While the current level of energy efficiency in these buildings varies geographically, the vast majority of multifamily buildings in every state would benefit from cost-effective energy efficiency measures. In the absence of detailed state level energy consumption data for the multifamily sector, the number of multifamily units is a sufficient high-level indicator of energy savings potential. Data from the 2005–9 American Community Survey indicates that, nationally, buildings of five or more units represent over 17% of total residential units, while buildings of two or more units provide nearly 26%. Multifamily buildings of five or more units represent over 20% of units in California, the District of Columbia, Florida, Hawaii, Illinois, Maryland, Nevada, and New York.

The number of multifamily units heating with utility-provided natural gas or electricity indicates how much of the sector derives its energy from utilities. In some states, particularly in the northeast U.S., a large portion of the residential market heats with non-utility fuels such as fuel oil. In most states, these nonutility fuels are not eligible for energy efficiency programs, unlike electricity and natural gas, which are regulated and eligible for the programs. Because data on heating fuel is not available for the multifamily sector specifically, we substituted data for the residential sector as a whole, from the 2005–9 American Community Survey. In the U.S. nearly 84% of occupied housing units are heated with natural gas or electricity from a utility. States with less than 60% of homes heated by a utility fuel are Alaska, Connecticut, Hawaii, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont.

Combining these two factors with a measurement of policy effectiveness allows us to determine which states have policies that, if improved, would significantly increase energy efficiency resources in a state. The Utility and Public Benefits Program and Policy chapter of the ACEEE 2010 State Energy Efficiency Scorecard measures institutional support for energy efficiency programs on a 20 point scale.[73] States with higher scores spend more on energy efficiency, achieve higher savings, and have policies in place that contribute to long-term energy-efficiency investments by utilities. The overall score includes points for 2009 electricity efficiency program budgets (5 points), 2008 electricity efficiency program energy savings (5 points), 2009 natural gas efficiency program budgets (3 points), energy efficiency targets (energy efficiency portfolio standards) (4 points), and utility incentives and removal of disincentives (3 points). The top five scoring states in 2010 in descending order were Vermont (19.5 points), California (18.5), Rhode Island (16), Massachusetts (15.5), and Minnesota (15). The arithmetic mean for the scores of all fifty states is 6.52. Figure 5 summarizes our findings. More information on specific policies in effect in each state is available from ACEEE's 2010 State Energy Efficiency Scorecard and the Database of State Incentives for Renewables and Efficiency.[74]

TABLE 2

MULTIFAMILY HOUSING UNITS, HEATING FUEL TYPES, AND AN ENERGY EFFICIENCY POLICY RATING

STATE	MULTIFAMILY UNITS (IN 5+ UNIT BUILDINGS)	MULTIFAMILY AS % OF TOTAL HOUSING UNITS	% OCCUPIED UNITS USING UTILITY-PROVIDED ELECTRIC OR NATURAL GAS FOR HEAT	UTILITY AND PUBLIC BENEFITS PROGRAMS AND POLICIES SCORE FROM ACEEE'S 2010 SCORECARD
Alabama	228,868	10.7	88.3	0
Alaska	38,864	13.9	58.7	0
Arizona	422,933	15.9	93.1	9
Arkansas	111,541	8.7	85.0	1.5
California	2,983,403	22.5	91.3	18.5
Colorado	421,965	19.9	91.4	10
Connecticut	252,808	17.6	45.6	10.5
Delaware	52,605	13.6	67.6	1.5
District of Columbia	141,050	49.7	93.5	5
Florida	2,056,756	23.8	96.0	4
Georgia	585,120	14.8	91.0	1.5
Hawaii	163,254	32.3	37.5	12
Idaho	46,745	7.5	82.4	8.5
Illinois	1,057,085	20.2	94.0	5.5
Indiana	339,011	12.2	87.4	5.5
Iowa	163,178	12.3	81.7	12
Kansas	134,452	11.1	89.0	0.5
Kentucky	202,438	10.6	87.1	3.5
Louisiana	189,951	9.9	95.1	0
Maine	60,939	8.7	8.4	10.5
Maryland	488,389	21.1	82.0	6
Massachusetts	542,892	19.9	59.9	15.5
Michigan	565,188	12.5	84.9	8
Minnesota	384,314	16.7	81.4	15
Mississippi	101,673	8.1	81.6	0
Missouri	294,239	11.1	84.3	1.5
Montana	36,849	8.5	75.9	4
Nebraska	116,100	14.9	87.8	0.5
Nevada	236,696	21.7	93.5	11
New Hampshire	81,527	13.8	27.1	9
New Jersey	692,571	19.8	82.2	7
New Mexico	83,652	9.7	81.5	6.5
New York	2,572,352	32.4	61.2	12
North Carolina	482,582	11.7	79.9	5
North Dakota	61,104	19.	76.4	0.5
Ohio	694,486	13.7	87.8	4.5
Oklahoma	172,614	10.6	88.3	1.5
Oregon	255,224	15.9	85.7	14.5
Pennsylvania	610,179	11.1	69.7	4.5
Rhode Island	69,982	15.5	56.0	16
South Carolina	234,589	11.6	89.9	1.5
South Dakota	46,329	13.0	73.1	4
Tennessee	326,468	12.0	91.2	1.5
Texas	1,781,577	18.9	94.6	3
Utah	122,585	13.3	95.1	11.5
Vermont	31,767	10.2	18.3	19.5
Virginia	551,761	16.9	82.8	1.5
Washington	530,883	19.3	87.2	12.5
West Virginia	60,133	6.8	82.3	0
Wisconsin	370,895	14.5	78.7	13
Wyoming	19,499	8.0	81.5	2.5
United States	22,272,065	17.4	83.7	6.52

Acknowledgements

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SPECIAL THANKS

Generous support for this report was provided by the John D. & Catherine T. MacArthur Foundation and by Living Cities.

The authors also wish to thank Brett Cullen and Shefali Agrawal for their research assistance, as well as the many industry experts who generously shared their time, expertise, and insights during our interviews and in reviewing this paper. The views expressed in our analysis are those of the authors and do not necessarily reflect the opinions or beliefs of the interviewees or Living Cities. Any errors or omissions are the responsibility of the authors.

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Increasing Energy Efficiency in Existing Multifamily Buildings

An Overview of Challenges, Opportunities, and Policy Tools

Prepared by the Cities of Berkeley, Oakland, and Emeryville

October 2011

This program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission."PG&E" refers to Pacific Gas and Electric Company, a subsidiary of PG&E Corporation.

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Acknowledgements

Staff at the cities of Berkeley, Oakland, and Emeryville would like to thank the following for their contribution to this report:

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Tenaya Asan, Build It Green
Kyle Barton, Conservation Services Group
Stephen Barton, Berkeley Rent Stabilization Board
Scott Bernstein, Center for Neighborhood Technology
John Bolduc, City of Cambridge, MA
Martin Bond, Community Energy Services Corporation
Andy Brooks, Association for Energy Affordability, Inc.
Karen Contreras, Pacific Gas and Electric Company
Lucas Davis, Haas School of Business, UC-Berkeley
Brian DiGiorgio, Pacific Gas and Electric Company
Ryan Freed, Efficiency Kansas
Merrian Fuller, Lawrence Berkeley National Laboratory
Matt Greco, City and County of San Francisco
Tim Johnson, Manitoba Hydro
Sophia Hartkopf, Heschong Mahone Group, Inc.
Miya Kitahara, StopWaste.Org
Sid Lakireddy, Berkeley Property Owners Association
Heather Larson, StopWaste.Org
Gary Livingston, Southern California Edison
Alex Lowenstein, Association for Energy Affordability, Inc.
Elizabeth McCollum, Heschong Mahone Group, Inc.
Beckie Menten, California Energy Commission
Martha Jane Murray, HEAL Arkansas
Joanne Panchana, Pacific Gas and Electric Company
Bill Pottinger, Pacific Gas and Electric Company
Sharyl Rabinovici, Goldman School of Public Policy, UC-Berkeley
Frank Spasaro, San Diego Gas & Electric
Nehemiah Stone, Benningfield Group Inc.
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Executive Summary

This report is designed primarily for local government policy makers. It is one component of a joint project between the cities of Berkeley, Oakland, and Emeryville aimed at developing effective strategies to increase energy efficiency in our communities' multifamily properties, including apartment buildings, cooperatives, and condos. The project, called *Building Energy Efficiency Solutions* (BEES), seeks to develop local solutions to the formidable barriers tenants and building owners face when trying to lower their energy and water consumption and reduce their utility bills. Solutions to address these barriers must not only be designed to increase energy efficiency, but must also be consistent with our communities' existing commitments to diversity and to providing healthy, affordable housing for residents.

Common barriers to increasing energy efficiency in existing multifamily buildings include:

- *Misaligned incentives between property owner and tenant.* When units are individually metered, the building owner has no direct financial incentive to make investments in in-unit energy upgrades. When a building is master-metered, tenants have no direct financial incentive to conserve energy.
- *High initial costs*. Many property owners do not have access to the upfront capital needed to invest in energy upgrades.
- *High transaction costs*. Property owners often feel overwhelmed by the process of identifying relevant upgrade opportunities and matching incentive programs.
- *Uncertain return on investment*. A range of variables affect the actual energy and money savings realized from a property owner's investment in energy efficiency. Many property owners lack access to technical assistance services that can help them to identify cost effective energy efficiency strategies and to calculate the payback.
- *Limited knowledge and motivation*. Property and owners and tenants often have limited knowledge of the potential benefits and process of making energy improvements, and limited motivation for engaging in this work.

While government and utility efforts to reduce energy use in existing multifamily buildings remain relatively limited compared to resources aimed at the single-family residential and commercial sectors, there are a growing number of government agencies and utilities across the country that are leveraging ratepayer dollars, one-time stimulus funds, and other resources with private sector investment to remove barriers to energy efficiency in existing multifamily buildings. The ultimate goal is sustained transformation in how the market functions, so that energy efficiency is business-as-usual amongst multifamily property owners, property managers, and tenants.

A fundamental takeaway from interviews with policy makers and multifamily property owners and managers that informed the study for this report is that achieving market transformation requires policy mechanisms that enable property owners to realize an economic return on investments in energy efficiency. Put another way, unless energy-related capital investments result in increased revenues or increased property value/equity, there is limited economic rationale for a multifamily building owner to make such an investment. Increased revenues can come in several forms, including:

- Increased building sale valuation
- Cost savings due to reduced energy use
- Less tenant turnover and the associated transaction costs and interruptions in rent payments
- Higher rents

This report outlines a range of policy mechanisms local and state governments and utilities are employing to achieve market transformation in existing multifamily buildings:

- *Mandatory improvement and disclosure requirements* designed to capture a baseline level of energy savings across a community's existing multifamily building stock and to make energy efficiency an explicit component of a building or unit's value
- *Rebates* to lower the cost of energy upgrades and to help property owners go beyond the minimum
- *Financing programs* to minimize the upfront cost of energy upgrades and to amortize costs over time
- *Tax-based incentives* to encourage private investment in energy efficiency
- *Strategies that help calculate benefits and align incentives for the affordable multifamily housing sector,* with potential relevance to rent controlled housing
- *Tools for removing the split incentive barrier* by increasing the capacity of property owners to make energy improvements and recoup their costs in a manner that enables appropriate, equitable sharing of costs and benefits between owners and tenants
- *Streamlined technical assistance* designed to minimize property owners' transaction costs associated with identifying upgrade opportunities and matching incentives and financing
- *Workforce development* tailored to the existing multifamily building context
- *Marketing, outreach, and education programs* used to connect multifamily stakeholders with the services available to them and to encourage the behavior changes necessary to achieve increased energy efficiency

The intent of this report is to identify these policy mechanisms and to derive lessons learned that may inform multifamily energy efficiency policy design in the cities of Berkeley, Oakland, Emeryville, and beyond. These lessons will be considered in developing policy recommendations in later phases of the BEES project.

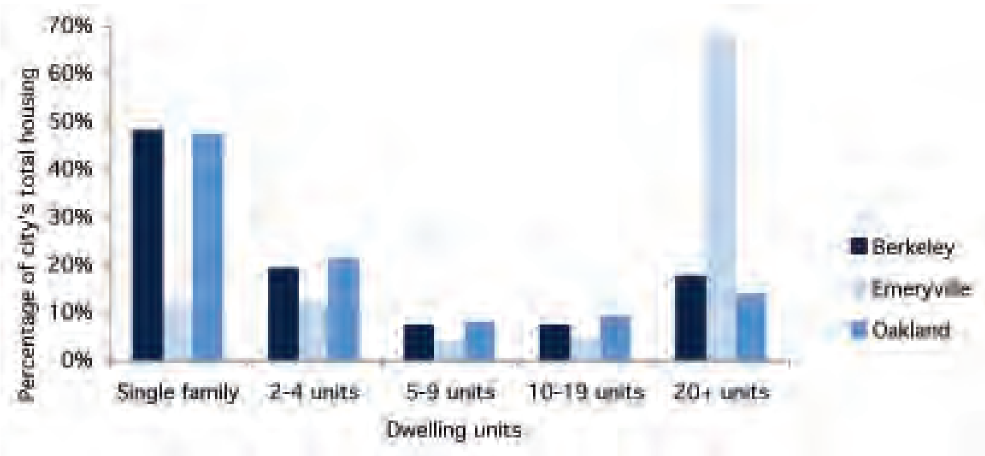
The two-year BEES project is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E) under the auspices of the California Public Utilities Commission.

Section 1: Introduction

Climate change represents a present and profound challenge for cities. Rising temperatures affect the availability of natural resources on which our communities depend, result in intensified heat waves, exacerbate local air pollution, and increase the incidence of large wildfires.[1] These and other consequences of our changing climate, along with other profound challenges such as rising energy and water costs and a sputtering global economy, demand urgent action.

An important but often overlooked arena for addressing each of these challenges is the existing multifamily building sector, which accounts for approximately 25% of U.S. households, one-third of California households, and collectively over 50% of households in the cities of Berkeley, Oakland, and Emeryville.[2] Existing multifamily housing represents approximately 9-15% of community-wide greenhouse gas emissions in these three communities.[3]

Figure 1: Housing Stock By Number Of Dwelling Units



Source: U.S. Census Bureau, 2009 American Community Survey

According to national, state-level and local studies the potential for increased energy savings and reduced greenhouse gas emissions in existing multifamily buildings is vast and largely untapped.[4] For example, a report on multifamily energy efficiency potential prepared by the Benningfield Group estimates that the U.S. could achieve electricity savings equivalent to the annual output of 20 coal plants *and* natural gas savings equivalent to the residential, commercial and industrial natural gas usage in California, Oregon, and Washington.[5] Capturing energy savings in this sector not only helps address the global threat of climate change, but also results in local benefits, such as increased comfort and energy affordability for tenants, job opportunities for energy service providers, and lower operating costs and attractive returns on investment for building owners.

[1] See http://cal-adapt.org/ for localized data on the impacts of climate change on California cities.
[2] U.S. Census Bureau, 2009 American Community Survey.
[3] Cities of Berkeley, Oakland and Emeryville. "BEES multifamily market characterization study: Oakland, Berkeley, & Emeryville." Sep. 2011.
[4] See the following reports:
Benningfield Group, Inc. "U.S. multifamily energy efficiency potential by 2020" The Energy Foundation, 27 Oct. 2009; Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee.
"Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011; Cities of Berkeley, Oakland and Emeryville.
"BEES Multifamily market characterization study: Oakland, Berkeley, & Emeryville." Sep. 2011.
[5] Estimated reduction equivalent does not include natural gas usage at power plants.

Despite the significant potential for energy savings and the associated benefits for communities, multiple, persistent barriers exist that slow the adoption of energy upgrades in existing multifamily buildings. As is discussed in greater detail later, barriers include:

- *Misaligned incentives between property owner and tenant*. When units are individually metered, the building owner has no direct financial incentive to make investments in in-unit energy upgrades. When a building is master-metered, tenants have no direct financial incentive to conserve energy.
- *High initial costs*. Many property owners do not have access to the upfront capital needed to invest in energy upgrades.
- *High transaction costs*. Property owners often feel overwhelmed by the process of identifying relevant upgrade opportunities and matching incentive programs.
- *Uncertain return on investment*. A range of variables affect the actual energy and money savings realized from a property owner's investment in energy efficiency. Many property owners lack access to technical assistance services that can help them to identify cost effective energy efficiency strategies and to calculate the payback.
- *Limited knowledge motivation*. Property and owners and tenants often have limited knowledge of the potential benefits and process of making energy improvements, and limited motivation for engaging in this work.

It is perhaps in part because of these and other formidable barriers that, when compared to the single-family housing sector, there is historically a dearth of government and utility policies and programs focused specifically on increasing energy efficiency in existing multifamily buildings. And given the fundamental differences between the single-family and multifamily sectors, simply applying single-family programs to multifamily buildings will not achieve the sector's energy-saving potential. As stated in a 2011 report by the Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee (MF HERCC),[6] "The opportunities and challenges unique to the multifamily sector can only be met if there are well-designed and well-coordinated programs and policies that address this sector's specific infrastructure."[7]

Indeed, even within the multifamily sector there is significant variability in building types, configurations, and ownership structures. Multifamily buildings include low-rise buildings, high-rise mixed use buildings, and small multifamily properties

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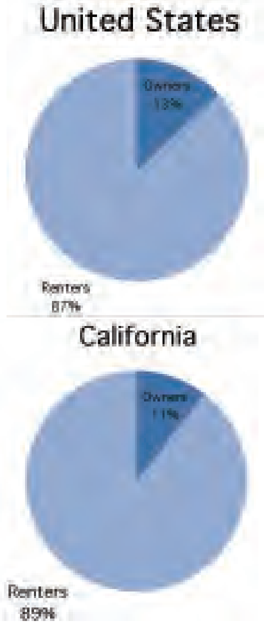
[6] Convened by the U.S. EPA Region 9, the Home Energy Retrofit Coordinating Committee is a collaborative of utilities, government agencies, building experts and others working together to develop consistent recommendations and standards for statewide home energy retrofit programs. The Multifamily Subcommittee (MF HERCC) formed to address the unique needs of the multifamily and affordable housing sectors. The MF HERCC is chaired by StopWaste.org.

[7] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011.

Figure 2: Multifamily occupancy by ownership



Source: U.S. Census Bureau, 2009 American Community Survey

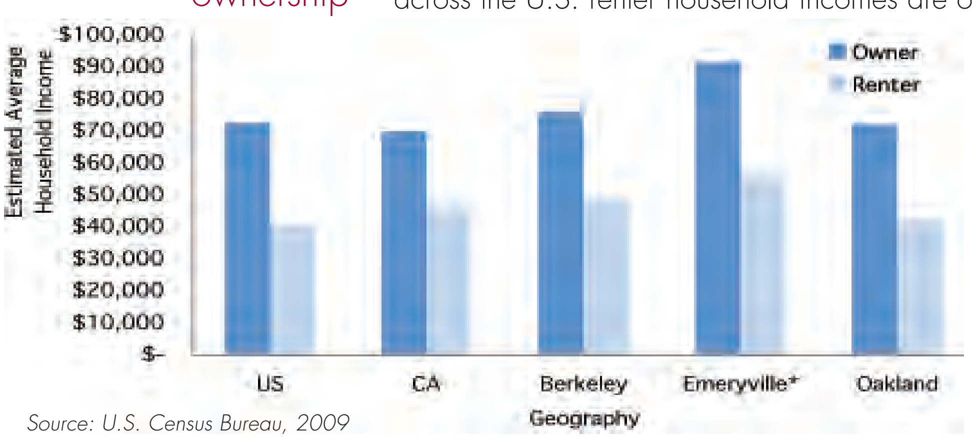
converted from a single-family home to apartments, among others. Each of these building types, plus factors like whether the units are affordable vs. market rate, owned vs. rented, or individually vs. master-metered for utilities affect the potential for energy efficiency improvements and the strategies and policies through which that potential would be achieved. For policy makers and program providers, understanding these factors and their potential impact on energy consumption is important because it enables policy and program design that focuses on the most strategic energy-saving opportunities and, therefore, the best use of program resources.

For example, programs targeting multifamily buildings can gain economies of scale by serving multiple units in one transaction. Further, because of their shared walls, units in multifamily buildings have less exposure to weather and, hence, less heating and cooling is lost to the exterior. This factor affects energy usage patterns as well as energy-saving opportunities. Less energy savings will come from building envelope and heating, ventilation and air conditioning (HVAC) efficiency measures and more will come from increased efficiency in water heating and appliances. Particularly in areas such as the northern California coast where air conditioning is not widespread, and in scenarios where central water heating systems are present, the largest opportunity for saving energy in multifamily buildings is increasing the efficiency of the water heating system.[8] Improving the efficiency of the boiler or water heater, insulating the hot water distribution system, retrofitting water fixtures, and adjusting controls represent compelling, cost-effective energy-saving opportunities.

Another critical factor in policy and program design is the impact on decision-making of whether a given unit is owner vs. renter-occupied. Close to 90% of single-family homes nationwide are owner-occupied, while nearly 90% of multifamily households are renters (see Figure 2).[9]

Generally, renters have significantly lower incomes than homeowners. In fact, across the U.S. renter household incomes are on average roughly half those of owner households (see Figure 3).[10] Nearly one-fourth of renter households experience severe housing cost burdens (more than 50% of pre-tax household income is spent on housing costs, i.e., rent and utilities), compared with approximately one in eight homeowners.[11]

Figure 3: Average household income by geography and ownership



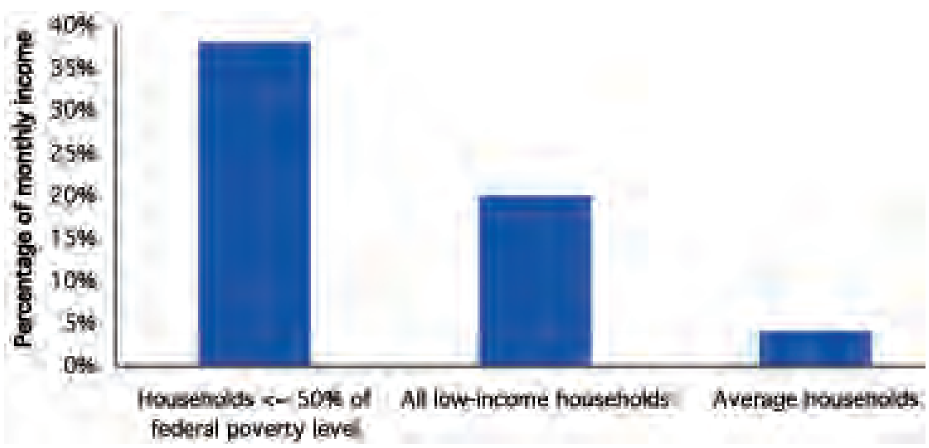
Source: U.S. Census Bureau, 2009 American Community Survey

[8] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011.
[9] U.S. Census Bureau, 2009 American Community Survey.
[10] Ibid.
[11] Joint Center for Housing Studies of Harvard University. "The state of the nation's housing 2010." 14 Jun. 2010.

At the same time, renters have considerably less control over the energy efficiency of their homes. In the most common tenant/landlord scenario, where tenants are paying their own energy bills, the building owner has no direct economic incentive to invest in making the unit more energy efficient because he or she will not realize an adequate return on that investment. In this scenario, even if energy prices increase, a landlord may continue to supply the tenant with lower cost, inefficient appliances. Likewise, the tenant has little incentive and often little means to invest in a unit that he or she does not own.

This "split incentive" between building owner and tenant is, at least in part, the reason why rented units often realize less of their energy-saving potential. Research points to evidence that renters are significantly less likely to have energy efficient appliances and that rental units are less well-insulated.[12]

Figure 4: Energy expenditure as a proportion of monthly income



Source: Multifamily Subcommit-tee of the California Home Energy Retrofit Coordinating Committee. "Improving Califor-nia's Multifamily Buildings: Opportunities and Recommen-dations for Green Retrofit & Rehab Programs." 8 Apr. 2011

The fact that renters are less able to affect the energy efficiency of their homes is troubling given that low-income households spend more of their monthly income on energy, compared to the average U.S. household. As Figure 4 illustrates, while energy expenditures as a percent of monthly income is a relatively low four percent for the average U.S. household, this expenditure increases to 20% for households at the federal policy level and to nearly 40% for households at or below 50% of the federal poverty level (see Figure 4).

For policy makers, understanding and addressing this disparity is not only an opportunity to improve the multifamily building stock, but also an opportunity to relieve some of the pressure rising energy costs place on individuals and families in our communities.

Another factor of particular relevance to policymakers in a small group of U.S. cities, including the cities of Berkeley and Oakland, is rent control. Rent control is a policy designed to maintain affordable housing and preserve community diversity by stabilizing rents. It does so by limiting the amount that landlords can increase the rent to an allowable annual adjustment rate. The annual adjustment rate is customarily a formula based on the consumer price index (CPI). Most forms of rent control, including in Berkeley and Oakland, are vacancy decontrol, meaning that rents are not regulated when a tenant leaves. For example, the annual allowable rent increase for Oakland in 2010 was 2.7%. A tenant of a rent controlled unit therefore would only have a maximum annual increase of 2.7% for the duration of their tenancy in that

[12] Davis, Lucas W. "Evaluating the slow adoption of energy efficient investments: Are renters less likely to have energy efficient appliances?" Jun. 2010.

unit. However, once a tenant vacates an apartment, the landlord is then able to adjust the rent to market rate. The new market rate rent is then re-controlled per the annual allowable adjustment until the unit turns over once again. In the relatively few U.S. cities where some form of rent control exists, energy policy makers will need to have a dialogue with rent control policy experts and local property owners of rent controlled units to better understand the effect rent control has on property owners' investment in building upgrades.

Purpose and Background of this Report

The State of California and local governments all across the state have set aggressive targets for reducing emissions that cause global warming (see Figure 5).

To say that achieving the targeted reductions in greenhouse gas (GHG) emissions will be difficult is an understatement. It requires an unprecedented all-hands-on-deck approach that includes examining the GHG reduction potential, and options for achieving that potential, in every sector of society. The purpose of this report is to highlight and derive lessons from a range of existing policies and programs throughout the U.S. and beyond designed to capture energy savings, reduce GHG emissions, and achieve other community benefits in one sector in particular: existing multifamily buildings.

Figure 5: Greenhouse gas emission reduction targets

California Achieve 1990 GHG Levels by 2020		
Berkeley	Oakland	Emeryville
33% below 2000 levels by 2020 80% below 2000 levels by 2050	36% below 2005 levels by 2020 83% below 2005 levels by 2050*	25% below 2004 levels by 2020

Oakland's 2050 emissions reduction target was recommended by City Council, but not fomally adopted

This report is designed primarily for local government policy makers. It is one component of a joint project between the cities of Berkeley, Oakland, and Emeryville aimed at developing effective strategies to increase energy efficiency in our communities' apartment buildings, cooperatives, and condos. The project, called *Building Energy Efficiency Solutions* (BEES), seeks to develop local solutions to the barriers tenants and building owners face when trying to lower their energy consumption, with particular emphasis on the problem of misaligned incentives between tenants and building owners. BEES is intended to help advance multifamily energy policy not only in Berkeley, Oakland, and Emeryville, but also in cities across the state and country that are grappling with similar challenges.

The two-year BEES project is funded by California utility customers and administered by Pacific Gas and Electric Company (PG&E) under the auspices of the California Public Utilities Commission.

The BEES project includes several main steps toward the ultimate goal of recommending local strategies to make it easier for building owners and tenants to save energy and money.

1. Derive lessons from existing efforts and research (the focus of this report): Existing efforts by local governments, researchers, and policy experts in several states and countries provide lessons learned that have implications for any entity working to improve energy efficiency in the existing multifamily sector. This component of the BEES project included literature review, a national survey of local government practitioners (see survey summary in Appendix) and dozens of interviews with leading experts in the field.

2. Analyze barriers, opportunities, and energy saving potential (the subject of a subsequent report): BEES project partners conducted an analysis of the multifamily market in the cities of Berkeley, Oakland, and Emeryville that estimates the scale of existing multifamily buildings' energy-saving potential and examines common practices and barriers among local building owners, property managers, and tenants.

3. Gather input from multifamily stakeholders and pilot a range of potential program solutions: Build on the two reports highlighted above and additional input from multifamily stakeholders by developing and piloting draft program recommendations designed to help achieve the local multifamily sector's energy-saving potential.

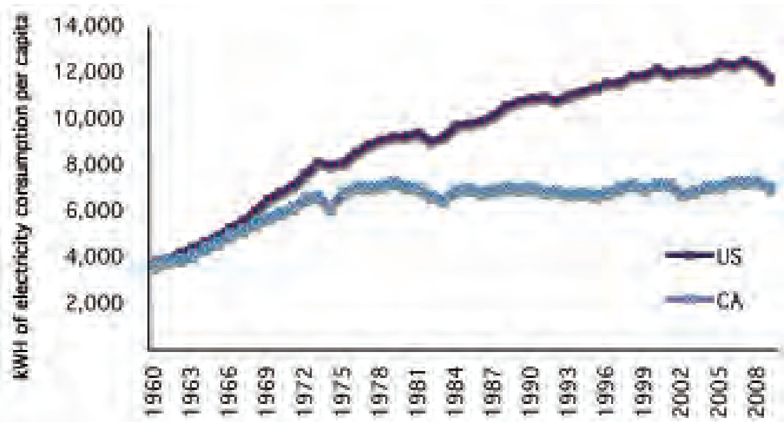
4. Based on project research, pilots, and stakeholder and community input, develop a range of formal policy options for community and City Council consideration: City leadership and other community members will have the opportunity to weigh the pros and cons of a range of policy and program options and to provide direction regarding which set of options to pursue.

The four steps that make up the BEES project set the stage for each of the three partner cities to further develop and launch thoughtful, effective multifamily energy policy.

Energy Efficiency: Our Biggest, Lowest Cost Resource

Energy efficiency opportunities in existing buildings are a tremendous, comparatively low-cost resource. If Saudi Arabia represents abundant energy resources, then the U.S. building stock represents the Saudi Arabia of energy efficiency. A 2009 report by McKinsey & Company estimates that, although there are significant barriers that must be overcome, the potential exists for the U.S. economy to reduce annual non-transportation energy consumption by approximately 23%

Figure 6: Per capita electricity consumption



Source: EIA, US Census, California Energy Commission 2009

(9.1 quadrillion BTUs)[13] by 2020, which would eliminate over $1.2 trillion in wasted energy costs. This reduction in wasted energy would result in a significant reduction in GHG emissions – the equivalent of taking the entire U.S. fleet of passenger vehicles and light trucks off the road.[14] It would also result in improved building comfort and in job opportunities that cannot be outsourced.

The State of California is recognized globally as a leader on energy efficiency. Since the 1970s, per capita electricity consumption in California has remained flat, while increasing 60% in the rest of the country (see Figure 6).[15]

While some of California's success at flattening per capita electricity use can be explained by a shift in the state's economy away from energy-intensive manufacturing, a significant portion of the success is also due to the state's robust energy efficiency standards for new construction. Achieving aggressive state and local GHG reduction targets requires not only continually ratcheting up standards for new construction, but also unlocking the energy efficiency potential of existing buildings, the majority of which were built prior to California's Building Efficiency Standards were enacted. The policy and program infrastructure for increasing energy efficiency in existing buildings is comparatively less robust, but many government and utility entities recognize this reality, and opportunities are emerging to shift a higher level of focus to saving energy in existing buildings.

In 2006, the state adopted AB 32, the Global Warming Solutions Act, which caps California's GHG emissions at 1990 levels by 2020. The Scoping Plan, designed to achieve that target, identifies energy efficiency in existing residential and commercial buildings as the single most important activity to reduce GHG emissions in the electricity and natural gas sectors. In 2008, the California Public Utilities Commission (CPUC) released its California Long Term Energy Efficiency Strategic Plan, which provides a roadmap for the efficiency gains targeted in the AB 32 Scoping Plan. The Strategic Plan also encourages deep, whole-home approaches to energy efficiency in existing structures through mechanisms such as comprehensive energy assessments, rebates, and financing options.

In 2009, unprecedented levels of funding for energy efficiency began to flow. Under the federal American Recovery and Reinvestment Act (ARRA), the U.S. Department of Energy (DOE) authorized over $12 billion to be awarded to states and local governments to implement strategies that stimulate demand for

[13] McKinsey & Company estimates that 35% of the annual 9.1 quadrillion BTUs of energy that could be reduced in existing buildings could be achieved in the residential sector.

[14] McKinsey & Company. "Unlocking energy efficiency in the U.S. Economy." Jul. 2009.

[15] EIA, US Census, California Energy Commission 2009.

energy upgrades and the jobs they create. In May 2009, California was awarded $226 million in ARRA State Energy Program funds, plus an additional $49.6 million in Energy Efficiency and Conservation Block Grant (EECBG) funds. Local governments across the U.S. and the state, including the cities of Berkeley, Oakland, and Emeryville, were collectively awarded millions of dollars in local ARRA EECBG funds as well. Earlier in 2009, the CPUC approved a three-year $3.1 billion budget for the state's investor-owned utilities ratepayer-funded energy efficiency programs, a 42% increase over the previous three-year cycle.

These funds represent not only an opportunity to achieve direct, short-term benefits such as energy and cost savings and new jobs, but also an unparalleled boost to public and private sector experience in implementing energy efficiency programs for existing buildings, including programs designed specifically for the existing multifamily building stock.

Targeting Market Transformation in the Existing Multifamily Building Sector

While government and utility efforts to reduce energy use in existing multifamily buildings remain relatively limited compared to resources aimed at the single-family residential and commercial sectors, there are a growing number of government agencies and utilities across the country that are leveraging ratepayer dollars, one-time stimulus funds, and other resources with private sector investment to remove barriers to energy efficiency in existing multifamily buildings. The goal of these efforts is not only reduced energy use and the associated greenhouse gas emissions. Increasing energy efficiency in the multifamily building stock is also an essential component of communities' existing commitment to provide comfortable, healthy, affordable housing for residents.

Increasing energy efficiency on a large scale in existing multifamily buildings requires transforming how the market functions, so that energy efficiency and the benefits it provides are seen as business-as-usual amongst multifamily property owners, property managers, and tenants. A fundamental takeaway from interviews with policy makers and multifamily property owners and managers that informed the study for this report is that achieving market transformation requires policy mechanisms that enable property owners to realize an economic return on investments in energy efficiency. Put another way, unless energy-related capital investments result in increased revenues or increased property value/equity, there is limited economic rationale for a multifamily building owner to make such an investment. Increased revenues can come in several forms, including:

- Increased building sale valuation;
- Cost savings due to reduced energy use;

- Less tenant turnover and the associated transaction costs and interruptions in rent payments; and/or
- Higher rents.

This report outlines a range of policy mechanisms local and state governments and utilities are employing to achieve market transformation in existing multifamily buildings:

- *Mandatory improvement and disclosure requirements* designed to capture a baseline level of energy savings across a community's existing multifamily building stock and to make energy efficiency an explicit component of a building or unit's value
- *Rebates* to lower the cost of energy upgrades and to help property owners go beyond the minimum
- *Financing programs* to minimize the upfront cost of energy upgrades and to amortize costs over time
- *Tax-based incentives* to encourage private investment in energy efficiency
- *Strategies that help calculate benefits and align incentives for the affordable multifamily housing sector* with potential relevance to rent controlled housing
- *Tools for removing the split incentive barrier* by increasing the capacity of property owners to make energy improvements and recoup their costs in a manner that ensures appropriate, equitable sharing of costs and benefits between owners and tenants
- *Streamlined technical assistance* designed to minimize property owners' transaction costs associated with identifying upgrade opportunities and matching incentives and financing
- *Workforce development* tailored to the existing multifamily building context
- Marketing, outreach, and education programs used to connect multifamily stakeholders with the services available to them and to encourage the behavior changes necessary to achieve increased energy efficiency

The intent of the report is to identify these policy mechanisms and to derive lessons learned that may inform multifamily energy efficiency policy design in the cities of Berkeley, Oakland, Emeryville, and beyond. These lessons will be considered in developing policy recommendations in later phases of the BEES project.

Each of the identified policy mechanisms is explained in more detail, including providing program examples and key considerations for policy makers, in Section 3.

Section 2:
Overview of Opportunities & Barriers

Several factors point to significant potential for energy savings in existing multifamily buildings.

Opportunities

Building vintage

Sixty percent of the nation's multifamily building stock was constructed prior to 1980.[16] In Berkeley, Oakland, and Emeryville, collectively 53% of existing multifamily units were built prior to California's first-in-the-nation building energy efficiency standards were enacted in 1978, a total of approximately 119,000 units.[17] California's building energy efficiency standards have ratcheted up over time, adding energy efficiency measures and construction practices as building science improves and technologies advance. Many older buildings have yet to benefit from these advances. So, it is safe to assert that a vast amount of cost effective upgrades are possible in the *existing* multifamily building stock.[18]

Figure 7: Housing stock by vintage and geography

Source: U.S. Census Bureau, 2009 American Community Survey

Centralized systems

Multifamily buildings, especially large ones, often have central domestic hot water systems and other central systems that are inherently more cost effective and efficient to upgrade than upgrading systems in individual units. For example, improving the efficiency of the central water heater and insulating the hot water distribution system often represent improvements with an attractive return on investment.

Leveraging building management

Many large multifamily properties are operated and maintained by professional building staff.[19] Property and asset management staff may not always be the decision-maker in large rehabilitation projects which require a developer /owner to amass significant amounts of construction capital, but they do tend to have

[16] U.S. Census Bureau
[17] U.S. Census Bureau, 2009 American Community Survey
[18] For a more detailed discussion of energy saving potential in existing multifamily buildings see Appendix A in following citation: Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011.
[19] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.16.

responsibility over operational budgets and make decisions about equipment replacement, maintenance and work done in units at time of unit turn-over. Given the right resources and training, these building professionals can play a critical role in ensuring *sustained* efficiencies post-energy upgrade, enabling energy upgrades over time and the penetration and spread of energy efficiency practices throughout the local multifamily housing market. In many cases, a property management professional who has been trained to spot energy saving opportunities for her clients can put the concepts being discussed here into practice far more quickly and widely than a single owner who has been trained to spot such opportunities in her own portfolio.

To be sure, despite the potential for energy savings in existing multifamily buildings discussed above, the barriers and complexities are also not trivial. Consider the following:

Barriers

Split incentives

The impact of split financial incentives between landlord and tenant is the most commonly cited barrier to energy upgrades in rental units. It is indeed a fundamental market barrier. When units are individually metered and therefore tenants pay the electricity and natural gas bills, the building owner is often reluctant to invest in energy improvements that offer no direct financial return. As the Benningfield Group points out in a 2009 report on multifamily energy efficiency potential, "An investment without a return is not an investment – it's a gift."[20] In this scenario, research suggests that a building owner's decision-making regarding purchase of in-unit appliances and other systems will be influenced primarily by first-cost considerations as opposed to future cost savings associated with more efficient equipment. Individual metering in multifamily buildings is by far the most common practice. The federal Public Utilities Regulatory Policy Act of 1978 required new apartment buildings to be individually metered for electricity. In Berkeley and Emeryville, approximately 90% of multifamily units are individually metered for electricity, while approximately 62% of units are individually metered for electricity in Oakland. The percentage of units individually metered for natural gas is approximately 65% in Berkeley, 20% in Emeryville, and 36% in Oakland.[21]

The split incentive also affects energy consumption in master metered buildings, i.e., where the landlord is paying the energy bills. In this scenario, it is the tenants who receive no price signal that would motivate energy conservation. For instance, research suggests that these tenants in master metered buildings set

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[20] Benningfield Group Inc. "Addendum report: U.S. Multifamily housing stock energy efficiency potential." 10 Jun. 2010. p.12.
[21] Metering configuration estimates were made based on data from PG&E on the number of residential account holders in each city. These data were compared to housing stock data to derive an estimate for the number of individually and master-metered units.

their thermostats higher in cold months and are less likely to turn it down when the unit is unoccupied.[22]

Market fragmentation

The multifamily market is exceedingly diverse in several meaningful ways. First, the building stock itself is diverse, which makes one-size-fits-all policies, programs and services ineffectual. The physical configuration of a building, e.g., low-rise vs. high-rise vs. mixed-use, presence or absence of central systems, and other configurations, affects the types of building systems present as well as the technical protocols and codes and standards that are applied.[23] Second, landlords also differ greatly depending on the size of their holdings, their access to capital, their investment time horizon, their sophistication in terms of building system know-how and access to technical planning and installation assistance, and other variables. These factors affect uptake in energy services and must be considered at the point of program design. Third, there is much diversity among tenants, perhaps most importantly in terms of length of tenancy. Units rented by student tenants typically tend to turn over every few years or more, for example, while an older single adult or young family might stay for a decade or more. These factors, along with others such as whether the units are affordable vs. market rate, owned vs. rented, or individually vs. master-metered for utilities affect the potential for energy efficiency improvements and the strategies by which that potential would be achieved.

High transaction costs

Several property owners interviewed for this project found the process of identifying relevant incentive programs overwhelming to the point that they do not bother to pursue services available to them. For these individuals, the cost of obtaining the right information, deciphering program requirements, securing financing, and finding the right contractors often outweighs the potential benefits associated with energy savings. Further, it is difficult for property owners to even know what the energy savings and associated cost/benefit from a given set of energy upgrades will be. Add to this the potential disruption to tenants caused by the retrofit, and it is easy to see how transaction costs are a major barrier to energy efficiency improvements in multifamily buildings.[24]

Initial costs

Property owners have a bevy of competing demands on their pocketbook. Even in scenarios where an initial investment in a given energy measure would ultimately provide an attractive return down the road, they may not have access to the upfront capital needed. This barrier is likely magnified for "mom and pop" property owners with small holdings that do not have access to larger, organizational resources. But

[22] Maruejols, Lucie & Young, Denise. "Split incentives and energy efficiency in canadian multi-family dwellings." Dec. 2010. p.2; Levinson, Arik & Niemann, Scott "Energy use by apartment tenants when landlords pay for utilities". Feb. 2003. p.3.

[23] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.13.

[24] Fuller, Merrian. "Enabling investments in energy efficiency: A study of programs that eliminate first cost barriers for the residential sector." Aug. 2008. p. 10.

for property owners large and small, lack of streamlined access to attractive rebates plus financing that can help spread the costs out over time as energy cost savings are realized is a significant barrier.

Uncertain return on investment

A range of variables affect the actual energy and money savings realized from a property owner's investment in energy efficiency. While some energy upgrades in existing multifamily buildings can yield positive returns in as little as 1-2 years, others can take much longer. Many property owners lack access to technical assistance services that can help them identify cost effective energy efficiency strategies and calculate the payback. Furthermore, although there is research that concludes that investments in energy efficiency add to a building's market value, property owners may still be wary.

These and other barriers, especially when taken together, help to explain why comparatively less attention and energy efficiency services have been dedicated to the existing multifamily sector. Fewer complexities stand in the way of capturing energy savings in owner-occupied single-family homes. That being said, there are a range of existing policies and programs, many of which are just emerging and made possible by one-time federal ARRA funds, designed to address the barriers and seize the opportunities outlined above. Policy makers grappling with how to increase existing multifamily sector energy efficiency can benefit from the contribution to the collective knowledge base that these existing efforts make.

Section 3: Overview of Policy Tools and Example Programs

This section reviews several existing policies and programs that can be used in efforts to reduce energy consumption in existing multifamily buildings. This selection should not be viewed as a comprehensive list of successful initiatives, but rather a sampling of programs that have been identified to illustrate the types of policy mechanisms that can be utilized to remove barriers to energy savings in this sector. Information about each of the highlighted initiatives was gathered through literature review as well as interviews with researchers and program implementers.

Clearly, achieving market transformation in the existing multifamily building sector requires a multi-faceted approach. It requires an approach that enables landlords to realize an economic benefit from investments in energy efficiency and that leverages the transactional nature of operating a multifamily building. Transactions occur, for example, when an appliance or other equipment is being replaced, when a unit turns over, or when a building undergoes a major remodel. Each of these "trigger events" can serve as an entry point for engaging property owners in energy upgrade programs.[25] Program outreach can be designed to recognize these entry points, and the energy service programs themselves can be designed to address the barriers highlighted in the previous section.

Below are highlights of existing policy mechanisms (and associated sample programs) designed to create energy savings in existing multifamily buildings. This Phase 1 report serves to outline the landscape of potential strategies, and does not include recommendations regarding which strategies should be pursued. Such recommendations will be considered in future phases of the BEES project. Considerations for policy makers are included for each of the strategies below to foster reflection on key issues should future action be taken in any of these areas.

Mandatory Improvement & Disclosure Requirements

Robust energy codes for new construction exist at the federal and state government levels. These codes are critical for maximizing energy efficiency at the time of construction, but the majority of the U.S. housing stock, including existing

[25] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.18.

multifamily buildings, was constructed before energy codes for new construction existed. Achieving state and local GHG reduction targets as well other policy priorities requires unlocking the vast energy efficiency potential in existing buildings, including residential properties.

A growing number of local governments are employing minimum requirements as a means of spurring market transformation in the existing multifamily building stock. These policies are typically triggered by a transaction such as the point of sale, lease, or remodel of the building or housing unit, but can also be required on a fixed schedule set by regulation. The policies take two general forms or a hybrid of each:

- *Mandatory improvements* require that energy and water saving upgrades be completed. The specific improvements may be prescribed by regulation or may be flexible as long as an overall energy efficiency level (or improvement) is reached.

  Mandatory improvement ordinances can be effective because they circumvent market barriers such as the split incentive that often stand in the way of landlords and tenants making voluntary investments in basic, cost-effective energy and water-saving measures. These ordinances essentially set a minimum standard for building energy efficiency. Mandatory improvements "level the playing field" for existing building owners. More extensive and expensive levels of energy efficiency can be captured through the provision of incentives, financing, outreach and education, and other policy tools discussed in more detail later in this report.

- *Mandatory disclosure of building energy data* includes the public disclosure of historic energy use or calculated energy ratings for a building or housing unit. The specific details of disclosure and the extent of data collection and analysis needed to gather the disclosed data vary greatly in existing regulations.

  Mandatory disclosure ordinances are a market transformation strategy because they help make the energy efficiency of a given building or unit transparent and an explicit component of its value. Property owners then have the potential to market and leverage the energy efficiency of their buildings to become more competitive in the rental and building sale market. Likewise, energy data disclosure also helps prospective tenants and buyers to compare the relative energy efficiency of their housing/building options. Because disclosure has the potential to drive demand for more efficient buildings, rewarding those who invest in efficiency upgrades, it is also used as a voluntary strategy in many regions, particularly within the United States. Disclosure is a market transformation strategy that can be supported by policies that raise the profile of building energy data.

Mandatory Improvement Ordinances

Policy summary and program examples

Several municipalities, including Berkeley (CA), Burlington (VT), Boulder (CO), Davis (CA) and San Francisco (CA), have adopted ordinances requiring building owners to install cost-effective energy efficiency measures. Historically such ordinances would impact a building only at the point of sale or remodel, but newer mandatory improvement ordinances tend to require upgrades of all applicable buildings on a set schedule. These municipal ordinances are often developed as a means of meeting state and local energy and carbon savings goals, such as those articulated in a local climate action plan.

Depending on the city and its regulations, mandatory improvement ordinances can require a prescriptive list of energy and water-saving measures to be installed or mandate a performance-based approach that requires diagnostic testing of the building or unit to reveal customized energy-saving opportunities. The cost of compliance for the building owner is usually capped so as to not be onerous.

Ordinances that mandate energy efficiency can impact commercial and/or residential buildings, including multifamily housing. The following examples provided below were selected for their applicability to the existing multifamily building sector.

The *City of Burlington's Residential Rental Housing Time of Sale Energy Efficiency Ordinance* is specifically designed for rental properties and, in an effort to address the split incentive barrier, only applies to apartments where the tenants are responsible for directly paying the heating costs.[26] It was adopted by the city in 1997 due to the recognition that rental properties were suffering from a lack of adequate insulation and overall substandard thermal performance. The ordinance requires certain energy upgrade measures at the time a residential building with rental units is sold. The total cost of the required energy improvements must not exceed three percent of the sale price or $1,300 per rental unit, whichever is less. Further, the ordinance only mandates installation of measures with a simple payback of seven years or less. Improvements that often qualify include wall, attic, and floor insulation; duct sealing; weather stripping for doors; and general sealing of air leaks throughout the home. The average cost of the energy upgrades is estimated at approximately $650-$750 per apartment and who pays for the work is negotiated between the buyer and seller of the building. Technical assistance and resources from local energy service providers are available to help affected property owners comply.

The *City of Berkeley's Residential Energy Conservation Ordinance (RECO)*, first adopted by the City in 1982, is also triggered at the time of sale, as well as at the time of a major renovation valued at $50,000 or more.[27] It requires installation of a prescriptive set of 10 basic energy and water saving measures, such as faucet aerators, water-efficient shower heads, duct sealing, weather stripping, attic insulation, and high-efficiency lighting in common areas of multifamily buildings. Like Burlington's ordinance, the Berkeley RECO has a cost cap. For multifamily properties the cost limit for the required upgrades is $0.50 per square foot. Cost of compliance for RECO-affected units is approximately $170-$2,500.

[26] Burlington Electric Department, "Burlington Electric Department – Public Power since 1905." [Online]. Available: https://www.burlingtonelectric.com/page.php?pid=37&name=ee_codes.

[27] City of Berkeley, "RECO Information – City of Berkeley, CA." [Online]. Available: http://www.ci.berkeley.ca.us/ContentDisplay.aspx?id=16030.

The *City of Boulder's SmartRegs legislation* is an example of the newer style of mandatory improvement regulation in that it requires increased energy efficiency in all rental units by a specific future date rather than the time of sale or renovation triggers mentioned above.[28] The legislation requires that by 2019 landlords meet adopted minimum energy efficiency levels either through a prescriptive 100-point system in which points are achieved by installing a range of energy upgrade measures, or through a performance path in which a given building achieves a specified level of energy performance on the Home Energy Rating System (HERS) Index. Boulder's SmartRegs legislation effectively adds an energy efficiency requirement to the City's existing Rental Housing Inspection and Licensing Program. In this scenario, the trigger for required energy upgrades is a specific future date (2019), and the compliance mechanism is the inspection associated with licensing rental properties.

Although compliance will not be enforced until 2019, the City of Boulder estimates that 500 rental units will comply with the rule by the end of 2011 with the help of rebates and other resources. SmartRegs provides owners and property managers with a one-stop-shop for energy efficiency solutions, including assistance from energy advisors that provide compliance status information, identify rebates and incentives, and help schedule contractors to do the work.

Mandatory improvement ordinance considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *Mandatory improvement ordinances have the potential to be controversial.* For example, Realtors often raise concerns that the point of sale trigger adds another element to an already complicated real estate transaction between a homebuyer and a seller. Property owners may also be resistant to the added cost associated with compliance.
- *Mandatory improvement ordinances can negate the significance of the split incentive barrier* by ensuring that basic, cost-effective energy and water saving measures are installed irrespective of the utility metering scenario.
- *Consider mandatory improvements as a gateway.* Work to develop rebates and other incentives that can seamlessly support energy upgrades that go beyond the mandatory improvements.
- *Lower the cost of compliance with mandatory improvement ordinances by simplifying the compliance process and by aligning the policy with existing incentive programs.* In Burlington, Berkeley, and Boulder, some of the cost of compliance can be offset through rebates from the local energy utility. In places such as California, New York and elsewhere, incentive programs exist that promote performance-based energy upgrades. Simplifying compliance procedures will also lower the actual or perceived administrative burden on Realtors and property owners.
- *Consider the trigger.* Potential triggers include the point of sale, lease, or major renovation or a date by which all residential properties within a given jurisdiction must achieve a certain minimum energy requirement. Like with other minimum requirements, identifying an effective trigger for compliance will have a significant impact on the number of units affected and, by association, the scale of energy saved. For example, Berkeley's RECO affects approximately 500-700

[28] Boulder County, "Climate Smart Loan Program." [Online]. Available: http://climatesmartloanprogram.org/index.html.

residential units per year, the overwhelming majority of which are single-family homes. Multifamily buildings are often owned by trusts and therefore are sold or transferred far less frequently than single-family homes. The point of sale trigger therefore has limited reach in Berkeley's existing multifamily building sector. In addition, triggers at the point of lease are harder to verify and enforce because those transactions are typically conducted without a third party like a realty agent or mortgage broker.

- *Consider performance-based rather than prescriptive requirements*. The Berkeley and Burlington mandatory improvement ordinances currently require a prescriptive list of energy and water-saving measures, while Boulder's SmartRegs offers a performance-based compliance mechanism. Berkeley is considering amending its RECO to require a performance assessment of the building or unit that reveals customized energy-saving opportunities. Especially in the context of the diverse multifamily building stock, a customized, audit-based approach should be considered.
- *Establish an effective system for tracking compliance and outcomes*. To streamline and encourage compliance and aid in tracking the effectiveness of the policy a clear system of tracking (and enforcement) of mandatory improvements should be established.

Mandatory Disclosure of Building Energy Data

Policy summary and program examples

A variety of local governments, states, and countries have adopted ordinances requiring building owners to disclose building energy data. Ordinances that mandate the public disclosure of energy data are designed to affect the rental and building sale market by making energy efficiency and energy costs an explicit, visible component of a unit or building's value. By making information on energy consumption and its associated costs available for prospective tenants and buyers, these factors then have the potential to transform markets by influencing decision-making.

Existing ordinances differ in the type of building energy data that they require for disclosure and whether the trigger for the disclosure is at a transaction point (sale or lease) or on a fixed schedule. As the examples cited in this report illustrate, the use of energy data disclosure strategies can also be employed as a voluntary market transformation strategy. In addition, at least one municipality has linked disclosure and improvement by requiring improvements in buildings with poor energy performance as revealed through mandatory disclosure.

There is a range of energy information and assessments that may be required as part of existing mandatory disclosure ordinances. Individual regulations will dictate the specific details of the building energy data that is required and how it is collected and assessed. In general, one of two types of energy rating systems (or a combination of the two) is used to generate information on the energy performance of a building (or unit):

- *Operational ratings* are one type of assessment that can be used to estimate the energy use of a building. "Operational" ratings use actual energy consumption over a given period to calculate its rating. In its simplest form, historic utility bills alone may be mandated for disclosure. In more sophisticated models, operational ratings will be normalized to remove some occupancy and weather impacts and to provide a benchmark that can be used as the basis of comparison. Operational ratings are the cheapest and simplest to collect and calculate, but also the most influenced by individual occupant behavior. Because individual behavior varies this information may or may not be predictive of future energy use or costs.

- *Asset ratings* model the energy efficiency of a building by inputting the building's physical characteristics, typically based on findings during an energy audit, under standardized weather and occupancy conditions. Ratings that combine operational and asset assessments are the most expensive to generate, but also provide the most robust results.

The output of a building energy rating system can be communicated or displayed in a variety of ways, as the following examples will demonstrate. Operational ratings are often used to benchmark the assessed property against other similar properties. Current regulation in the U.S. which mandates disclosure of building energy data requires utility records or operational ratings.

Voluntary programs in the U.S. and mandatory regulations in other countries require "energy labels" to brand and broadcast the results of building energy ratings, particularly those based on asset ratings. These energy labels are similar to miles per gallon stickers on new cars and can provide standardized information such as a dwelling unit's expected energy use, a measure of how that energy use compares to other similar homes, an indication of the GHG emissions associated with the energy use, and the potential to reduce energy consumption and GHG emissions.

Policy makers should be aware of the range of energy rating tools in the context of analyzing or developing mandatory (or voluntary) energy data disclosure ordinances. Each of the assessment options has relative advantages and costs. The program examples below are included to illustrate some existing energy data disclosure ordinances that are applicable to the multifamily building sector.

The *State of Maine* adopted an *Act Regarding Energy Efficiency Standards for Residential Rental Properties* in 2006 requiring that historical energy consumption data be disclosed at a multifamily residential unit's point of lease.[29] The law also requires landlords to provide potential renters with an Energy Efficiency Disclosure Form that lists aspects of the property that affect energy consumption, such as level of insulation and types of appliances. The form indicates minimum efficiency standards for each aspect of the building. The law requires that the form be posted in a prominent place in the apartment when the unit is being shown as well as presented to the tenant prior to signing the lease or paying an initial deposit for the rent.

The purpose of Maine's law is to provide potential renters with an understanding of how much energy a property uses prior to deciding whether or not to rent the property. The law is intended to result in improved energy efficiency over time as landlords and tenants become more knowledgeable about sources of wasted energy and energy upgrade opportunities.

Rather than developing their own equivalent of an Energy Efficiency Disclosure Form, the City of Seattle relied on the U.S. EPA's ENERGY STAR Portfolio Manager Tool when creating their regulation. Passed in 2010, *Seattle's Energy Disclosure and Benchmarking Ordinance* was designed to help Seattle meet its

[29] State of Maine, "Energy Efficiency Disclosure Form for Rental Units in Maine: Fact Sheet." [Online]. Available: http://www.maine.gov/mpuc/online/forms/FactSheetPDF.pdf

goal of achieving a 20% improvement in the energy performance of existing buildings by 2020.[30] The ordinance established energy performance measurement standards and reporting requirements for non-residential buildings of at least 10,000 square feet and multifamily buildings with five or more dwelling units. Building owners are required to benchmark the energy performance of their buildings using the U.S. EPA's ENERGY STAR Portfolio Manager, a free online energy management tool that tracks the energy and water consumption of a building or building portfolio.

Benchmarking information is an example of an operational rating (see box at right). The benchmarking information must be disclosed to any prospective tenant, buyer, or lender involved in providing financing for the building. The benchmarking information must also be reported to the city government; multi-family properties are required to provide the City with a benchmarking report every three years beginning April 2012. The benchmarking reports will help inform city government efforts to target incentives and other programs to where the energy saving potential is greatest.

The municipal utility in Seattle, Seattle City Light, is tasked with working with building owners and managers to provide them with the energy data they need to comply with the ordinance. In addition, each tenant located in an affected building must provide any data that cannot otherwise be acquired by the building owner and that is needed to comply with the ordinance. Failure to provide the requested information to the

Energy ratings for a building (or unit) can be "operational" ratings, "asset" ratings, or a blend of the two:

- Operational ratings are based on actual energy consumption over a specific time period and are typically normalized to minimize weather and occupant impacts. An operational rating reflects a combination of the physical systems of a building and how they are operated. Typically used in the non-residential sector, operational ratings may have limited applicability to future occupants if operational behaviors such as thermostat settings, lighting and shower use, and plug loads (computers, televisions, etc.) vary dramatically. However, there may be a case for operational ratings in the multi-family sector because the occupants are more fluid and energy use is averaged over the number of units, making it less specific to the behavior of a single occupant.
- Asset ratings are based on an energy audit of the fixed characteristics (or assets) of a home including its windows, walls, roof, heating equipment, ducts, and heating and cooling equipment. The applicable climate, based on the building location, is also inputted into the modeling software. A standard set of operating parameters (such as the thermostat settings and plug loads) are used to determine the energy efficiency of the building features, rather than the specific habits of the current occupants. An asset rating standardizes many assumptions to remove behavioral factors and make it easier to compare one home to another. However, the cost of the audit and modeling may be high and the modeled energy use may not actually reflect actual energy use.
- Blended operational/asset ratings use operational data to normalize or correct the asset rating provided by a computer simulation model and may be the most valuable, but also the most expensive.

[30] City of Seattle, "City Green Building – Energy Benchmarking & Disclosure: Overview." [Online]. Available: http://www.seattle.gov/dpd/GreenBuilding/OurProgram/EnergyBenchmarkingDisclosure/Overview/.

building owner within 30 days can result in penalties. Also, if the building owner does not comply with the ordinance the City may issue a citation and associated fee of $150 ($500 for repeat violations) to the building owner. Approximately 9,000 buildings will be subject to the energy information disclosure requirements.

Along with Seattle, both Washington DC and New York City have enacted ordinances that mandate the measurement and disclosure of energy use for applicable multifamily buildings based on operational ratings. While several regions of the U.S. require disclosure of operational ratings, it is primarily areas outside of the U.S. that utilize asset ratings generated from energy audits. Other countries have mandated the use of asset ratings to generate information, including energy labels, which must be disclosed on multifamily properties and other residential properties.

Within the U.S. the disclosure of building information based on asset ratings has primarily been through voluntary home energy label programs developed by non-profit organizations and the Federal government, including the Energy Smart Home Scale (E-Scale), ENERGY STAR programs like ENERGY STAR for Homes, and the new Home Energy Score (HES). Of these programs, the HES is particularly interesting because it is designed specifically for existing homes. Although currently being piloted on single family homes, the HES will be expanding to the multifamily homes as well. In addition, the State of California is actively working to implement a disclosure program based on an asset rating that will impact the multifamily building sector.

The California Energy Commission is currently working to fully adopt the *California Home Energy Rating System* (CA HERS) Program for residential buildings as mandated by the Public Resources Code Section (PRC) 25942.[31] This current Phase II is working to extend the CA HERS program to cover whole-house home energy ratings of existing (and newly constructed) homes including labeling procedures "that will meet the needs of home buyers, homeowners, renters, the real estate industry, and mortgage lenders with an interest in home energy ratings" (PRC 25942). In addition to creating home energy labels, CA HERS Phase II is working to explicitly include rater training and evaluation of multifamily buildings.

Outside the U.S., countries within Europe and the government of Australia have laws mandating the disclosure of building energy use based on asset ratings generated by energy audits and displayed on standardized energy labels. The energy labels that are generated by this process are typically required at the time of construction, sale, or lease.

In the United Kingdom all residential buildings, including multifamily, are required to have an energy audit to model the energy consumption for that unit or building. The energy assessor uses standardized assessment procedures for new and existing homes and has standard assumptions to proportion the efficiency of centralized heating systems across units in multifamily buildings. The energy assessor provides the output of the energy assessment and modeled energy consumption (on a per square meter basis) in a standardized report and on a set energy label called an *Energy Performance Certificate* (EPC).[32] The cost and responsibility of obtaining an EPC falls on the current owner at the time a building is constructed, sold, or rented. An EPC is valid for 10 years.

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[31] California Energy Commission, "Home Energy Rating System Program (HERS)." [Online]. Available: http://www.energy.ca.gov/HERS/.

[32] Directgov, UK, "Energy Performance Certificates: Directgov – Home and community." [Online]. Available: http://www.direct.gov.uk/en/HomeAndCommunity/BuyingAndSellingYourHome/Energyperformancecertificates/index.htm.

The unit or building's energy efficiency is illustrated on an A through G scale on the EPC, with an A being very efficient. The EPC also includes the potential energy use for the building or unit if energy saving measures were to be undertaken.

A similar asset rating system is in use in the northwestern part of the U.S., although the disclosure of its findings is currently voluntary rather than mandated by existing regulation. The *Energy Performance Score* (EPS) was developed by Earth Advantage Institute with funding from the Energy Trust of Oregon and used in the States of Washington and Oregon for new and existing homes.[33] EPS methodology was tested with a pilot program on 300 existing homes in 2008 and launched in 2010 as a voluntary program in Oregon and Washington for new and existing homes. In October 2010 the DOE provided funding to also pilot EPS programs in parts of Massachusetts, Virginia, and Alabama. In addition, the Energy Trust of Oregon has implemented a 2011 EPS Pilot which involves a visual in-home assessment and a comparison of various modeling tools.

An EPS requires a home energy audit, conducted by a Building Performance Institute (BPI) auditor with online EPS certification. The auditor collects information on the ways energy (electricity, natural gas, propane, and heating oil) is used in the home while accounting for the home's size, location, and assets. Standardized assumptions on occupancy, occupant behavior, and regional weather are used to determine normal energy use for the home. The resulting EPS label includes estimated energy consumption from all sources (converted and reported as kWh/yr), potential consumption after upgrades and comparisons to the state average and target all on a relative scale. In addition, the EPS includes present and potential carbon emissions (tons/yr) along with comparisons, also placed on a graphic scale. Along with the audit and scorecard, EPS includes a recommendation report on potential energy upgrades based on cost effectiveness.

As seen above, there are a variety of ordinances that mandate either the disclosure of building energy information or energy efficiency improvements. Increasingly, there are opportunities for these separate ordinances to work hand-in-hand. Specifically the disclosure of building energy information can inform and determine what type of improvement, if any, will be most effective.

One example of this "hybrid" type of mandatory ordinance is the *Austin, TX, Energy Conservation Audit and Disclosure (ECAD) Ordinance.*[34] The ECAD was approved by City Council in 2008 and amendments adopted in 2011 specifically impacted the requirements in multifamily properties (apartment or condominium buildings with five or more units). An owner of a multifamily property that receives electricity from the municipal utility, Austin Energy, must hire a certified ECAD auditor to conduct an energy audit of the building in the calendar year the building turns 10 years old (or by June 2011 if older).

The ECAD auditor checks about 10% of each type of floor plan in each building and pressure tests the duct system, identifies windows with at least an hour of direct sunlight each day, and inspects attic insulation. The resulting energy audit report must be posted at the multifamily property, provided to current and prospective tenants, and submitted to Austin Energy for entry into their database.

[33] Energy Performance Score, "EPS Audit." [Online]. Available: http://www.energy-performance-score.com/.
[34] Austin Energy, "About the Energy Conservation Audit and Disclosure (ECAD) Ordinance." [Online]. Available: http://www.austinenergy.com/about%20us/environmental%20initiatives/ordinance/index.htm. [Accessed: 04-Oct-2011].

Austin Energy will notify any multifamily property owner whose energy audit reveals that their property uses more than 150% of the average energy use per square foot of the multifamily properties in the Austin Energy service area. At the time of the notice, these owners must disclose to current and potential tenants that their electric bills will be higher than if they lived in a more energy efficient comparable property. In addition, within 18 months of receiving the notice, the property owner must make energy upgrades that reduce the energy use of the building by 20%. Preliminary estimates suggest that about 50 of the almost 1,000 apartment complexes in Austin will have energy use above 150% of the average.

Mandatory disclosure ordinance considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *Mandatory disclosure ordinances can negate some of the effect of the split incentive barrier* by making energy efficiency improvements a transparent, explicit part of a building or unit's value. This added value has the potential to be translated into an economic benefit for the property owner.
- *Consider the direct relationship between cost and accuracy of generating an energy rating.* Operational ratings are cheaper and easier to generate, but can be problematic when tenants are individually metered both because of the influence of individual behavior and privacy issues restricting access to tenants utility data. Asset ratings typically require an energy audit which can be expensive, particularly in a large, complex multifamily building. Because an asset rating is based on energy modeling rather than actual consumption, its accuracy may also be imperfect. Cost, accuracy, and application considerations are critical in selecting an energy rating system to support mandatory disclosure.
- *Involve the local utility from the beginning.* The utility will be a critical partner in enabling building owners to easily access energy consumption data in a form that meets ordinance requirements. Many local governments that enact disclosure requirements based on operational ratings have municipally-owned utilities and therefore may have more control over and access to utility data compared to local governments where municipal utilities do not exist.
- *Develop a standard, easy to follow energy reporting procedure for building owners and tenants.* The process for reporting data and knowing which data to report must be easy to follow for building owners and, when necessary, tenants. Consider aligning reporting requirements with the outputs of existing tools, such as ENERGY STAR Portfolio Manager, which enable automatic data uploads from the utility.
- *Consider the trigger for initial and ongoing compliance.* Define an appropriate trigger for initial energy disclosure as well as for renewing compliance after a defined period of time.
- *Involve Realtors and other stakeholders from the beginning.* Realtors will have specific concerns that the local government must understand and may have insights into the mandatory reporting of building energy data. Their understanding and promotion of building energy data within the real estate community will be essential to achieving the desired market transformation goals.
- *Support market transformation.* Promote the value and desirability of a highly rated building. Facilitate the communication of energy ratings by listing them with publicly-maintained property information and by making sure they are readily accessible. In order to have the greatest impact on the market, a disclosure policy should be mandatory, widespread, and strictly enforced.

Cash Rebates to help property owners go beyond the minimum

Rebates are used by all levels of government and utilities to lower the cost of minimum requirements and to stimulate demand for upgrades that go beyond the minimum that is required. This policy mechanism is designed to help address the initial cost barrier discussed above. Lowering the initial cost of a given upgrade, in combination with attractive financing, streamlined technical assistance and other services and policies discussed in this report, can help a project achieve financial feasibility.

Broadly, there are a couple types of rebate programs designed to stimulate demand for energy upgrades in existing multifamily buildings:

- *Prescriptive rebates* are commonly offered by utilities throughout the U.S. and are designed to provide an incentive for specific energy-saving devices.
- *Performance-based rebates* require that certain levels of energy efficiency improvement be met in order to qualify for the incentive.

Prescriptive Rebates

Policy summary and program examples

Rebates for the installation of specific energy efficiency devices in existing buildings, known as prescriptive rebates, are commonly offered by utilities and also by some governmental organizations throughout the United States. These programs are relatively easy to administer, are typically available on a first-come, first-serve policy, and can complement other energy efficiency programs.

For utilities, offering rebates for specific energy-saving devices to lower peak energy demand and long term energy use is a more cost-effective and environmentally beneficial option than adding additional energy-production capacity. Utility energy efficiency rebate and incentive programs are typically financed through utility ratepayer fees. For local, state, and federal governments, prescriptive rebates can be an effective tool for helping residents and businesses lower energy consumption and associated costs.

The California Statewide Multifamily Energy Efficiency Rebate Program (MFEERP) is one of the few programs in the nation that tailors a portion of its rebate offerings to the existing multifamily sector.[35]

MFEERP is administered by the state's four investor-owned utilities (IOUs). Guidelines and incentive levels are established by the California Public Utilities Commission, which regulates the IOUs. MFEERP offers prescribed rebates on a range of lighting, appliance, and building envelope energy efficiency improvements to existing multifamily buildings with two or more dwelling units in the IOU service areas.

MFEERP rebates are available for in-unit measures as well as for common areas. Example in-unit measures for which there is a rebate include lighting, ceiling fans, dishwashers, and more. Example common

[35] "CA Statewide Multifamily Rebate Program (MFEERP)." [Online]. Available: http://www.eebestpractices.com/pdf/SummaryProfileReport_R52.PDF

area rebates include those for central water heaters, LED exit signs, occupancy sensors, and clothes washers. Tens of thousands of customers have taken advantage of MFEERP rebates since the program's inception in 2002.

In conjunction with ratepayer-funded programs administered by PG&E, the City and County of San Francisco is using $2.1 million in one-time ARRA funds to launch the *San Francisco Boiler Systems Incentive Program*.[36] The program provides rebates designed to increase installation of more modern, energy efficient boilers in multifamily properties. Many multifamily properties in San Francisco still use old, inefficient boilers, some of which date back to the 1920s and 1930s. These boilers can be a headache for property owners because they are prone to breaking down and consume copious amounts of energy. But the cost of replacing them is high, so many remain on line. Recognizing this problem, the city dedicated a portion of its ARRA funds to providing generous cash rebates specifically for boilers. Rebates cover approximately 30-40% of project cost. The program is expected to result in significant energy savings – approximately 400,000 therms – and reduce GHG emissions by over 2,100 metric tons annually. The boiler replacement program is run in conjunction with the Energy Watch program, which is overseen by PG&E and provides rebates for lighting and HVAC systems.

Another example of an effective prescriptive rebate program is the *Con Edison Multifamily Energy Efficiency Program in New York*.[37] The program targets small to mid-sized multifamily buildings. It includes a free walk-through survey that identifies potential upgrades to building systems. Each upgrade has an associated rebate. The owner can choose what upgrades to act on and then move forward with bringing in a private contractor to do the work. Once the upgrades are installed, Con Edison performs quality control by ensuring that equipment was installed correctly and is serving its intended purpose. The program works fast. Importantly, it also interfaces with federal Weatherization Assistance Program (WAP) funding so that Con Edison and WAP funds can be used together to offset the cost of the improvements.

In addition to providing rebates for building-wide measures, the Con Edison program provides free in-unit energy and water-saving devices, such as CFLs, power strips, and faucet aerators. Tenants also have access to rebates for additional measures, including ENERGY STAR air conditioners and energy efficient refrigerators.

Prescriptive rebate considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *Develop and/or promote rebates for both building owners and tenants*. Although building owners hold much of the decision-making authority related to upgrading building systems and major appliances, tenants can play a role by choosing energy efficient electronic equipment and minor appliances such as microwaves. The Con Edison Multifamily Energy Efficiency Program is one of several programs that provide services designed for both tenants and building owners.

- *Prescriptive rebates are most effective when part of an integrated strategy or package*. Given that a range of barriers need to be addressed in order to make it easier and economically

[36] City of San Francisco, "sfenvironment.org: our city's programs: Energy: Energy Efficiency: Boiler Systems Incentive Program." [Online]. Available: http://www.sfenvironment.org/our_programs/interests.html?ssi=1&ti=14&ii=267.

[37] Con Edison, NY, "Con Edison: Energy Efficiency – Multi-Family Residences Can Save by Upgrading to High-Efficiency Equipment." [Online]. Available: http://www.coned.com/energyefficiency/residential_multifamily.asp.

feasible for multifamily building owners to invest in energy efficiency, successful programs will include not only rebates, but also other services such as streamlined technical assistance, low-cost financing, and marketing and recognition.

- *Prioritize public awareness and program accessibility*. Work with partners such as utilities and community-based organizations such as property owner associations to develop an outreach strategy to effectively and efficiently inform the target audience. In the San Francisco and New York examples above, contractors are a key partner as they are eager to promote the incentives in order to help generate business.
- *Reduce transaction costs for the customer by integrating various program incentives in order to streamline service delivery*. The Con Edison Multifamily Energy Efficiency Program highlighted above interfaces with federal WAP funding. The initial free energy survey provided through the program identifies upgrades that can be funded by both federal WAP funding and Con Edison and then employs funding from both programs to help lower the cost of the combined energy upgrade scope. This service integration lowers staff costs and makes it easier for the consumer to participate and benefit.
- *The timing of when the rebate is delivered may affect uptake*. Rebates are typically issued after an energy measure has been purchased and installed. This requires building owners to make the upfront investment and then process the reimbursement. If the owner does not have the necessary upfront capital and/or is not able to take on additional debt, the rebate may not be a motivator.

Performance-Based Rebates

Policy summary and program examples

While traditional prescriptive rebate programs can be effective at capturing energy savings in existing multifamily buildings, especially in the context of upgrading individual appliances or pieces of equipment, the existing multifamily sector also demands performance-based incentives that are sensitive to the diverse nature of multifamily building types and building systems. As opposed to providing a prescriptive, one-size-fits-all list of recommended upgrades, the performance-based approach employs energy audits and/or diagnostic testing of the building or unit that reveals customized energy-saving opportunities. Performance-based rebate programs require that specific levels of energy efficiency improvement be met in order to qualify. The Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee recommended in its 2011 report that utility-funded rebate and technical assistance programs require a minimum of 10% to 20% energy savings depending on building vintage.[38] In California, the percentage energy savings of a given set of measures is modeled based on state-level protocols.

The *Sacramento Municipal Utility District (SMUD) Home Performance Program for Multifamily* is using ARRA funding to supplement prescriptive rebates with performance-based incentives for multifamily properties of five or more units.[39] Under the program, owners of buildings that install upgrades modeled to achieve a 20% energy improvement can receive $2,300 (at the time of this writing) per dwelling unit,

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[38] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.36.

[39] Sacramento Municipal Utility District, "Making multi-family buildings energy efficient I Home Performance Program I SMUD." [Online]. Available: http://hpp.smud.org/multi-family-program.

plus an incremental increase of $50 per dwelling unit for each additional percentage point improvement above 20%. Rebates are capped at $3,800 per dwelling unit for improvements of 50% or more.

Qualifying property owners must first hire an independent, certified home energy rater to conduct a whole-building energy assessment. The rater suggests building upgrades based on cost-effectiveness. Building owners may select any contractor to complete the upgrades. The rater then verifies the upgrade installation and conducts a final analysis of the projected energy savings, at which time the SMUD rebate is paid.

The SMUD Home Performance Program for Multifamily, as well as other ARRA-funded performance-based programs in Los Angeles and San Diego, CA, benefit from lessons learned from an earlier California-based program called Designed for Comfort (DfC). Administered by California's investor-owned utilities, DfC was California's first comprehensive, performance-based incentive program for existing multifamily buildings. DfC is now discontinued. But the DfC program, along with the SMUD program and others now emerging with support from ARRA and state-level funds, are serving as models for the multifamily component of a new statewide program called Energy Upgrade California.

Energy Upgrade California is a collaborative effort between state regulatory agencies, local governments, utilities, and others to coordinate resources to promote energy efficiency and renewable energy projects for homes and businesses across the State.[40] Energy Upgrade California has leveraged more than $1.2 billion including $146 million from the ARRA State Energy Programs.

Energy Upgrade California provides cash rebates for performance-based energy upgrades in single-family and multifamily homes. Utility rebates for single family became available as of early 2011. Multifamily rebates and programs are currently available only in select areas where other sources of ARRA funding are being utilized, including Sacramento, Alameda, Los Angeles, and San Diego Counties. For example, Energy Upgrade California in Alameda County is offering free technical assistance followed by green labeling rebates for projects that achieve certification in the GreenPoint Rated Existing Home Multifamily program. Specific rebates and programs will continue to vary by county, but utility rebates are expected to roll out statewide in 2012.

Several other programs exist in other parts of the U.S. including the Chicago-based *Center for Neighborhood Technology's Energy Savers Program*.[41] This program includes performance-based rebates in a one-stop energy efficiency shop for multifamily property owners. It packages a free whole-building energy assessment with financing options, assistance coordinating tax benefits, and assistance with contractor oversight and bid review. On average, participating buildings achieve 30-35% energy savings with a 6-7 year payback.

Performance-based rebate program considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *Performance-based rebate programs offer flexibility to serve a variety of building scenarios in the multifamily sector*. The multifamily building stock varies dramatically by building vintage, size, type of utility metering, and other physical factors. As such, performance-based programs offer

[40] Energy Upgrade California, "Energy Upgrade California | Reduce Energy Use. Save Money. Create Jobs." [Online]. Available: https://energyupgradeca.org/overview.

[41] CNT Energy, "Energy Savers CNT Energy." [Online]. Available: http://www.cntenergy.org/buildings/energysavers/.

flexibility and a tailored approach that could not be replicated through a set package of whole-building prescriptive measures.

- *Set significant, yet achievable, energy use reduction thresholds*. This approach, as exemplified by the SMUD and Center for Neighborhood Technology programs, targets a given percentage reduction in energy usage, and offers tiered incentives for addition energy savings.
- *Consider linking performance-based energy rebates with other programs to streamline and enhance achievements*. The individualized nature of a performance-based energy program could be expanded to incorporate other environmental goals, including reduced potable water usage and landfilled material, as seen through the Energy Upgrade California in Alameda County program's green building label incentive. Integrating various programs also eases the transaction costs, a common barrier for multifamily property owners.

Financing to minimize upfront costs and amortize costs over time

Loan programs provided by the government, utilities, or other private-sector lenders provide financing that can help multifamily property owners overcome the initial cost barrier by spreading out, or amortizing, the cost of an upgrade over time.

Many multifamily property owners are experienced at employing a range of financing mechanisms and sources to conduct necessary building rehabilitation and retrofits. Financing designed to enable energy upgrades in multifamily buildings must complement traditional financing sources property owners use to conduct other common retrofits, such as seismic improvements, roof replacement, installation of new building systems, and more.[42] It is important for policy makers and program administrators to recognize these events as entry points for making energy upgrades part of the retrofit scope.

As well as traditional sources of financing such as bank loans, other forms of special financing exist that are specifically designed to enable energy upgrades:

- *On-bill financing* has the potential to help address the split incentive barrier by enabling building owners and tenants to invest in building-wide and in-unit energy upgrades without any upfront cost. On-bill financing is paid back over time through a line item on the utility bill.
- *Property assessed clean energy financing (PACE)* also enables property owners to make energy upgrades with no upfront cost. PACE financing is paid back through a line item on the building owner's property tax bill.

[42] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.15.

Another financing option we explored as part of our research is Energy Service Companies, commonly known as ESCOs. An ESCO is a private business that provides comprehensive energy services for a given building or set of buildings, usually in the municipal or large commercial context, and is paid for those services by the dollar savings achieved through efficiency gains. ESCOs may assume the risk that the upgrade project will save an estimated amount of energy, but this is an important stipulation that must be clearly articulated in the contract. ESCOs have had limited application in the existing multifamily building sector, but examples do exist and the model would seem to hold potential. Although not explored in detail in this report, the cities of Oakland, Berkeley, and Emeryville will include this model in considerations moving forward.

On-Bill Financing

Policy summary and program examples

On-bill financing is an innovative option for removing barriers to multifamily energy upgrades. This type of financing could be an attractive option for building owners as well as tenants. On-bill financing eliminates the upfront cost of a given improvement or set of improvements and enables the borrower to pay back the financing over time from the energy savings associated with the upgrade. In some on-bill programs, the financing is tied to the meter rather than the building owner or tenant. This set up is especially important in the multifamily sector as it enables the current occupant to move and the next occupant to pick up the on-bill payments. Monthly payments are designed to be lower than the expected energy bill savings associated with the upgrade.

Several on-bill programs are sustained by a revolving loan fund. As in the Efficiency Kansas example highlighted below, governments can use seed money in the form of grants or other funding to begin providing financing for energy upgrades. As repayments are made, funds become available for new loans to other residents or businesses. Hence, the funding revolves from one entity to another as repayments replenish the fund.

Efficiency Kansas is a state-run program supported by $37 million in ARRA funds.[43] The program includes several utility partners that utilize Efficiency Kansas funds to provide financing to their customers. The financing is tied to the meter. For residents (and businesses) the process starts with a comprehensive energy audit conducted by a state-approved auditor. The auditor provides a recommended package of energy upgrades. The package is designed to generate enough energy savings to pay back the Efficiency Kansas loan over a maximum of 15 years (180 monthly bill payments). The customer then solicits bids from contractors and gets the work done. The auditor conducts a post-retrofit inspection to ensure quality. The subsequent monthly charge on the customer's utility bill does not exceed 90% of the projected energy savings. This is an important program feature designed to guarantee that any upgrades undertaken do not result in an additional financial burden. The maximum residential loan amount is $20,000.

Given on-bill financing programs' potential to address major barriers affecting energy efficiency efforts in multifamily buildings, it is a policy tool worth consideration. That being said, establishing such a program is complicated and therefore requires the full buy-in of participating utilities. On-bill financing requires changes to a utility's billing system and development of repayment allocation procedures that take time and money to generate.

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[43] "Efficiency Kansas: Home." [Online]. Available: http://www.efficiencykansas.com/.

On-bill financing considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *The efficacy of on-bill financing in multifamily properties is unclear.* Certainly low or zero-interest on-bill financing has the potential to serve as an effective tool for property owners and tenants alike in terms of removing barriers to investing in efficiency improvements that will lower their energy bills. What is unclear is the impact on-bill financing has in buildings where units are individually metered. In this scenario, the split incentive barrier may still persist.
- *Design a simple, user-friendly application process.* The Efficiency Kansas program places high priority on minimizing hassle and associated transaction costs for their customers. The program includes accessible web-based information and online applications, an emphasis on fast turnaround time for loan approvals, streamlined technical assistance to identify appropriate energy upgrades, a system for quality control, and easy on-bill loan repayment.
- *Tying the loan to the meter, as opposed to the building owner or tenant, may help to ease concerns related to the payback period for certain investments in energy upgrades.* For example, Efficiency Kansas program participants not only experience no out-of-pocket costs to make energy upgrades, but also are not responsible for paying back the financing once they move. The loan repayment stays with the property, which may enable even relatively short-term occupants to choose to make energy upgrades.
- *Promote energy upgrade financing as part of an integrated package*. Like rebates, streamlined technical assistance, marketing assistance and other resources for multifamily stakeholders, financing is only one component of a successful program to capture increased energy savings in existing multifamily buildings.
- *Partner with contractors.* Successful marketing of a multifamily financing program depends on partnering with contractors and supporting their efforts to understand and promote the program. Informed contractors can utilize attractive financing and other incentives as tools for marketing their own services.

Property Assessed Clean Energy Financing

Policy summary and program examples

Property assessed clean energy (PACE) programs enable local governments to provide financing to residential and commercial property owners for energy upgrades and renewable energy projects. Participating property owners then pay the financing back over a set number of years via a charge on the building owner's property tax bill. The financing is secured with a lien on the property, which is senior to the mortgage. There is little to no upfront cost to the property owner to participate, and if the property is sold before the end of the repayment period, the new owner inherits both the repayment obligation and financed energy improvements.

PACE programs tap into existing mechanisms that local governments are already familiar with, such as special tax districts or assessment districts, and allow these mechanisms to support clean energy projects. PACE programs can be funded through internal public agency funds or through issuance of bonds.

PACE can offer several benefits for property owners. One major benefit is the ability of participating property owners to achieve energy upgrades at little upfront cost and to amortize the repayment over a longer period (20 years) compared to many conventional financing programs. The long repayment period is designed to enable the payments to closely match the energy savings associated with the financed improvement. Because the repayment is also tied to the property as opposed to the property owner, current owners can invest in energy upgrades today knowing that repayment would be transferred to a new owner if he/she decides to sell the property in the future.

PACE was first proposed by the City of Berkeley in 2007. Several other PACE programs subsequently emerged throughout the U.S., but due to federal regulatory issues related to PACE liens being senior to the mortgage, residential PACE program development is suspended as of this writing. Despite suspension of development of new residential PACE programs, there are still a handful of active residential PACE programs as well as some local governments actively developing or administering commercial PACE financing.

One such program is the *ClimateSmart Loan Program in Boulder County, CO*.[44] This program is one of a handful of PACE programs that was active before the Federal Housing Finance Agency (FHFA) effectively placed a moratorium on such programs in July 2010. ClimateSmart offered one round of commercial PACE loans in fall 2010, but the residential CilmateSmart Loan program was suspended.

ClimateSmart for the residential sector began accepting applications in 2009. Phase 1 of the residential program financed approximately $9.8 million in energy retrofits. Eligible improvements included air sealing, insulation, lighting retrofits, reflective roofs, landscaping (e.g., planting trees on south side of house), solar hot water systems, solar photovoltaic systems, and wood/pellet stoves, among others. The program was designed to take applications before the county issued bonds to finance the improvements. The first application period in April 2009 closed with 393 applications for over $7.5 million in financing. The county then issued a bond to cover this amount.

According to a 2011 analysis of ClimateSmart by the U.S. Department of Energy,[45] residential ClimateSmart program spending in Boulder County contributed to 85 short-term jobs, more than $5 million in earnings, and almost $14 million in economic activity within the county. Reduced energy use from the upgrades saved participants approximately $125,000 during the first year. Phase 1 program costs totaled about $13 million, which means that short-term in-county benefits alone exceeded the initial investment in the program.

Businesses and multifamily properties were eligible for Boulder County's commercial ClimateSmart loans. Of the approximately $1.5 million in loans originated in September/October 2010, approximately $57,600 in loans were for energy upgrades in multifamily properties. Six multifamily properties participated, five of which replaced windows and one of which upgraded a furnace.

PACE financing considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

[44] Boulder County, "Climate Smart: Loan Program." [Online]. Available: http://climatesmartloanprogram.org/index.html.
[45] Goldberg, Marshall and Cliburn, Jill K. & Coughlin, Jason. "Economic impacts from the Boulder County, Colorado, ClimateSmart loan program: Using property-assessed clean energy financing." 2010

- *PACE financing can address multiple major barriers to investment in energy efficiency in existing multifamily buildings.* It can reduce the "high initial cost" barrier by eliminating or greatly minimizing upfront costs of making energy improvements. It can also make ongoing loan repayments easier by enabling the payments to closely match the energy savings achieved through the upgrade.
- *Prime the pump with rebates and other services.* Like other forms of financing, PACE financing will be more attractive to multifamily property owners if rebates exist to lower the cost of the energy upgrades and to lower the loan amount.
- *Partner with contractors to market the program.* Contractors will leverage PACE and other incentives to enlist clients.
- *Capture and report outcomes.* Given that PACE is a relatively new strategy that is still being tested, effectively tracking and reporting outcomes and case studies will not only assist with internal project management and planning but will also benefit other local governments considering PACE as an option.
- *PACE financing has been applied in existing multifamily buildings.* Six multifamily properties participated in the first round of Boulder County's ClimateSmart Loan program. Other PACE programs have also served multifamily property owners too.
- *The future of PACE is uncertain, but is worth monitoring.* There are currently four active commercial PACE programs. There are several more commercial PACE programs that are in the design or planning stage.[46]

Tax-based incentives to encourage energy efficiency investments

Tax incentives, both income and property-based, can be used to encourage private investment in energy efficiency. Tax incentives are ultimately designed to reduce total project costs by reducing the amount of taxes owed by the consumer. Tax incentives can come in the form of a tax credit, which directly reduces the amount of income taxes or property taxes due by the credit amount; or in the form of a tax deduction, which reduces a consumer's taxable income and, therefore, the taxes that are due. Ideally, reduced government tax revenue due to the provision of tax incentives is offset by additional tax revenue gained from job creation spurred by increased investment in energy upgrades.

In addition to income tax credit and deductions opportunities, local governments might also elect to reduce property taxes as a means of offering incentives to building owners that do energy efficiency or renewable energy projects. At a minimum, local and state governments should take care to make sure that such projects will not subject the building owner to additional property taxes.

[46] Renewable Funding, Lawrence Berkeley National Laboratory, Clinton Climate Initiative. "Policy brief: Property assessed clean energy financing: Update on commercial programs." Mar. 2011.

Current tax incentives for energy efficiency improvements that impact the multifamily sector are available at all levels of government:

- *Federal tax incentives* for energy efficiency tend to be short in duration and, like the Residential Energy Efficiency Tax Credit, may be modified during their tenure. The Low Income Housing Tax Credit is an enduring Federal tax incentive that can include energy efficiency and has been used extensively in the creation of affordable multifamily housing.
- *State tax incentives* include limits to income tax liability for projects that advance energy efficiency in buildings including multifamily housing developments.
- *Local tax incentives* use property tax credits or abatement to encourage development or redevelopment that is energy efficient.

Federal tax incentives

Policy summary and program examples

Federal tax incentives, available nationwide, can help remove barriers to energy upgrades. Targeted at property owners or developers, there are current Federal tax deductions and tax credits available to the multifamily building sector. In addition, there are also Federal tax incentives to support the installation of renewable energy systems, including geothermal heat pumps, small wind turbines, solar energy systems, and fuel cells, which may apply to selected multifamily units or buildings. However, the applicability of the multifamily sector is difficult to determine and is worked into legislation designed to apply to either a commercial building owner or a homeowner. Therefore, assistance at the local level may be needed to help identify and fully utilize the available Federal incentives.

The *Energy Efficient Commercial Buildings Deduction* was initially established as part of the Energy Policy Act of 2005, has been extended several times, and currently expires at the end of 2013.[47] Owners of new or existing commercial buildings are eligible for tax deductions from $0.30-$1.80 per square foot for installing energy efficiency measures such as improvements in interior lighting, building envelope, HVAC, or hot water systems that meet specific energy reduction targets. Although not immediately obvious, multifamily high rise buildings (with four or more habitable stories) are a type of commercial building eligible for the tax deductions allowed by this regulation.

Specific tax incentives also exist to encourage development of energy efficient, affordable rental housing for low-income households. The *Low Income Housing Tax Credit* (LIHTC) program provides the private market with an incentive to invest in affordable rental housing. Federal housing tax credits are awarded to non-profit affordable housing developers of qualified projects.[48] Non-profit developers then sell these credits to investors to raise capital for their projects, which reduces the debt that the developer would otherwise have to borrow. Because the debt is lower, a tax credit property can in turn offer lower, more affordable rents.

[47] "Commercial Building Tax Deduction Coalition." [Online]. Available: http://www.efficientbuildings.org/.
[48] U.S. Department of Housing and Urban Development, "Low-Income Housing Tax Credits I HUD USER." [Online]. Available: http://huduser.org/portal/datasets/lihtc.html.

Investors receive a dollar-for-dollar credit against their Federal tax liability each year over a period of 10 years. The amount of the annual credit is based on the amount invested in the affordable housing. This federal tax credit program is administered and allocated at the state-level. As of the Housing and Economic Recovery Act of 2008, Federal code requires that the energy efficiency of a project must be one of the considerations in a state's priority and allocation of LIHTC. In New Jersey and other states, for example, affordable housing developers competing for the LIHTC must build to the ENERGY STAR for Homes qualification and can earn points by including various clean energy measures in the development.

State tax incentives

Policy summary and program examples

In addition to Federal income tax incentives, and the state programs to administer LIHTC funds, some states have created programs that limit tax liability for projects that advance energy efficiency in buildings, including multifamily housing developments.

The State of Oregon operates the longest running, and perhaps most innovative, tax incentive program in the U.S. designed to increase investment in clean energy. The *Oregon Business Energy Tax Credit* (BETC) was adopted in 1979 and is operated by the Oregon Department of Energy.[49] Qualifying business owners, including rental property owners, can deduct 35% of eligible energy efficiency and renewable energy project costs from their state income tax liability, up to a maximum of $10 million. The tax credit is based on the incremental difference in cost between the existing equipment and the new, more efficient equipment. New equipment must be at least 10% more efficient than existing equipment; lighting retrofits must be at least 25% more efficient.[50]

The BETC includes an innovative feature that enables the owner of an energy project to transfer the tax credit to another entity in exchange for a lump-sum payment. Although the lump-sum payment, which is set by the Oregon Department of Energy, is lower than the tax credit value, it can still be attractive for businesses or property owners who would rather have the payment in advance of the tax refund.

In addition, several states, including New Mexico and Oregon, have created legislation that grants corporate or personal income tax credits for buildings that are built or renovated to strict energy standards. Funds for the State of Maryland's program are currently exhausted, but did include multifamily buildings with at least 12 units as one type of eligible project.

Local tax incentives

Policy summary and program examples

At the local level, communities may choose to offer property tax incentives to encourage development, redevelopment or retrofits that are energy efficient.

[49] Oregon Department of Energy, "ODOE: Information for Businesses Business Energy Tax Credits." [Online]. Available: http://www.oregon.gov/ENERGY/CONS/BUS/BETC.shtml.

[50] Asia Pacific Partnership on Clean Development and Climate, Renewable Energy & Energy Efficiency Partnership, Alliance to Save Energy, American Council on Renewable Energy. "Compendium of best practices: Sharing local and state successes in energy efficiency and renewable energy from the United States." Apr. 2010. p.64.

Howard County, Maryland, for example, offers several types of property tax credits to encourage energy efficiency and green building practices.[51] The County's offerings include both a High Performance Building Tax Credit and a Green Building Tax Credit for buildings that receive the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Silver certification or above. In addition, the Energy Device Conservation Credit is available to homeowners that install new heating, hot water or electric generation systems using a renewable energy source like solar or geothermal.

The *City of Cincinnati, Ohio* currently offers property tax abatement for new LEED construction of 1-3 unit residential buildings, including condominiums, for 100% for 15 years (up to $546,400).[52] In addition, renovated LEED residential buildings can qualify for a 10-year tax abatement on the improvements.

Federal, state, and local tax incentive considerations for policy makers

Consider the items below in the course of taking any action in this policy area:

- *Assistance is needed to identify improvements eligible for tax incentives.* Determining whether multifamily buildings are eligible for existing Federal, state, and local tax incentives is often not trivial, particularly as incentives are altered over time. Local outreach and assistance to multifamily building owners and residents should include regularly updated identification of applicable tax incentives.
- *Consider opportunities to tailor incentives to the multifamily sector.* There are few tax incentives that are tailored to the multifamily sector. As national efforts to capture energy savings in multifamily buildings evolve, finding opportunities to provide strategic tax incentives to multifamily building owners may hold potential.

Strategies for affordable housing and with potential relevance to rent controlled housing

Each of the policy tools outlined in this report is relevant to the affordable multifamily housing sector. The purpose of this section is to highlight specific tools currently in use <u>only</u> in the existing multifamily affordable housing (i.e., government-owned or subsidized) sector. The tools identified below are tailored to this sector's unique complexities, but are also relevant, in concept, to the rent controlled market.

Note that although there are many important efforts underway to better align and streamline energy services, incentives, and workforce training in the multifamily

[51] Howard County, Maryland, "Howard County – Real Property Tax Information." [Online]. Available: http://countyofhowardmd.us/Departments.aspx?ID=1465#anch71808.
[52] City of Cincinnati, "City of Cincinnati – LEED-CRA Green Commercial Tax Abatement." [Online]. Available: http://www.cincinnati-oh.gov/cdap/pages/-16940-/.

affordable housing sector, the scope of this report does not include a comprehensive review of existing efforts.

One policy mechanism used by the Tax Credit Allocation Committee[53] (TCAC) in California to remove barriers to energy efficiency in the affordable housing sector is the *California Utility Allowance Calculator (CUAC)*.[54] The CUAC is designed to make utility allowances affecting tenants' rents more accurately reflect the true energy costs in a given building.[55] We highlight the CUAC for its potential to help developers of affordable multifamily housing recoup investments in energy efficiency in their buildings while improving occupant comfort at the same time. We also highlight the CUAC for its potential relevance in concept, not in current practice, to rent controlled and non-rent controlled market rate housing.

Currently, the CUAC is intended for use in new affordable housing construction or substantial rehabilitation projects receiving Low Income Housing Tax Credits and that include energy efficiency improvements beyond those required by the 2008 California Building Energy Efficiency Standards[56] and/or onsite solar photovoltaic systems.

Utility allowances are provided by public housing authorities to cover the cost of qualified tenants' energy utilities in public housing and U.S. Department of Housing and Urban Development (HUD)-assisted housing. The public housing authorities' utility allowance calculation is an estimate based on existing housing stock and other variables. This estimate often does not reflect energy efficiency gains (and associated lower energy costs) made in new or upgraded construction. This can have the effect of creating a disincentive for affordable housing developers to invest in energy efficiency.

Public housing authorities and TCAC cap the housing burden of the tenants they serve to 30% of adjusted gross income (AGI). The housing burden includes rent plus an estimate of utility costs. If, for example, a tenant's AGI is $800 per month, the housing burden (rent plus utilities) would be capped at $240. If the utility allowance is $40 per month, then rent to the building owner is effectively $200. If, based on property-specific knowledge of utility cost savings from energy upgrades calculated by the CUAC, the utility allowance is decreased to $25 per month, then the rent to the building owner increases to $215. The extra $15/month to the building owner helps to offset the cost of his/her investment in the energy upgrades or other capital improvements that benefit the tenant.

A critical component of the example above is the property-specific knowledge of utility cost savings from an energy upgrade. This estimate is conducted through a

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[53] The California Tax Credit Allocation Committee (TCAC) administers the federal and state Low Income Housing Tax Credit Programs. Find more information on TCAC here: http://www.treasurer.ca.gov/ctcac/

[54] Go Solar California, "California Utility Allowance Calculator (CUAC) for the New Solar Homes Partnership." [Online]. Available: http://www.gosolarcalifornia.org/affordable/cuac/index.php.

[55] The utility allowance is the amount affordable housing tenants are expected to pay each month for utilities, as a portion of the HUD maximum allowable "housing burden" (total amount residents are expected to pay for combined rent and utilities).

[56] For affordable housing projects done in 2009 the applicable state Building Energy Efficiency Standards is the 2005 version.

software model used by qualified professionals approved by the State of California to calculate project-specific utility allowances. The accuracy of the estimate is critical as it affects the utility allowance provided to the income-qualified tenant. The professional using CUAC must verify that a given project is actually more energy efficient than the default. Specific energy upgrade measures must be closely verified by a third party through visual inspection, review of manufacturer specifications for installed appliances, and other forms of diligence.

Property-specific knowledge of utility cost savings from an energy upgrade is a critical component of the CUAC; that is also the component of this tool that is potentially conceptually relevant to rent controlled and non-rent controlled market rate existing multifamily buildings. If, for example, an owner of a rent controlled, individually metered multifamily property conducts an energy upgrade to his/her building that reduces tenants' utility bills, and the impact of the energy upgrade on the tenants' utility bills can be reliably quantified and verified by a third party, then the potential also exists that the costs and benefits of the energy upgrade can be equitably shared between owner and tenant. Such a mechanism would squarely address the split incentive barrier. This concept will be considered in developing policy recommendations in later phases of the BEES project.

A tool related to the CUAC, the *Energy Efficiency-Based Utility Allowance (EEBUA)*, is also designed to help affordable housing developers achieve a payback for investment in energy efficiency. Unlike the CUAC, the EEBUA does not provide a property-specific calculation of the utility cost savings from energy upgrades. Instead the EEBUA is established by a given public housing authority for any building within the housing authority's jurisdiction that achieves a certain minimum level of energy efficiency. The EEBUA level represents the average energy savings of projects within the housing authority's jurisdiction that achieve a minimum verifiable level of efficiency.[57]

Finally, in addition to the tools identified above, also under consideration in the cities of Berkeley, Oakland, and Emeryville are additional strategies to create incentives for increased energy efficiency for property owners that have tenants with Section 8 vouchers.

CUAC and EEBUA considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *The CUAC and the EEBUA have the potential to help create an incentive for affordable housing property owners to invest in energy upgrades*. These tools can enable property owners to recoup some

[56] For a detailed discussion of utility allowance options see: Enterprise Green Communities. "Utility allowance options for investments in energy efficiency: Resource guide." May 2011.

of their investment in energy upgrades. Such investments make housing units healthier and more comfortable for tenants.

- *The CUAC currently only applies to new affordable housing construction receiving Low-Income Housing Tax Credits*. Applying the CUAC to existing construction is a potential next step, but verifying energy improvements would be more complicated in this context.
- *TCAC employs a sophisticated process for conducting verification of accurate energy modeling as well as verification of installation of energy efficiency improvements that would result in energy and utility cost savings*. Any city or county public housing authority or other entity proposing to rely on the CUAC will need to have a mechanism for ensuring the same level of quality control.

Tools for removing the split incentive barrier

Split financial incentives between multifamily building owners and tenants are commonly cited as a barrier to making energy upgrades, especially where units are individually metered for energy use as is commonly the case in the East Bay. Building owners are often reluctant to invest in energy improvements that reduce energy costs for tenants but offer no direct financial return for the owner. In buildings without individual meters where owners pay utility costs, tenants likewise receive no direct financial incentive to conserve energy. It may be possible to accelerate the implementation of energy efficiency upgrades if tools can be developed to directly remove the split incentive barrier.

Tools could be designed to remove the split incentive barrier by increasing the capacity of property owners to make energy improvements and recoup their costs in a manner that pays for the improvements made while ensuring appropriate sharing of costs and benefits between owners and tenants and protections of both parties (e.g., owners cannot impose additional payments upon renters at a rate greater than energy cost savings realized by renters). Assuming accurate and transparent projections can be derived for energy improvement project implementation costs, energy savings and cost savings, it may be possible to enable repayment by either party to the implementing party through a variety of mechanisms. It would be necessary to meet cost protection and other needs of both owners and tenants, and to enable appropriate sharing of the net benefits created through energy efficiency.

Despite being a potentially significant strategy, few examples of model actions in this area have been identified in use in other jurisdictions.

Tools to remove the split incentive barrier could potentially take several forms, including:

- Development of legally vetted model lease language that property owners would be encouraged to incorporate into their lease agreements designed to enable energy improvements to be made under specified conditions with a clear process for identifying costs and benefits to both parties and a structure for enabling costs to be recouped in an appropriate manner;

- Adoption of policy changes if needed to enable such lease language to be incorporated; and,

- Development of technical tools for projecting cost savings associated with certain energy improvements to existing multifamily buildings to help all parties establish a ceiling on potential repayment obligations passed on to tenants (e.g., enhanced version of the CUAC).

Several organizations (e.g., Building Owners and Managers Association) have developed model green lease language for owner-tenant relationships in the commercial sector that may have application in the multifamily residential sector as well.

Streamlined technical assistance

Policy summary and program examples

Streamlined technical assistance can significantly advance efforts to engage multifamily property owners in conducting energy and green upgrades in their building and in taking advantage of programs and services designed to help them do so. Effective technical assistance includes the following components:

- Preliminary design assistance and scoping for individual energy upgrade projects

- Independent evaluation of energy upgrade opportunities in a building or portfolio of buildings, including input on prioritization, integration with asset management plans and clear communication of costs and benefits, such as return on investment

- Tailored identification of and connection to rebates, financing, tax incentives and other services that will lower the cost and otherwise make energy upgrades economically feasible for a building owner

- Assistance identifying contractors and other energy services professionals as necessary

- Assistance with ongoing monitoring of building performance post-energy audit and upgrade

It is important that such assistance be coordinated and easy to access for property owners. Feedback from property owners and managers gathered for this report pointed to the need for a “one-stop shop” or single point of contact that would reduce the transaction costs and stress associated with developing a project scope and securing the necessary incentives.

The two program examples highlighted below exemplify the start to finish, streamlined technical assistance that can mitigate transaction costs for multifamily property owners:

- *Energy Upgrade California* is a program designed to provide incentives and customized guidance to multifamily property owners to help identify deep energy savings at the lowest possible cost.
- *Smart Lights* is a successful San Francisco Bay Area-based program that functions as an independent one-stop-shop for lighting and refrigeration upgrades in small businesses.[58] The streamlined, integrated nature of the program provides lessons for multifamily energy programs.

Energy Upgrade California is ultimately envisioned to serve as a streamlined energy efficiency upgrade resource for California residents. At the current time, the resources available through Energy Upgrade California are limited to single-family residents, except for selected markets.

For example, the Energy Upgrade California in Alameda County program is using funding from the U.S. DOE Better Buildings Program to provide multifamily building owners a free consultation with a green building expert to help establish upgrade goals for a building or portfolio. This customized guidance helps building owners access additional resources and maximize the energy and other green benefits, including water savings, of the upgrades while minimizing cost. As part of Energy Upgrade California in Alameda County, existing multifamily buildings are also eligible to receive rebates for the third-party green building certification GreenPoint Rated. The certification provides recognition and marketing benefits for green upgrades.

Efforts are also under way to develop an online "Navigation Tool" that effectively provides the streamlined technical assistance offered by Energy Upgrade California in Alameda County. StopWaste.Org, in partnership with Heschong Mahone Group, Incorporated (HMG), is developing the logic model and promoting the tool to potential users. Renewable Funding is responsible for programming the tool and integrating it with the state's Energy Upgrade California web portal.

Users of the Navigation Tool will input basic property data, including building locations, vintages, and utility billing data, in addition to anticipated building rehabilitation projects (or goals) and available funding. For each building, users will add detail on each building component and system, such as the type, age, and efficiency of the boiler.

The Navigation Tool's output will include upgrade opportunities and recommendations based on the extensiveness of the upgrade approach. A customized list of

[58] Community Energy Services Corporation, "CESC – Community Energy Services Corporation – Smart Lights." [Online]. Available: http://www.ebenergy.org/smart-lights/.

available upgrade incentive programs, matched to the identified upgrade opportunities, will also be created for the user. The tool will help the user in ranking the priority of the potential projects and buildings within the portfolio. In customizing the potential pool of programs to those that are applicable based on the building characteristics and the owner's rehabilitation priorities, the Navigational Tool reduces administrative costs and barriers for the building owner. The Navigational Tool also encourages the maximum leveraging (and layering) of programs and resources. Rather than forcing an "all or nothing" approach, the Navigational Tool is designed to inspire action through customized recommendations.

The Navigation Tool will ultimately be housed on the Energy Upgrade California website. A log-in will allow for repeated visits to update information and check in on the prioritized list of portfolio properties and their corresponding incentive program recommendations. A related project, the Tracking Tool, will integrate with the Navigation Tool and allow managers of multifamily buildings to monitor their buildings and upgrades over time.

The technical assistance being provided through Energy Upgrade California has many of the same components that make the *Smart Lights Program* an effective service for small businesses and multifamily property owners in the East Bay of the San Francisco Bay Area. Administered by the Community Energy Services Corporation (CESC), Smart Lights offers small businesses and common areas of multifamily buildings free start-to-finish technical assistance and instant rebates to reduce the cost of upgrades such as comprehensive lighting retrofits and refrigeration tune-ups. The Smart Lights service includes:

- An independent, single point of contact for the client
- A free no-obligation energy efficiency assessment
- Clear, upfront communication of a project's cost/benefit analysis
- Instant rebates that typically range from 50%-70% of total project costs and up to 90% in some instances
- Low-cost equipment through negotiated volume pricing with qualified installation contractors
- Free start-to-finish project management and quality control
- Rebates paid directly to contractor to help defray the client's out-of-pocket and transaction costs
- Referrals to other energy-efficiency programs as needed

At the time of this writing, CESC is also piloting an integrated audit that identifies improvement opportunities beyond lighting and refrigeration upgrades.

In Berkeley alone Smart Lights provided high quality energy-efficient lighting and refrigeration improvements to 25% of the approximately 3,500 Berkeley businesses between 2002 and summer 2011. As of August 2011, annual savings on energy bills across all Berkeley businesses served by Smart Lights exceed $1 million. The corresponding energy saved annually across all projects is approximately 6.4 million KWh.

The Smart Lights program is funded by California ratepayers through PG&E under the auspices of the California Public Utilities Commission.

Streamlined technical assistance considerations for policy makers

Below is an issue that should be considered in the course of taking any action in this policy area:

- *Multifamily property owners desire streamlined, start-to-finish, one-stop-shop technical assistance that is independent of a profit motive.* The current energy program landscape is confusing and daunting for multifamily stakeholders. This causes missed opportunities for energy upgrades. Programs like Smart Lights and Energy Upgrade California can provide valuable lessons for how to design an effective technical assistance package that improves access to other existing programs and services.

Workforce development

As discussed in this report, existing multifamily buildings are diverse in several ways and include complexities and barriers that do not exist in single-family homes. The vintage and physical configuration of a multifamily building affects the types of building systems present as well as the technical protocols and applicable codes and standards. As such, the multifamily sector requires programs and services designed specifically for multifamily buildings. It follows that the energy professionals doing the work must also participate in specialized training geared toward the multifamily context.

In its 2011 report, the California Home Energy Retrofit Coordinating Committee (HERCC) recommends targeting specialized training at four types of professionals that have important roles in capturing energy savings in multifamily buildings:[59]

- *Energy raters/verifiers*: Training for these professionals should ensure that they are well-versed in energy program and incentive requirements and have the expertise to evaluate and recommend energy-saving opportunities in multifamily buildings and verify the quality of completed upgrades. The HERCC supported the development of a multifamily-specific training curriculum for raters/verifiers.

[59] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.29.

- *Building operators*: Training should be designed to empower building operators to sustain energy savings over time and to help educate tenants about a building's green features and resident-oriented rebates and services.

- *Central water heating contractors*: Given the significant potential for energy savings associated with improving water heating systems in multifamily buildings, the HERCC recommends targeted training for the professionals that work on such systems.

- *Energy analysts*: Training for these individuals includes instruction in the use of software tools necessary to model energy baseline and energy reduction opportunities.

Importantly, the HERCC also recommends that professional qualifications and trainings required for various energy programs offered throughout the state should be coordinated so trained workers can work across programs while limiting the amount of separate trainings and certifications required of them.[60]

As multifamily-specific training programs emerge and evolve throughout California and the U.S., we cite here one innovative training program example that exemplifies the HERCC's recommendation above regarding empowering building operators maximize energy efficiency in their buildings.

Based in New York City, the Green Supers Program is a cooperative effort between the city, property managers, superintendents, and SEIU local 32BJ, the largest private sector union in the state.[61] During the course of five weeks, building superintendents and resident managers are trained on how to operate their buildings in a way that maximizes energy and water efficiency and minimizes utility bills. The 40-hour training covers everything from building science basics, to optimizing heating and cooling systems, to monitoring indoor air quality. Concepts like green cleaning and pest control are also covered, and electives are offered on topics ranging from green roofs, to renewable energy, to water reuse.

The class is a mix of classroom learning and hands-on training. Upon completion of written and field tests each participant is awarded green building certifications from the Building Performance Institute and the Urban Green Council.

Local 32BJ is a key partner in helping to recruit participants for the training. The union has contact information for it members, which makes marketing the program to them relatively easy. Contributing to the success of the program has also been property management companies' support for having their employees participate in the training. Management companies have been approving employees' requests to enroll

[60] Multifamily Subcommittee of the California Home Energy Retrofit Coordinating Committee. "Improving California's multifamily buildings: Opportunities and recommendations for green retrofit & rehab programs." 8 Apr. 2011. p.29.
[61] "1,000 Green Building Superintendents – Our Plan for a Greener New York City." [Online]. Available: http://www.1000supers.com/about.php.

in the 40-hour course and many have also provided building space in which students learn practical field applications.

The Green Supers Program is funded by the U.S. Department of Labor and administered by the Thomas Shortman Fund.

Workforce development considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *Building energy professionals need specialized training designed specifically for multifamily buildings.*
- *Professional qualifications and trainings required for various multifamily energy programs funded by utilities and government should be coordinated so trained workers can work across programs while limiting the amount of separate trainings and certifications required.*
- *Building operators, superintendents and other building staff are a key audience that requires training and support in order to maximize and sustain the benefits of energy upgrades.* The Green Supers Program effectively empowers these stakeholders to better understand their buildings and the systems, appliances, and products within.

Marketing, outreach and education

Multifamily property and owners and tenants often have limited knowledge of the potential benefits and process of making energy improvements, and limited motivation for engaging in this work. Property owners lack access to resources that can illustrate the scale of energy (and money) saving potential in their buildings. Even for property owners seeking to increase energy efficiency in their buildings, the prospect of identifying appropriate improvements and the energy programs and services that support getting those improvements done can be overwhelming and frustrating. Marketing, outreach and education efforts can help to foster interest in energy efficiency and to address this frustration by raising awareness of existing services relevant to the existing multifamily sector and demystifying the process of taking advantage of them.

Collectively, marketing, outreach and education can connect multifamily stakeholders with the services available to them and to encourage the behavior changes necessary to achieve reduced energy use and the associated emissions. For the purposes of this report, marketing, outreach and education activities are grouped into three broad categories:

- *Targeted outreach* activities identify the key audience and tap into trusted and existing networks. Target audiences for the multifamily sector are often contractors, property owners, managers, building operations staff, and tenants.

- *Marketing and engagement* raises awareness and creates demand for a program. Marketing can be used to motivate or provide publicity as positive reinforcement to those who participate in energy efficiency programs.
- *Consumer education* teaches tenants and building owners and managers about maximizing energy performance and minimizing energy use. Technology can assist in educating consumers about energy consumption through mechanisms such as smart bills or smart meters.

Targeted outreach

Policy summary and program examples

Outreach to key stakeholders in the development phase of a project can create support for new programs or policies. Once a program is ready to launch, outreach is vital to increasing participation. Local energy efficiency contractors and other industry partners can be key allies in targeted outreach efforts. It is in the best interest of contractors to be engaged and informed regarding available incentive programs as such programs can be a selling point for their services. Some outreach programs utilize contractors as the primary point of contact for both identifying energy upgrade opportunities and in educating owners on applicable rebates and incentives.

Property owners can be another key target audience for outreach efforts, as they are the ultimate decision-makers regarding major capital investments. Local property owner associations that represent property owner interests and often have regular meetings and newsletters can be a valuable outreach avenue. Reaching property owners and managers in the early stages of a building retrofit project, before decisions about scope and the associated financing are made, is critical.

Other audiences of importance include building operators and managers. Many multifamily buildings have professional building operation staff persons who communicate with building owners regarding large purchasing decisions, and who are also in charge of building system maintenance, tenant relations, and other matters. These individuals are the frontline for all building related matters and therefore need appropriate training for how to identify and sustain energy efficiency opportunities. They can be equipped to inform tenants and building owners about incentives that are available to them. Highlighted in the previous section, the *Green Supers* program in New York City works effectively through the local union to train on-site building managers on the importance of energy efficiency and how to operate and maintain a green apartment building.

Although tenants are not empowered to make many of the decisions required to achieve deep energy savings in a multifamily rental building, they are nonetheless an important audience for outreach and education. Collectively, their preferences regarding unit comfort and energy efficiency can affect the market over time by nudging landlords toward more investment in energy upgrades. Further, tenants are often empowered to make some basic in-unit upgrades, such as appliance and lighting upgrades and weatherization.

In Berkeley, *Rising Sun Energy Center* operates a program called *California Youth Energy Services (CYES)* that is available to homeowners and tenants alike.[62] Rising Sun hires youth ages 15-22 and trains

[62] "Rising Sun Energy Center: California Youth Energy Services." [Online]. Available: http://www.risingsunenergy.org/content/cyes.html.

them to conduct basis energy and water use assessments and to install free energy and water-saving devices such as CFLs, clotheslines, and faucet aerators. The CYES teams also provide personalized recommendations for further savings and associated incentives. The program is funded by utility ratepayer dollars. It is a free service and is one of the few energy service programs that specifically targets renters.

Marketing and engagement

Policy summary and program examples

Marketing, through broadcast media, peer-to-peer messaging or even competition, can increase participation and give validity to an energy efficiency program or service. Marketing is also used to showcase program outcomes and recognize the work of landlords who demonstrate leadership in energy efficiency.

Weatherize DC, for example, is achieving results in the single-family energy retrofit market by using a combination of high-level media marketing and house meetings where neighbors share their experiences in making energy upgrades.[63] Also targeting neighborhood relationships is *Energy Smackdown*, an energy efficiency competition that pits neighborhoods against one another to see which group can save the most energy.[64] Energy Smackdown also piloted a reality television program to motivate and challenge the home audience to save energy and water and reduce waste.

Marketing a building's green features when it is available for rent or sale helps educate buyers and tenants about key green attributes or potential energy savings. Green certification, through a third-party organization like LEED or GreenPoint Rated, can give validity to these claims and potentially influence buyer and tenant decision-making. The marketability of green building certification, or other green features, is greatly enhanced if tied into the real estate Multiple Listing Service (MLS) or standard rental listing. A rental or for-sale listing service that adds additional fields to identify green features including the energy efficiency of the home recognizes building owners for creating high performance homes. Portland successfully incorporated green criteria into the *Portland Regional Multiple Listing Service* (Portland RMLS) in 2007.[65] The additional fields included a green certification field and drop down menus of green features, such as ENERGY STAR appliances, recycled content for materials, and solar. A training program for real estate professionals was concurrently offered to standardize terms and educate agents on how to market green features to homebuyers.

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63 The DC Project, "Weatherize D.C." [Online]. Available: http://www.weatherizedc.org/.
64 BrainShift Foundation, Inc., "Energy Smackdown." [Online]. Available: http://www.energysmackdown.com/.
65 "RMLS.comTM Regional Multiple Listing Service – Home." [Online]. Available: http://www.rmls.com/RC2/UI/Home.asp

Consumer education

Policy summary and program examples:

Regardless of who is paying the utility bill, it is important that both renters and property owners understand how energy efficiency and conservation actions can be taken and what the benefits of such action would be. Tailored consumer education can help educate both the landlord and the end-user on energy efficiency.

Most tenant education involves a checklist of simple activities designed to reduce consumption. Providing tips about turning off lights or turning down thermostats can encourage end-users to conserve but may not have long-term results. An effective education campaign however, provides ongoing feedback and information to help the consumer move towards a set of goals. Education is also needed when new technologies are installed to help tenants understand how to optimize use and limit frustration with automated technologies.

When tenants pay the utility bill, real-time access to energy data can be used to motivate energy use reductions. Technologies such as home energy monitors that communicate energy use on user-friendly displays can provide consumers with information about the cost of the energy they consume and demonstrate how changes in behavior can alter energy consumption and expenditures. Utility bills inserts that leverage social norms can also encourage behavior change of the energy end-user by showing their usage compared to other similar customers. *Sacramento Municipal Utility District (SMUD)* in partnership with *Positive Energy* piloted a *Home Energy Reporting System* to better use their customer data to engage residential customers.[66] Customers receive monthly reports alongside their bill where they are compared against similar households, in order to give each household a true "benchmark" about how they were doing in terms of relative consumption. The monthly bill reports can be customized in order to best target messaging, are designed to be easy to read, and are received on an opt-out basis rather than opt-in. Initial results for this program showed that households receiving the reports reduce energy consumption by approximately 2%.[67]

Consumer education considerations for policy makers

Below is a selection of issues that should be considered in the course of taking any action in this policy area:

- *Know your audience.* Messaging should be relevant and useful to your chosen audience (building owners, property managers, building supervisors, tenants, etc.).
- *Provide tools for property owners to market their green choices.* Property owners and managers who invest to upgrade or green their buildings need mechanisms to communicate to consumers that they have a superior product.
- *Reach property owners through building owner associations.*
- *Incorporate tenant engagement and education.*
- *Without repeated social, physical, or emotional reinforcement, new information will probably be ignored and recommendations will go unheeded.* Education campaigns that generate multiple encounters with the information over a moderate period of time and through multiple sensory and social channels (social peers, newspapers/media, visual signage, etc.) are more likely to work.

[66] California Energy Commission, "Home Energy Rating System Program (HERS)." [Online]. Available: http://www.energy.ca.gov/HERS/.
[67] Positive Energy Written Testimony submitted to PA PUC on 11/14/2008 see Docket No. M-0061884 http://www.puc.state.pa.us/electric/pdf/EnBanc-DSR/Ttmy-PE111908.pdf

Conclusion

Capturing energy savings in existing multifamily buildings is an important but often overlooked arena for reducing global warming emissions, increasing energy affordability, and creating jobs. Our review of the research, plus interviews with economists and building experts working in the multifamily context, not only illustrated the significant energy-saving potential in this sector, but also the need to capture that potential in our communities.

But while the potential is clear, the barriers to achieving it are not trivial. These include split financial incentives between landlords and tenants, a highly diverse and fragmented market for which one-size-fits-all strategies will not work, and high transaction costs that stand in the way of engaging property owners in energy upgrade efforts.

Several governments in the U.S. and beyond are employing innovative policy mechanisms to address these barriers. In doing so they are contributing solutions not only for the benefit of their own communities, but also for the benefit of other policy makers grappling with the same challenge. This report benefited from these on-the-ground actions and is designed to inform future action, not only in Berkeley, Oakland and Emeryville, but for a broader audience as well.

Clearly, achieving market transformation in existing multifamily buildings requires a multi-pronged approach. A combination of minimum standards and requirements; incentives that enable going beyond the minimum required; and outreach, technical assistance and other strategies that remove barriers to accessing the resources and services that are available are needed. This report is not meant to serve as a comprehensive review of all such programs and policies, but, rather, a selection of efforts that help illustrate the types of policy mechanisms that are available.

Our review of existing efforts is the first step in an effort by the cities of Berkeley, Oakland, and Emeryville to develop enhanced local strategies to increase energy efficiency, improve occupant comfort and safety, and lower the energy cost burden in our communities' apartment buildings, cooperatives, and condos. A companion to this report includes an analysis of the energy-saving potential of the local multifamily building stock. Using these two reports as a foundation, the next steps for the BEES project are to develop, gather community input on, and pilot potential strategies for implementation in our communities.

Appendix

Multifamily Energy Efficiency Survey

Purpose and methodology

In March 2011, the cities of Berkeley, Oakland, and Emeryville, CA conducted a Multifamily Energy Efficiency Survey of local governments across the U.S. to glean best practices and identify commonly faced hurdles. The survey was a first step in our research. Survey responses helped the three cities to begin to understand the multifamily energy efficiency policy landscape. This report, *Increasing Energy Efficiency in Existing Multifamily Buildings: An Overview of Challenges, Opportunities & Policy Tools*, benefited from the survey responses summarized below as well as literature review and interviews with leading experts in the field.

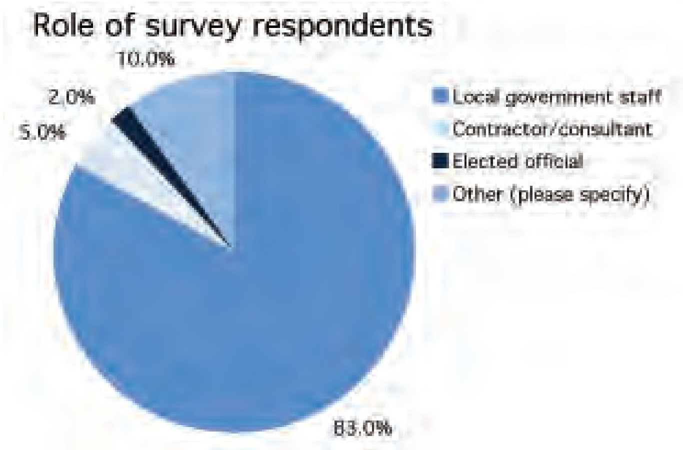
The survey contained 9 questions and was administered online using Survey Monkey. The survey received 100 responses; the number of complete survey responses totaled 51 (n=51). It was distributed to over 2,000 recipients, mainly through existing local government networks and membership organizations, including:

- Green Cities California
- ICLEI – Local Governments for Sustainability
- League of California Cities
- Local Government Commission
- Urban Sustainability Directors Network

For more information about the survey please contact Timothy Burroughs, City of Berkeley Climate Action Coordinator, at tburroughs@cityofberkeley.info.

Response Summary:

Q1: What is your role at the local government for which you work? (n=100)



Q2: For which local government do you work or consult? (n=95)

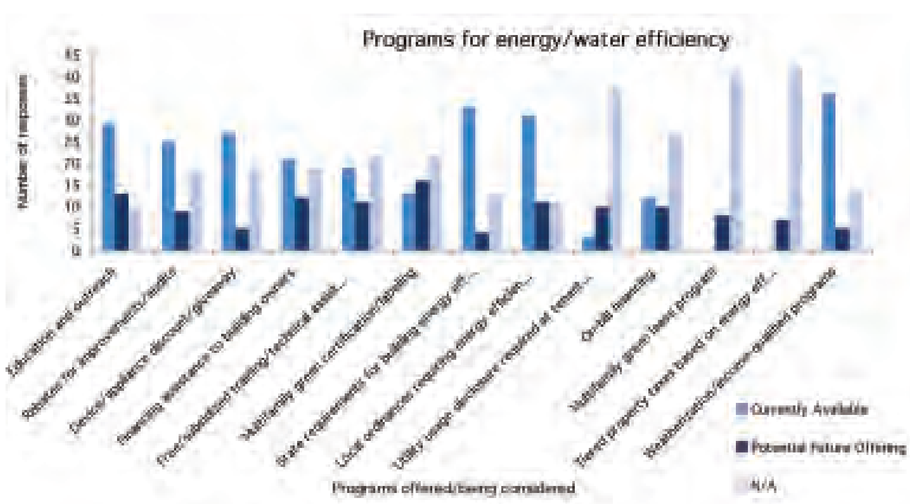
The majority of responses came from communities in California. Because most of the survey responses came from California, and because the cities of Berkeley, Oakland, and Emeryville are also in California, the focus of the report is weighted toward California-based policy. That said, we did receive a handful or survey responses from East Coast and Midwest communities and we believe that the report findings are relevant to cities across the U.S.

Geographic distribution of survey responses.

Q3: Please indicate programs or efforts that are currently offered, or are being considered, to increase energy and/or water efficiency in your community's multifamily buildings. These efforts may be offered by your local government or another organization such as a utility. (n=56)

The top three programs/efforts that are currently offered are:

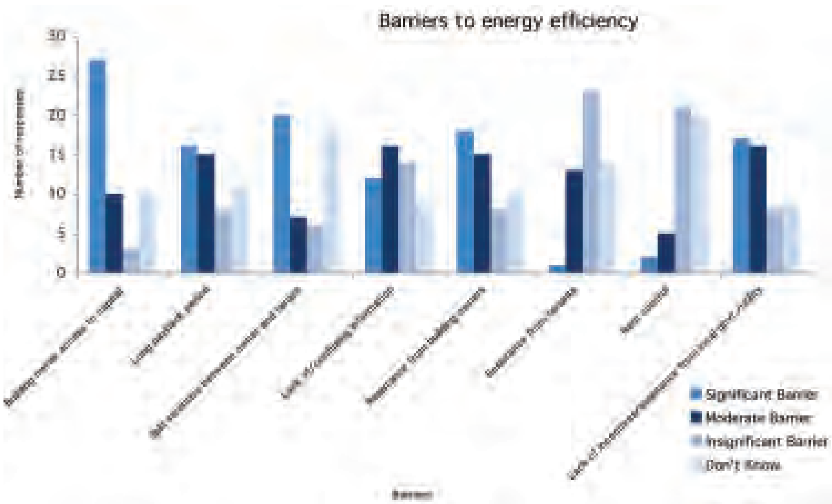
- Weatherization/income-qualified programs
- State-level energy efficiency requirements for buildings
- Local building ordinances with energy efficiency requirements



The top three programs/efforts that are being considered are:

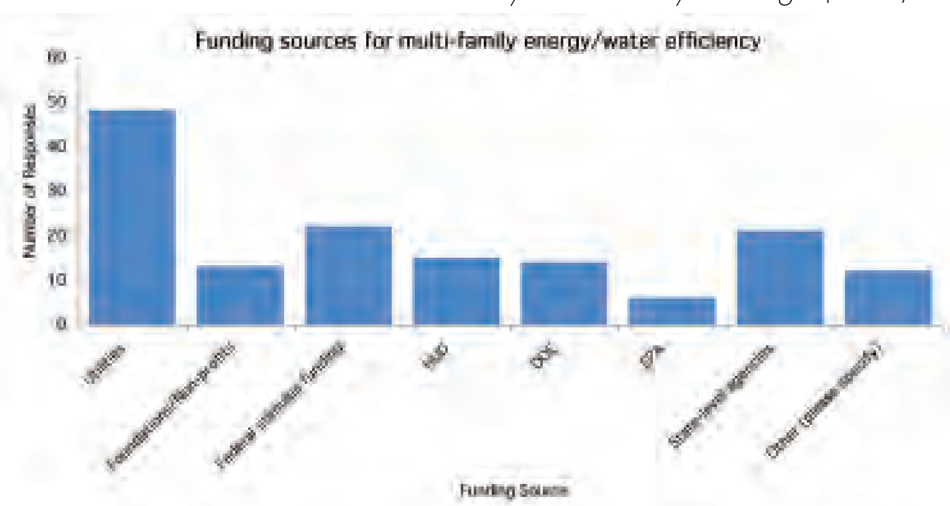
- Multifamily green certification or green labeling programs
- Education and outreach to tenants and building owners
- Financing assistance to building owners for energy efficiency measures

Q4. Please provide a brief description for each of the existing or anticipated programs you indicated on the previous question. If possible, provide a link to more program information.



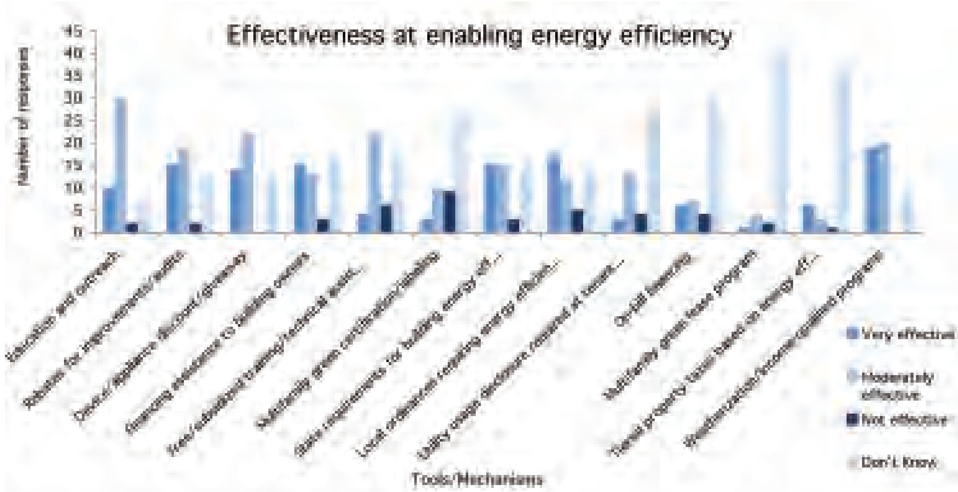
Rebates for purchase of energy efficient appliances, and on-bill financing for larger expenses like solar, incorporating energy into rental safety inspections and audits at time-of-sale were some of the existing or anticipated programs that are being offered or considered. We highlight specific programs and discuss the broader mechanisms these represent in this report.

Q5. Based on your experience, please rate the following barriers to energy efficiency in multifamily buildings. (n=51)



Responses indicate that building owners' access to capital, split incentives, and lack of incentives/assistance available from the local government or utility are important barriers. These and other barriers are discussed in the body of this report.

Q6. What are the funding sources for multifamily energy/water efficiency programs in your community? Please check all that apply. (n=53)



Over 90% of the respondents to this question checked utilities as a funding source for energy efficiency programs. Federal stimulus and state-level agencies are mentioned by approximately 40% of respondents. A high-level discussion of funding for energy efficiency efforts in existing multifamily buildings is discussed in Section 1 of the report, with particular emphasis on funding for multifamily energy efficiency programs in California.

Q7. Based on your experience, please rate the following on their effectiveness at enabling energy efficiency in multifamily buildings. (n=50)

Weatherization/income-qualified programs, local building ordinances with energy efficiency requirements, rebates for capital improvements or energy audits, and financing assistance to building owners for energy efficiency measures are all perceived to be very effective at enabling energy efficiency in existing multifamily buildings. These and other strategies are explained further in the body of the report, Section 3.

Q8. If you are aware of particularly effective programs or resources for encouraging energy and/or water efficiency in multifamily buildings in other communities, please share (provide links if possible). (n=11)

Responses received are integrated into the main report.

Q9. In addition to energy or water efficiency programs, does your community have other programs directed towards multifamily buildings (for example, occupant health and safety programs or requirements, seismic retrofit program, etc.)? If so, please provide a brief description of each. (n=21)

Recycling and solid waste management programs for multifamily buildings were mentioned often. Other mentions included smoking ban ordinances to protect health in multifamily buildings, and hazardous material remediation.

Characterization and Analysis of Small Business Energy Costs

by

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for

SBA
Office of Advocacy
www.sba.gov/advo

under contract number SBAHQ-06-M-0475

Release Date: April 2008

SBA Office of Advocacy www.sba.gov/advo

Small Business Research Summary

Advocacy: the voice of small business in government

April 2008 No. 322

Characterization and Analysis of Small Business Energy Costs

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2008. [53] pages. Under contract SBAHQ-06-M-0475

When viewed at the macroeconomic level, even substantial energy price increases may not entail significant firm-level impacts because energy costs are a relatively small proportion of total overall production costs. However, energy expenditures are a much higher percentage of total input costs in certain industry sectors, and small entities often face unique challenges that affect their ability to absorb price increases.

To add to the state of knowledge on small entity impacts of energy price increases, this report compiles available information to (1) characterize the potential impact of energy price increases on small entities in individual industry sectors; and (2) identify whether, and to what extent, small entities face higher energy prices by major economic sector. The study results indicate that small entities in the manufacturing and commercial sectors have the greatest exposure to energy price rises.

Overall Findings

An analysis of sector-level energy price information indicates that small entities in the manufacturing and construction sectors pay higher prices for most, but not all, fuels. These price disparities are most pronounced for electricity and natural gas, with electricity in the manufacturing sector responsible for the greatest price differential. The smallest size establishment category (under 50 employees) pays 35 percent more for electricity than the sector average, while the largest establishment category (1,000 or more employees) pays 17 percent less than the sector average. Therefore, small manufacturing sector entities that use substantial amounts of electricity face a significant competitive disadvantage.

Highlights

The analysis found significant price differentials between what the smallest and largest entities paid for energy in the commercial and manufacturing sectors. Small businesses in the commercial sector faced a 30 percent price differential for electricity and a 20 percent price differential for natural gas. In the manufacturing sector, small businesses faced a 28 percent price differential for distillate fuel oil, a 27 percent price differential for natural gas, and a 14 percent price differential for coal.

Discussion

Of the 17 manufacturing sector industries for which 2002 data were available, small entities in 10 of these sectors spent considerably more on energy than larger entities when measured on the basis of expenditures per value of industry shipments. Three manufacturing sector industries had energy costs per dollar of output that were more than double those incurred by larger entities (food manufacturing; leather and allied products manufacturing; and computer and electronic product manufacturing). Profitability data further illustrate the challenges that small entities face from price increases in energy and other production inputs—13 of the 19 manufacturing sector industries with available profit data have profit margins that are lower for small entities than their larger counterparts.

Similarly, small entities have higher energy expenditures per dollar of sales than larger entities in 26 of the 31 commercial sector industries studied. The median commercial sector industry has a small entity energy cost per sales ratio that is 2.7 times the ratio of large entities. General merchandise stores; food and beverage stores; and couriers and messengers are three of the commercial sector industries with the highest small entity energy cost per sales ratios relative to those of their larger counterparts. The couriers and messengers industry is particularly affected; its small entity energy expenditures add up to more than 10 percent of total small entity sales. As with manufacturing industries, a majority of commercial sector industries have lower small entity baseline profit margins than their larger industry counterparts.

Although the results for other economic sectors (agriculture, mining, construction, electric generation) show a more equal distribution of small and large entity baseline profit margins and energy expenditures per unit of output, all but the electric generation sector has one or more individual industries for which available data suggest that energy price increases are expected to result in greater impacts on small entities than large entities.[1]

This study highlights some of the unique challenges that confront small entities when energy prices rise, and identifies the economic sectors and specific industries in which small entities are most vulnerable to such price increases. Given continuing energy price trends, it is reasonable to assume that more and more small firms will see their competitive positions weakened, leading to impacts on capital availability and profitability, and the potential for small business closures.

Scope and Methodology

The researchers used publicly available data on energy costs from the Economic Census conducted by the U.S. Bureau of the Census in the Department of Commerce, the Department of Energy's Energy Information Administration (EIA), and the U.S. Department of Agriculture. All surveys measured expenditures by firms of various sizes on an array of energy goods, including fuels and electricity. The EIA surveys included considerably greater detail, but only covered the manufacturing, commercial, and electricity generation industries. Further data on firm size and revenues were taken from the Economic Census of 2002. Firm size, revenue, and energy use data were synthesized into industry tables and firms were compared across size categories to ascertain whether small firms pay proportionately more or less than their larger counterparts within an industry.

This report was peer reviewed consistent with the Office of Advocacy's data quality guidelines. More information on this process can be obtained by contacting the director of economic research at *advocacy@sba.gov* or (202) 205-6533.

Ordering Information

The full text of this report and summaries of other studies performed under contract with the U.S. Small Business Administration's Office of Advocacy are available on the Internet at ***www.sba.gov/advo/research***. Copies are available for purchase from:

National Technical Information Service
5285 Port Royal Road
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(800) 553-6847 or (703) 605-6000
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www.ntis.gov
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CD-ROM A00 ($24.00)
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1 Data do not suggest that small entities in the Electric Generation sector face disproportionate energy price impacts—the likely cause for this phenomenon is the relative lack of competition in this sector (e.g., most jurisdictions grant monopolies to electricity providers, with retail electricity rates generally requiring the approval of the local public service commission).

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A. EXECUTIVE SUMMARY

When viewed at the macroeconomic level, even substantial energy price increases may not imply significant firm-level impacts because energy costs are a relatively small proportion of total overall production costs. However, energy expenditures are a much higher percentage of total input costs for many industry sectors, and small entities often face unique challenges that affect their ability to absorb price increases. This study provides information for understanding the significance of energy costs to small entities in individual industry sectors, and by extension, the potential for energy price increases to negatively impact these entities.

A literature review indicated a general lack of information characterizing the significance of energy prices to small entities; however, the limited information available suggests that rising energy prices and/or price uncertainty have more significant effects on smaller size firms. In addition, industry surveys of small entities in the manufacturing and construction sectors indicate that energy price increases are of growing concern to small businesses, and moreover, past price increases have had an impact on the earnings and profitability of a significant proportion of survey respondents.

To add to the state of knowledge on the impacts of energy price increases on small entities, the author compiled available information to (1) characterize each industry's potential for energy price increases to impact small entities and (2) identify whether, and to what extent, small entities face higher energy prices by major economic sector. The results indicate that the manufacturing and commercial sectors have the greatest potential for small entity energy price impacts. Of the 17 manufacturing sector industries for which 2002 data were available, small entities in 10 industries spent considerably more on energy than larger entities when measured on the basis of expenditures per value of industry shipments. In three manufacturing sector industries, the energy costs per dollar of output for small firms were more than double those incurred by larger entities (food manufacturing; leather and allied products manufacturing; and computer and electronic product manufacturing). Profitability data further illustrate the challenges that small entities face from energy (and other production input) price increases: 13 of the 19 manufacturing sector industries with available profit data have lower profit margins among small entities than among their larger counterparts.

Similarly, small entities have higher energy expenditures per dollar of sales than larger entities for 26 of the 31 commercial sector industries studied. The median commercial sector industry has a small entity energy cost per sales ratio that is 2.7 times the ratio for large entities. General merchandise stores; food and beverage stores; and couriers and messengers are three of the commercial sector industries with the highest small entity energy cost per sales ratios relative to those of their larger counterparts. The couriers and messengers industry is particularly noteworthy in that small entity energy costs are more than 10 percent of the value of total small entity sales. As with manufacturing industries, a majority of commercial sector industries have lower small entity baseline profit margins than their larger counterparts.

Although the results for other economic sectors (agriculture, mining, construction, electric generation) show a more even distribution of small and large entity baseline profit margins and energy expenditures per unit of output, all but the electric generation sector have one or more individual industries for which available data suggest that energy price increases are expected to result in greater impacts on small entities than large entities.[1]

An analysis of sector-level energy price information indicates that small entities in the manufacturing and construction sectors pay higher prices for most, but not all, fuels. These price disparities are most pronounced for electricity and natural gas, with electricity in the manufacturing sector responsible for the greatest price differential; the smallest size establishment category (under 50 employees) pays 35 percent more than the sector average for electricity, while the largest category (1,000 or more employees) pays 17 percent less than the sector average. Therefore, small manufacturing entities that use substantial amounts of electricity face a significant competitive disadvantage. In addition, significant price differentials between smallest and largest entities were found in these sectors:

[1] Data do not suggest that small entities in the electric generation sector face disproportionate energy price impacts. The likely cause of this phenomenon is the relative lack of competition in this sector (e.g., most jurisdictions grant monopolies to electricity providers, with retail electricity rates generally requiring the approval of the local public service commission).

- 30 percent price differential for electricity used in the commercial sector;
- 28 percent price differential for distillate fuel oil used in the manufacturing sector;
- 27 percent price differential for natural gas used in the manufacturing sector;
- 20 percent price differential for natural gas used in the commercial sector; and
- 14 percent price differential for coal used in the manufacturing sector.

This study highlights some of the unique challenges that confront small entities when energy prices rise, and it identifies the economic sectors and specific industries in which small entities are most vulnerable to such price increases. Given continuing energy price trends, it is reasonable to assume that a growing number of small firms will see their competitive positions weakened, with ramifications for their ability to raise capital and their profitability, as well as the potential for small business closures.

B. INTRODUCTION

The purpose of this study was to compile available energy data from federal government and other sources to characterize the impact of energy costs by industry sector, firm size, and fuel type.[2] This study provides key information for understanding the potential for energy cost increases to negatively affect small entities by industry sector.

When firms are forced to absorb energy price increases, profit margins will be reduced or potentially eliminated. Given the prevalence of economic globalization, increased energy costs in the United States can result in domestic plant closures in cases where firms are no longer able to compete with foreign plants with lower cost structures. More generally, reduced profits may result in cash flow impacts, which may affect firms' access to capital for investments, a particular concern for small firms, which tend to have greater difficulty raising capital than larger firms. Furthermore, energy cost increases will result in reduced product demand and reduced revenues to the extent that such costs are passed through to consumers.[3] For sectors that use energy both as a fuel and raw material (e.g., plastics), the impact of energy price increases can be compounded.

When viewed at a broad level, energy costs are a relatively small proportion of total intermediate production inputs. Even fairly large energy price increases may not suggest a significant effect when viewed at this aggregate level. However, energy expenditures are a much higher percentage of total input costs for certain industry sectors.

To assist in understanding the issue, the author performed a review of the literature on small firm energy costs and energy price increase impacts. Much of the literature either dates to the energy crises of the 1970s/early 1980s, or is not specific to small businesses. Many of the most recent studies rely on data that predates energy price shocks that followed in the aftermath of the Gulf Coast hurricanes of 2005. There were two different types of relevant studies identified via the

[2] The author also sought to characterize energy costs by geographic region, but the available data were deemed too limited to allow such characterization.
[3] Additional reductions in demand will occur via energy price increases at the consumer level (e.g., gasoline and residential heating and cooling costs), which strain household energy budgets.

literature review: (1) quantitative analysis papers from the academic literature; and (2) reports summarizing the results of surveys conducted by industry trade associations. While the first group presents theoretical analyses of energy cost-related concepts (e.g., uncertainty, variable input costs, and returns to scale) on small firm decision-making, the second group uses survey data to draw conclusions about the impact of increased energy prices on small businesses.
A synthesis of these different studies leads towards the general conclusion that, all else being equal, energy price increases and price uncertainty are of greater concern to small businesses than large businesses.

1. Review of Academic Literature

Given the paucity of small business energy price impact literature, the focus of the review of academic literature is necessarily limited to the impact of price increases for general production inputs. It is reasonable to assume, however, that the results from these studies can be applied to energy inputs. The following three studies suggest that energy price increases, as well as increased energy price uncertainty, have larger impacts on smaller size firms.

Nguyen and Lee (2002)

Nguyen and Lee recently assessed the potential disparity in economies of scale between U.S. manufacturing companies of different sizes. Using 1991 data from the Manufacturing Energy Consumption Survey (MECS) and the Annual Survey of Manufacturers, Nguyen and Lee found that there is no statistically significant difference in production efficiency between establishments of different sizes—that is, small establishments were determined to produce as much output for a given level of inputs as large establishments (Nguyen and Lee, 2002). Output in this study was measured as value of shipments, and capital, labor, materials, and energy were the inputs included in the establishment size production functions.

The study's applicability to the issue at hand is limited in that: (1) data constraints restricted the analysis to establishments with at least 20 employees; (2) it did not investigate the potential for industry-specific economy of scale differences existing within the Manufacturing sector; and (3) it solely focused on the manufacturing sector (while the majority of small firms are found in other industry sectors).

In addition, the study does not state whether the analysis incorporated establishment size energy price differentials that appear to exist.[4] If large and small manufacturers pay similar prices for energy (and/or face similar energy price increases), then the study suggests that increased energy prices do not differentially impact small manufacturers' ability to competitively produce goods because they are no less efficient in converting inputs (of which energy is one) into production. Given their similar estimated production efficiencies, however, any production input price disadvantages that smaller manufacturers may experience (including energy costs), would be expected to place them at a competitive disadvantage relative to their larger counterparts. [Section D.2 of this report describes data indicating that small manufacturing sector entities pay substantially higher prices for electricity, natural gas, and distillate fuel oil than large entities.]

Ghosal and Loungani (2000)

Uncertainty about the price of production inputs such as energy can cause firms to become more averse to risking investments in capital. Ghosal and Loungani establish a negative investment-uncertainty relationship among manufacturing firms in the United States (Ghosal and Loungani, 2000), and the ratio is greater for smaller firms. Therefore, increases in the uncertainty of energy cost inputs are expected to result in less overall capital investment by businesses, with smaller firms experiencing greater reductions.

Koetse, *et al.*, 2006

In a study that yielded a similar result to that of Ghosal and Loungani (2000), Koetse *et al.* (2006) further identifies the impact of energy price uncertainty on capital investment. In this case, the authors studied the impact of perceived wage and energy price uncertainty on capital

[4] In particular, the paper only describes how energy quantity estimates were developed by establishment size—no information is provided on how quantities were converted to expenditures (i.e., whether an overall average fuel price was applied or whether the existence of establishment size category-specific prices was investigated/incorporated).

investment and investment in energy-saving technologies. They find that "especially for investment in energy-saving technologies, there is strong evidence of structural differences between small and large firms. Specifically, uncertainty appears to have a larger influence on decision making in small firms than in large firms" (Koetse *et al.*, 2006). They cite the ability of larger firms to hedge against risk and absorb investments with longer payback periods as key reasons for the disparity in the investment-uncertainty ratio between small and large firms.

These studies suggest likely capital investment impacts from the large energy price fluctuations experienced recently, including impacts on investments in energy efficiency improvements. They further indicate that such impacts are likely to be more pronounced for smaller firms.

2. Review of Industry Literature

The four reports discussed below provide the results of targeted surveys to identify issues of greatest concern to small firms. The reports generally focus on small firms in a specific sector (either construction or manufacturing). The surveys indicate that rising energy prices are of increasing concern to small businesses and that past increases have led to earnings and profitability impacts for a significant share of respondents.

Associated General Contractors of America

A November 2005 Associated General Contractors (AGC) report focuses on construction sector costs, including energy costs (AGC, 2005). The report notes that diesel fuel cost increases affect the construction sector in multiple ways since diesel fuel is used to operate off-road equipment (e.g., earthmovers and tower cranes), to run motors for construction vehicles (e.g., concrete mixers, pumpers, and dump trucks), and as fuel for transporting construction material deliveries and construction debris. The report finds that diesel fuel prices paid by U.S. construction firms rose by an average of 47 cents per gallon, or 22 percent between 2004 and 2005.

The report also notes that natural gas prices directly affect the cost of a variety of construction plastics that use natural gas as a feedstock, pointing to a recent increase in the price for polyvinyl chloride (PVC) pipe of 20 to 100 percent. Given supply interruptions from the 2005 Gulf Coast hurricanes, coupled with an explosion at a key plastics factory in Texas and the potential for weather-related demand increases for natural gas, AGC indicated that other hydrocarbon-based products such as insulation, roofing materials, and membranes will likely see a near-term price of increase of 20 to 50 percent.

The report does not delve into how construction businesses are coping with increased diesel fuel and natural gas costs (nor price uncertainty for other key inputs such as cement and concrete, steel, gypsum, and wood products).

<u>International Profit Associates' Small Business Research Board</u>

Early in 2006, the International Profit Associates' Small Business Research Board performed a survey of small businesses, with particular emphasis on the construction industry. The survey asked respondents what the single most important issue was for their small businesses. Twenty-five percent of Construction industry respondents cited the cost of materials as the most important issue; 10 percent of respondents in non-construction businesses cited these costs as most important. Only 3 percent of small construction businesses cited energy and fuel costs as the most important issue, while 16 percent of small non-construction businesses identified these costs as most important.

In a survey conducted in the second quarter of 2007, small businesses across all surveyed industries listed energy and fuel costs as the third most important issue of concern, while small Construction and Contracting industry firms listed these costs as the second most important issue (IPA, 2007).[5] Although not directly comparable, the results of these two surveys suggest a shift in attention to energy costs.

[5] Taxes were considered to be the most important issue by both groups of small business owners.

<u>National Federation of Independent Businesses</u>

In 2001, the National Federation of Independent Businesses (NFIB) conducted a poll of approximately 750 small businesses to determine how these firms adjust to price (including energy price) increases (NFIB, 2006). The survey results indicated the following with respect to actions taken in response to energy price increases in the first half of 2001:

- Three types of energy – gasoline, electricity, and natural gas – were responsible for nearly all concerns about energy prices, with most respondents identifying gasoline price increases as impacting their small businesses;
- The most prevalent way of offsetting increasing energy costs was reducing earnings; 76 percent of small business owners reported adjustment via lower earnings or profits; the second most frequently taken way of adjusting was energy conservation measures (57 percent); only 29 percent of owners indicated implementing price increases;
- Actions taken to adjust for cost increases were heavily influenced by the size of the increase and the amount of advance notice the owner had that a price increase was forthcoming; and
- About one quarter of respondents indicated that it is likely or highly likely that cost increases with no notice will force them to borrow to ease the adjustment to the price increase.

One shortcoming acknowledged by NFIB researchers was that the survey data did not indicate levels of baseline profitability. Therefore, they were unable to determine whether particular responses were more likely based on firm financial health.

National Association of Manufacturers

In a 2001 report, the National Association of Manufacturers (NAM) notes that small and medium-size manufacturers consumed about 38 percent of all energy used in manufacturing, but paid approximately 52 percent of the total cost of manufacturing energy (NAM, 2001).[6] These data suggest that smaller manufacturing firms face considerably higher energy prices than larger firms. The report also notes that the energy costs of small- and medium-sized manufacturers increased by $115 billion in 1999, or 1 percent of total U.S. gross domestic product.

A survey of NAM members indicated that a 58 percent increase in natural gas prices between 1999 and 2000 reduced profits by an average of 13 percent. However, some companies saw profits reduced by as much as 150 percent. More than half of the businesses surveyed asserted that an investment tax credit would provide a sufficient incentive for them to upgrade to more energy efficient boilers, the piece of equipment responsible for the greatest energy use in manufacturing plants.

C. SUMMARY OF STUDY METHODS AND DATA SOURCES

The author compiled energy data from federal government and other sources to characterize the impact of energy costs by industry sector, entity size, and fuel type.[7] Table 1 displays a summary of the energy expenditure data developed by major sector, including the level of industry sector detail and specific fuel types for which costs were developed. This table highlights the data limitations that constrain the ability to develop consistent expenditure data across all sectors.

[6] For this study, NAM defined small manufacturers as firms that employ 500 or fewer employees, and medium manufacturers as those employing between 500 and 2,000 employees.

[7] The data analysis may assist future researchers in understanding how energy cost increases affect small entities in specific industries; and it may help identify key industry sectors for focusing a survey to understand the actions that they have taken to address past energy price increases, and the challenges associated with potential future price increases.

Table 1. Summary of Small Entity Energy Expenditure Estimation

Sector	NAICS Code Level	Reflect Potential Price Differential Between Small and Large Entities?	Electricity/Fuel Types for which Estimates Developed	Comments
Agriculture	4-digit or 5-digit	Yes – by sales category: <$100k; $100k-$249,999; $250k-$499,999; $500k-$999,999; and $1+ million	Electricity; gasoline and gasohol; diesel fuel; natural gas; and "LP gas, fuel oil, kerosene, motor oil, grease, etc."	Energy expenditure data not available for NAICS codes: 1133 (logging); 1141 (fishing); 1142 (hunting and trapping); 1151 (support activities for crop production); 1152 (support activities for animal production); and 1153 (support activities for forestry)
Mining	3-digit	No	None, although data are available to estimate electricity expenditures	Assumes the same energy cost/total cost of supplies ratio for all size categories.
Construction	3-digit	No	Electricity; natural/manufactured gas; gasoline/diesel obtained from other establishments of company or purchased from other companies; purchased on-highway fuel; purchased off-highway fuel; and "all other fuels/lube" (above only available at NAICS code-level, not receipts size category-level)	Assumes the same energy cost/total cost of supplies ratio for all revenue size categories (and fuel type estimates assume same proportion of total energy cost from each fuel type for all size categories).
Electric Generation	NAICS 2211	Yes for all 223 public utilities and about one-third of private utility fuel records	10 fuel types, but only for private utilities	Estimates computed for each individual utility. Energy expenditure data not available for NAICS codes: 2212 (natural gas distribution) and 2213 (water sewage & other systems)
Manufacturing	3-digit	Yes – by employment size category: <50; 50-99; 100-249; 250-499; 500-999; and 1000+	Depends on NAICS code–may include: electricity; residual fuel oil; distillate fuel oil; natural gas; liquefied petroleum gas and natural gas liquids; coal; and coke & breeze.	Regional data were available in some, but not all, cases; only national data are reported.
Commercial	3-digit	Yes – by employment size category: <5; 5-9; 10-19; 20-49; 50-99; 100+	Electricity, natural gas, and fuel oil	No available information on commercial sector motor fuel expenditures. Energy expenditure data are not available for all commercial sector industries.

1. Energy Expenditure Data

Detailed economic information is available every five years from the Economic Census conducted by the U.S. Department of Commerce's Bureau of the Census. Economic Census publications provide useful information characterizing energy expenditures for most economic sectors (e.g., the 2002 Census publication Business Expenses Survey reports the total cost of materials, and the cost of electricity and fuels for many industry sectors). The last Economic Census was conducted for 2002 – a year that did not experience unusually high or low energy prices. Therefore, 2002 Economic Census data should be representative of long-run energy costs.

For three sectors, detailed energy data were available from the Department of Energy's Energy Information Administration (EIA):

- **Electric Generation –** 2002 data from Form EIA-861 ("Annual Electric Power Industry Report") database; Schedule 7 ("Electric Operation and Maintenance Costs") of Form EIA-412 ("Annual Electric Industry Financial Report") database; Form EIA-906 ("Power Plant Report) database; Form EIA-423 ("Monthly Cost and Quality of Fuels for Electric Plants Report") database; and the report *Cost and Quality of Fuels for Electric Plants, 2002 and 2003*;

- **Manufacturing –** 2002 Manufacturing Energy Consumption Survey (MECS); and

- **Commercial –** 2003 Commercial Buildings Energy Consumption Survey (CBECS).

In addition to the above EIA sources and the Economic Census publications, the author also compiled agriculture sector energy expenditure data from the U.S. Department of Agriculture (USDA)'s 2005, 2002, and 1997 Census of Agriculture and the USDA's Farm and Operator Households database.

To evaluate the relative impact of energy costs on small entities in these sectors, we used the above data sources to develop energy costs for specific establishment size categories.[8] Table 2 reports all of the size categories for which the author estimated energy expenditures, and the size categories that were aggregated to represent small entities in each major sector.
Appendix A provides further details on the data sources and procedures used to estimate energy expenditures by sector and size category.

2. Revenue Data

Guidance published by the U.S. Small Business Administration's Office of Advocacy suggests that costs as a percentage of total revenues is a metric for evaluating the burden of cost increases on small entities in relation to the burden for large entities (SBA, 2003). To facilitate calculation of energy cost-to-revenue percentages, the author compiled revenue data by size category that match the size categories for which energy expenditure data were developed. These revenue data were generally compiled from the appropriate sector publication of the 2002 Economic Census:

- Agriculture – 2002 Census of Agriculture;
- Mining – 2002 Census of Mining;
- Construction – 2002 Census of Construction; and
- Manufacturing – 2002 Census of Manufacturing.

[8] Because energy cost impacts are ultimately determined by firms rather than establishments, firm-level energy data were preferred. However, these data are not generally available.

Table 2. Energy Expenditure Estimate Size Categories

Sector	Unit of Measure	Size Categories	Small Size Category
Agriculture	Revenue per Farm	Less than $100,000 $100,000 to $249,999 $250,000 to $499,999 $500,000 to $999,999 $1 million or more	Farms with less than $500,000 in revenue
Mining	Employees per Establishment	0 to 4 5 to 9 10 to 19 20 to 49 50 to 99 100 to 249 250 to 499 500 to 999 1,000 to 2,499 2,500 or more	Establishments with less than 500 employees
Construction	Sales or Receipts per Establishment	Less than $25,000 $25,000 to $49,999 $50,000 to $99,999 $100,000 to $249,999 $250,000 to $499,999 $500,000 to $999,999 $1 million to $2,499,999 $2,500,000 to $4,999,999 $5 million to $9,999,999 $10 million or more	Establishments with sales or receipts less than $10 million
Electric Generation		Each individual utility	Utilities with net electric generation of 4 million megawatthours or less
Manufacturing	Employees per establishment	1 to 4 5 to 9 10 to 19 20 to 49 50 to 99 100 to 249 250 to 499 500 to 999 1,000 to 2,499 2,500 or more	Establishments with less than 500 employees
Commercial	Employees per establishment	1 to 4 5 to 9 10 to 19 20 to 49 50 to 99 100 or more	Establishments with less than 100 employees

For the commercial sector, revenue data were first compiled from Economic Census data available from the Bureau of the Census's AmericanFactFinder weblink.[9] In cases where revenue data were reported in the Bureau of Census's 2002 Business Expense Survey with different values than the Economic Census estimates, the author adjusted the Census values to match the Business Expense Survey. These adjustments were implemented to ensure consistency with the energy expenditure data compiled from the Business Expense Survey. (See Appendix A for details.) For the electric generation sector, the author compiled 2002 revenue data for each individual utility from EIA's *Annual Electricity Industry Financial Report,* based on the 2002 Form EIA-861 database.

3. Profit Data

The author compiled profitability data (pre-tax profits as a percentage of sales) by North American Industrial Classification System (NAICS) code and firm size from Risk Management Association's online version of *Annual Statement Studies* (RMA, 2007). These data assist in identifying sectors for which small entities' baseline profit margins are particularly slim, indicating the potential for relatively small energy price increases to negatively impact small firm health. Risk Management Association's firm size profitability data were available for the following sales ranges: $0 to $1 million; $1 million to $3 million; $3 million to $5 million; $5 million to $10 million; $10 million to $25 million; and more than $25 million. To develop NAICS code-level estimates of average profits as a percentage of sales for small and large firms, the author identified a representative small firm threshold for each major sector. Table 3 identifies this threshold, which was selected to most closely match SBA's small firm threshold.[10] Table 3 also repeats the small entity threshold used in compiling small establishment energy

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[9] AmericanFactFinder, which is located at http://factfinder.census.gov/, is a repository for Economic Census data, including revenue data that appear in the following publications covering the commercial sector: wholesale trade; retail trade; transportation and warehousing; information; finance and insurance; real estate and rental and leasing; professional, scientific, and technical services; management of companies and enterprises; administrative and support and waste management and remediation services; educational services; health care and social assistance; arts, entertainment, and recreation; accommodation and food services; and other services (except public administration).

[10] The SBA designates small business size standards at the 6-digit NAICS code level. Because revenue and energy expenditure data by size category were generally not available at this level of detail, the author identified a major sector-level firm size threshold reflecting the predominant industry size standard within each sector.

expenditure data as reported in Table 2 above. To estimate average small and large firm profitability within each NAICS code, the author weighted the pre-tax profit margins for each of the appropriate firm size categories by the *Annual Statement Studies* reported sales data for each size category.

Table 3. Comparison of Small Size Category Definitions

Sector	Predominant SBA Small Firm Size Threshold	Energy Expenditure Data Small Size Category	Profitability Data Small Size Category	Rationale for Selection of Small Firm Profitability Sales Category
Agriculture	$750,000 in revenue	Farms with less than $500,000 in revenue	Firms with less than $1 million in sales	Smallest size category available
Mining	500 employees	Establishments with less than 500 employees	Firms with less than $10 million in sales	Overall mining sector average revenues of $5.7 million for *establishments* with 500 or less employees
Construction	$13 million in revenue	Establishments with sales or receipts less than $10 million	Firms with less than $10 million in sales	$10 million is closest available category to SBA small firm threshold
Electric Generation	Net electric generation of 4 million megawatthours	Utilities with net electric generation of 4 million megawatthours or less	(no profitability data available)	
Manufacturing	500 employees	Establishments with less than 500 employees	Firms with less than $25 million in sales	$25+ million is largest available size category ($92.0 million is average value of shipments for manufacturing sector *establishments* with 250-499 employees)
Commercial	100 employees	Establishments with less than 100 employees	Firms with less than $10 million in sales	Approximately $9.7 million in sales for commercial sector *establishments* with 50 to 99 employees

D. RESULTS

The following two sections present the results of the analyses performed in this study—the first section characterizes energy cost impacts by industry sector, entity size, and fuel type. This is followed by a section that identifies manufacturing, commercial, and electric generation sector energy price differentials by establishment size category and fuel type.

1. Energy Expenditure Impacts

Table 4 presents total estimated 2002 small entity energy expenditures by major sector. This table indicates that more than 85 percent of total small entity energy expenditures occurred in the commercial and manufacturing sectors.

Table 4. Summary of 2002 Small Entity Energy Expenditures by Major Sector

Major Sector	NAICS Codes	Estimated Small Entity Energy Expenditures ($million)	Share of Total Small Entity Energy Expenditures (percent)
Commercial	423 thru 813	52,343	41.0
Manufacturing	311 thru 339	45,629	35.7
Construction	236 thru 238	14,011	11.0
Agriculture	111 thru 112	7,876	6.2
Mining	211 thru 213	5,443	4.3
Electricity Generation	2211	2,482	1.9
SUBTOTAL		**127,784**	100

Tables 5 through 10 present the following information for each major sector NAICS code for which energy expenditure data were available:

- Total small entity energy expenditures (in millions of dollars);
- Small entity energy expenditures as a percentage of small entity revenue;[11]
- The ratio of small entity energy expenditures as a percentage of small entity revenue to large entity energy expenditures as a percentage of large entity revenue;
- Small entity pre-tax profit margin; and
- The ratio of the small entity pre-tax profit margin to the large entity pre-tax profit margin.

Measures 1 and 2 provide direct information for evaluating the significance of energy costs to small entities in each NAICS code; higher values indicating greater importance within that industry. Measure 3 evaluates whether energy costs are of greater significance to small entities than large entities within that NAICS codes; larger values suggest that energy costs disproportionately impact small entities in that sector (i.e., for a given dollar of revenue, small entities spent more on energy than large entities). Smaller values for measure 4 indicate that small entities have lower profit margins, indicating the potential for relatively small energy price increases to negatively impact small firm health. The final measure (ratio of the small entity pre-tax profit margin to the large entity pre-tax profit margin) shows whether small entity baseline profitability is higher or lower than that of large entities. Values below 1.0 suggest that smaller entities have less ability than larger entities to absorb energy price increases via reductions in profits.

Tables 11 through 13 identify the sectors in which energy costs are of greatest concern to small entities. Table 11 lists the ten sectors with the highest total small entity energy costs; Table 12 lists the ten sectors in which small entities have the highest ratios of energy expenditures to revenue; and Table 13 lists the ten sectors in which energy costs, measured as a percentage of sector revenue, are of greater significance to small entities than large entities.

[11] For the construction sector, percentages are relative to total value of business done; for the manufacturing sector, percentages are relative to value of shipments; for the commercial sector, percentages are relative to sales.

Table 14 identifies the five sectors in which small entities appear to be most vulnerable to energy price increases. These sectors were chosen because they appear the most often in Tables 11-13; they have low small entity profit margins; and the small entities in these sectors generally have lower profitability levels than the sector's large entities (suggesting that small entities in these sectors have a less ability to absorb energy price increases than large entities).

For the five sectors identified in Table 14, Table 15 reports the percentage of 2002 total small entity energy expenditures by type of energy.[12] This table clearly indicates that the importance of each energy type is varies by sector. For example, electricity accounted for more than 92 percent of 2002 small entity energy expenditures in the general merchandise stores sector, but only 3 percent of total energy expenditures in the truck transportation sector. Similarly, natural gas was responsible for more than one-quarter of the small entity energy expenditures in the durable goods merchant wholesalers sector, but less than 1 percent of total energy expenditures in the truck transportation sector. As expected, the two transportation-related priority sectors identified in Table 15 (truck transportation and couriers and messengers) have the greatest percentage of total expenditures from motor fuels (96 percent and 83 percent, respectively). Of the priority sectors, the dairy cattle and milk production sector is unique in that electricity and motor fuels are responsible for similar percentages of total energy expenditures.

[12] Because size category-specific motor fuel expenditure data were not available for the couriers and messengers and truck transportation sectors, Table 15 reports overall sector percentages for these sectors rather than small entity percentages

Table 5. Summary of Small Entity Energy Expenditures in the Agriculture Sector

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Revenue		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
1111 – Oilseed and Grain Farming	2,175	8.0	2.6	13.8	3.1
1112 – Vegetable and Melon Farming	261	15.0	0.6	N/A	N/A
1113 – Fruit and Tree Nut Farming	260	6.6	1.0	4.0	0.5
1114 – Greenhouse, Nursery, & Floriculture Production	293	9.9	0.7	4.6	2.9
11191 – Tobacco Farming	91	8.3	1.1	N/A	N/A
11192 – Cotton Farming	218	13.5	0.6	N/A	N/A
11193 – Sugarcane Farming	760	14.4	0.7	N/A	N/A
11194 – Hay Farming	760	14.4	0.7	N/A	N/A
11199 – All Other Crop Farming	760	14.4	0.7	7.8	2.2
11211 – Beef Cattle Ranching & Farming, including Feedlots	2,077	12.7	0.2	10.0	4.2
11212 – Dairy Cattle and Milk Production	632	7.2	0.8	1.7	0.2
1122 – Hog and Pig Farming	196	7.8	0.4	11.5	0.8
1123 – Poultry and Egg Production	463	10.5	0.6	N/A	N/A
1124 – Sheep and Goat Farming	53	17.3	0.6	N/A	N/A
1125 – Animal Aquaculture	395	20.8	1.3	N/A	N/A
1129 – Other Animal Production	395	20.8	1.3	N/A	N/A

Notes: N/A - not available.
Shaded cells indicate that available data for these NAICS codes were reported as a combined total of individual NAICS codes.

Table 6. Summary of Small Entity Energy Expenditures in the Mining Sector

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Revenue		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
211 – Oil and Gas Extraction	2,350	2.4	1.3	24.0	1.1
212 – Mining, Except Oil and Gas	2,641	6.7	0.9	7.5	1.0
213 – Support Activities for Mining	452	2.7	1.0	16.1	1.4

Table 7. Summary of Small Entity Energy Expenditures in the Electric Generation Sector

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Revenue		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
2211 - Electric Power Generation, Transmission & Distribution	2,482	7.3	0.7	N/A	N/A
2211 Public Utilities	1,766	10.0	0.7	N/A	N/A
2211 Private Utilities	716	4.4	0.4	N/A	N/A

Notes: N/A - not available [however, electric d*istribution* sector (NAICS 221122) data generally indicate higher profit margins for smaller-sized firms].

Table 8. Summary of Small Entity Energy Expenditures in the Construction Sector

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Total Value of Business Done		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
236 – Construction of Buildings	3,190	1.6	1.6	4.7	0.9
237 – Heavy and Civil Engineering Construction	1,985	3.3	1.0	9.4	1.4
238 – Specialty Trade Contractors	8,836	2.8	1.1	4.0	1.0

Table 9. Summary of Small Entity Energy Expenditures in the Manufacturing Sector

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Value of Shipments		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
311 - Food Manufacturing	5,744	1.9	2.4	4.1	1.4
312 - Beverage & Tobacco Product Mfg	511	N/A	N/A	8.0	1.2
313 - Textile Mills	1,089	3.3	0.9	1.7	1.2
314 - Textile Product Mills	247	1.0	0.6	3.0	0.8
315 - Apparel Mfg	284	0.8	1.6	2.1	0.4
316 - Leather & Allied Product Mfg	65	1.2	2.4	5.0	1.8
321 - Wood Product Mfg	1,965	2.4	0.9	3.7	0.8
322 - Paper Mfg	N/A	N/A	N/A	2.9	1.0
323 - Printing & Related Support Activities	1,012	1.2	0.8	2.6	0.7
324 - Petroleum & Coal Products Mfg	2,204	2.4	0.8	3.1	0.6
325 - Chemical Mfg	19,439	7.6	1.2	4.8	0.9
326 - Plastics & Rubber Products Mfg	N/A	N/A	N/A	3.1	0.9
327 - Nonmetallic Mineral Product Mfg	4,504	5.2	1.2	4.5	0.7
331 - Primary Metal Mfg	2,976	3.8	0.3	5.2	1.0
332 - Fabricated Metal Product Mfg	N/A	N/A	N/A	4.6	0.9
333 - Machinery Mfg	1,414	0.9	1.5	4.3	0.8
334 - Computer & Electronic Product Mfg	1,583	1.2	2.3	4.8	1.0
335 - Electrical Equipment, Appliance, & Component Mfg	777	1.2	1.9	5.7	1.2
336 - Transportation Equipment Mfg	1,203	0.9	1.9	3.5	0.9
337 - Furniture & Related Product Mfg	437	0.8	0.8	2.7	0.9
339 - Miscellaneous Mfg	687	0.8	1.4	4.5	0.9

Notes: N/A - not available.

Table 10. Summary of Small Entity Energy Expenditures in the Commercial Sector

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
423 - Durable Goods Merchant Wholesalers	2,446	0.3	1.9	0.1	0.03
424 - Nondurable Goods Merchant Wholesalers	2,487	0.3	2.8	1.6	0.8
441 - Motor Vehicle & Parts Dealers	1,564	0.3	3.2	1.3	0.9
442 - Furniture & Home Furnishings Stores	656	0.8	0.7	2.1	1.0
443 - Electronics & Appliance Stores	342	0.6	2.5	2.7	0.9
444 - Building Material & Garden Equipment & Supplies Dealers	1,451	0.9	4.8	2.3	0.6
445 - Food & Beverage Stores	5,578	2.1	53.3	1.8	1.1
446 - Health & Personal Care Stores	N/A	N/A	N/A	3.3	1.6
447 - Gasoline Stations	1,354	0.5	1.2	N/A	0.9
448 - Clothing & Clothing Accessories Stores	N/A	N/A	N/A	2.8	0.7
451 - Sporting Goods, Hobby, Book, & Music Stores	551	0.8	0.4	1.0	0.4
452 - General Merchandise Stores	2,514	4.1	42.5	1.3	0.4
453 - Miscellaneous Store Retailers	742	0.7	0.1	3.2	0.9
454 - Nonstore Retailers	346	0.4	3.0	1.9	0.9
484 - Truck Transportation	15,231	12.3	11.9	4.3	1.2
492 - Couriers & Messengers	1,704	10.8	56.9	2.0	0.9
493 - Warehousing & Storage	122	1.0	1.5	9.2	1.6
511 - Publishing Industries (Except Internet)	61	0.1	7.8	4.7	0.8
512 - Motion Picture & Sound Recording Industries	32	N/A	N/A	4.8	1.0
532 - Rental & Leasing Services	88	0.1	2.5	11.7	1.7
541 - Professional, Scientific, & Technical Services	304	0.1	1.6	7.9	0.7
561 - Administrative & Support Services	377	0.2	2.7	5.6	1.2
562 - Waste management & Remediation Services	116	0.3	2.0	5.1	1.1

Table 10 (continued)

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
621 - Ambulatory Health Care Services	301	0.1	1.0	9.4	1.5
622 - Hospitals	160	4.7	21.3	9.2	2.4
623 - Nursing & Residential Care Facilities	409	0.8	3.7	4.3	1.2
624 - Social Assistance	181	0.2	1.0	3.9	1.9
711 - Performing Arts, Spectator Sports, & Related Industries	49	0.1	3.7	1.9	0.7
712 - Museums, Historical Sites, & Similar Institutions	34	0.8	3.9	0.7	0.1
713 - Amusement, Gambling, & Recreation Industries	273	0.6	2.1	2.8	0.2
721 - Accommodation	3,260	7.1	4.6	8.1	0.7
722 - Food Services & Drinking Places	8,414	2.8	4.9	3.7	1.2
811 - Repair & Maintenance	297	0.2	0.5	3.6	0.8
812 - Personal & Laundry Services	513	0.6	0.9	5.1	1.2
813 - Religious/Grantmaking/Civic/Professional & Similar Org	386	0.4	9.1	6.8	1.1

Notes: N/A - not available

Table 11. Top 10 Sectors with the Highest Small Entity Energy Expenditures

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
325 – Chemical Manufacturing	19,439	7.6	1.2	4.8	0.9
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0
238 – Specialty Trade Contractors	8,836	2.8	1.1	4.0	1.0
722 – Food Services & Drinking Places	8,414	2.8	4.9	3.7	1.2
311 – Food Manufacturing	5,744	1.9	2.4	4.1	1.4
445 – Food & Beverage Stores	5,578	2.1	53.3	1.8	1.1
327 – Nonmetallic Mineral Product Manufacturing	4,504	5.2	1.2	4.5	0.7
721 – Accommodation	3,260	7.1	4.6	7.2	0.6
236 – Construction of Buildings	3,190	1.6	1.6	4.7	0.9
331 – Primary Metal Manufacturing	2,976	3.8	0.3	5.2	1.0

Table 12. Top 10 Sectors with the Highest Small Entity Energy Expenditures as a Percentage of Sales

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
1125 & 1129 – Animal Aquaculture & Other Animal Production	395	20.8	1.3	N/A	N/A
1124 – Sheep and Goat Farming	53	17.3	0.6	N/A	N/A
1112 – Vegetable and Melon Farming	261	15.0	0.6	N/A	N/A
11193, 1194, & 1199 – Sugarcane, Hay, & All Other Crop Farming	760	14.4	0.7	N/A	N/A
11192 – Cotton Farming	218	13.5	0.6	N/A	N/A
11211 – Beef Cattle Ranching and Farming, including Feedlots	2,077	12.7	0.2	N/A	N/A
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0
492 – Couriers and Messengers	1,704	10.8	56.9	2.3	1.0
1123 – Poultry and Egg Production	463	10.5	0.6	N/A	N/A
1114 – Greenhouse, Nursery, and Floriculture Production	293	9.9	0.7	4.6	2.9

Notes: N/A – not available.

Table 13. Top 10 Sectors with the Highest Ratio of Small Entity to Large Entity Energy Expenditures to Sales

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
492 – Couriers and Messengers	1,704	10.8	56.9	2.3	1.0
445 – Food & Beverage Stores	5,578	2.1	53.3	1.8	1.1
452 – General Merchandise Stores	2,514	4.1	42.5	1.3	0.4
622 – Hospitals	160	4.7	21.3	7.4	2.0
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0
813 – Religious/Grantmaking/Civic/ Professional & Similar Org.	386	0.4	9.1	6.6	1.1
511 – Publishing Industries (except Internet)	61	0.1	7.8	5.2	0.9
722 – Food Services and Drinking Places	8,414	2.8	4.9	3.7	1.2
444 – Building Material & Garden Equipment & Supplies Dealers	1,451	0.9	4.8	2.2	0.5
721 – Accommodation	3,260	7.1	4.6	7.2	0.6

Table 14. Top 5 Sectors in Which Small Entities Are Most Vulnerable to Energy Cost Impacts

NAICS Code	Small Entity Energy Expenditures (million $)	Energy Expenditures as % of Sales		Pre-Tax Profit Margin	
		Small Entity (%)	Small Entity/ Large Entity	Small Entity (%)	Small Entity/ Large Entity
492 – Couriers and Messengers	1,704	10.8	56.9	2.3	1.0
11212 – Dairy Cattle and Milk Production	632	7.2	0.8	1.7	0.2
452 – General Merchandise Stores	2,514	4.1	42.5	1.3	0.4
423 – Durable Goods Merchant Wholesalers	2,446	0.3	1.9	0.3	0.08
484 – Truck Transportation	15,231	12.3	11.9	3.7	1.0

Table 15. Total Energy Expenditure Percentages by Fuel Type for Most Vulnerable Sectors

NAICS Code	Small Entity Energy Expenditures (million $)	Percentage of Total Energy Expenditures					
					Non-Motor Fuels		
		Electricity	All Fuels	Motor Fuels	Total	Natural Gas	Other
492 – Couriers and Messengers*	1,704	13.9	86.1	83.3	2.8	2.5	0.4
11212 – Dairy Cattle and Milk Production^	632	43.9	56.1	45.8	10.3	1.3	9.1
452 – General Merchandise Stores	2,514	92.2	7.8	N/A	7.8	6.7	1.1
423 – Durable Goods Merchant Wholesalers	2,446	72.4	27.6	N/A	27.6	25.6	2.0
484 – Truck Transportation*	15,231	3.1	96.9	96.4	0.5	0.5	0.1

* - due to lack of motor fuel expenditure data by size category, NAICS code 484 and 492 data are estimates for the total sector rather than for small entities.
^ - separate motor fuel expenditure estimates are available for diesel (17.2) and gasoline/gasohol (28.6).
N/A - not available.

The study results indicate that the manufacturing and commercial sectors have the greatest potential for small entity energy price impacts. *When measured on the basis of expenditures per value of industry shipments, small entities spent considerably more on energy in 2002 than larger entities in a majority (10 of 17) of the manufacturing sector industries with available data*. The data reveal three manufacturing sector industries as having energy costs per dollar of output that are more than double those incurred by larger entities: food manufacturing; leather and allied products manufacturing; and computer and electronic product manufacturing. Profitability data further indicate the challenges that small entities face from increases in energy and other production input prices: *13 of the 19 manufacturing sector industries with available data have lower baseline profit margins among small entities than large ones*.

Similarly, small entities have higher energy expenditures per dollar of sales than larger entities in 26 of the 31 commercial sector industries studied. The median commercial sector industry has a small entity energy cost per sales ratio that is 2.7 times the ratio of large entities. General merchandise stores; food and beverage stores; and couriers and messengers are three of the commercial sector industries where small entity energy costs per sales ratios are highest relative to their large entity counterparts. The couriers and messengers industry is particularly noteworthy in that small entity energy expenditures amount to more than 10 percent of total small entity sales. *In addition, data indicate that a majority of commercial sector industries have smaller small entity baseline profit margins than their larger industry counterparts.*

Although the results for other economic sectors (agriculture, mining, construction, electric generation) show a more equal distribution of small and large entity baseline profit margins and energy expenditures per unit of output, all but the electric generation sector have one or more individual industries for which available data suggest that energy price increases are expected to result in greater impacts on small entities than large entities

2. Energy Price Disparities

As noted earlier in the Section B.1 discussion, it appears that the Nguyen and Lee (2002) analysis did not evaluate the possibility that smaller manufacturing sector establishments may face higher energy prices than their larger counterparts. This section provides energy price information by entity size as compiled in this study for the manufacturing, commercial, and electric generation sectors.

Table 16 displays 2002 energy price information by fuel type and employment size category from the 2002 Manufacturing Energy Sector Consumption Survey (MECS). Table 17 converts this information into ratios representing how each employment size category's energy price relates to the overall sector average energy price. This table clearly shows small manufacturing establishments faced higher than average prices in 2002 for electricity, distillate fuel oil, and natural gas. (Coal prices also appear to be higher than average for most of the smaller establishment size categories.)

Table 16. Energy Prices in the Manufacturing Sector by Fuel Type and Establishment Size Category, 2002

Employment Size Category	Dollars per Million Btu					
	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG and NGL	Coal
Under 50	19.11	3.64	7.38	4.63	5.19	2.15
50-99	17.76	3.62	7.07	4.13	7.07	N/A
100-249	15.51	4.05	6.48	4.1	5.16	1.92
250-499	13.08	3.91	6.43	3.83	6.36	1.77
500-999	12.35	3.51	5.43	3.78	5.75	2.04
1,000 or more	11.72	3.89	5.58	3.6	5.96	1.89
Sector average	14.13	3.78	6.56	3.9	5.84	1.87

Source: E.H. Pechan based on Manufacturing Energy Sector Consumption Survey.
N/A - not available.
LPG and NGL = liquefied petroleum gas and natural gas liquids

Table 17. Comparison of Size Category Price and Average Sector Price in the Manufacturing Sector, 2002

Employment Size Category	Ratio of Employment Size Category Price to Average Sector Price					
	Electricity	Residual Fuel Oil	Distillate Fuel Oil	Natural Gas	LPG and NGL	Coal
Under 50	1.35	0.96	1.13	1.19	0.89	1.15
50-99	1.26	0.96	1.08	1.06	1.21	N/A
100-249	1.10	1.07	0.99	1.05	0.88	1.03
250-499	0.93	1.03	0.98	0.98	1.09	0.95
500-999	0.87	0.93	0.83	0.97	0.98	1.09
1000 and Over	0.83	1.03	0.85	0.92	1.02	1.01

Source: E.H. Pechan based on Manufacturing Energy Sector Consumption Survey.
Notes: N/A - not available.
LPG and NGL = liquefied petroleum gas and natural gas liquids

Table 18 presents energy prices by fuel type and employment size category as computed from 2003 CBECS microdata.[13] Table 19 displays this information as ratios of each employment size category's average price to the overall commercial sector average price. This table indicates that

[13] See the Commercial Buildings Energy Consumption Survey (CBECS) microdata section of Appendix A for discussion of this data set.

smaller commercial sector entities face higher electricity and natural gas prices than their larger counterparts, with electricity prices up to 30 percent higher for the smallest entities relative to the prices paid by the largest entities.

Table 18. Energy Prices by Fuel Type and Establishment Size Category in the Commercial Sector, 2003

Employment Size Category	Dollars per Million Btu		
	Electricity	Fuel Oil	Natural Gas
0 to 4	32.72	9.94	10.32
5 to 9	30.00	9.21	11.06
10 to 19	27.88	8.79	9.00
20 to 49	26.78	9.79	8.84
50 to 99	24.53	6.57	8.47
100 or more	23.58	9.80	8.29
Sector average	30.98	9.71	10.04

Source: E.H. Pechan based on the Commercial Buildings Energy Consumption Survey.

Table 19. Comparison of Size Category Price and Average Sector Price in the Commercial Sector, 2003

Employment Size Category	Ratio of Employment Size Category Price to Average Sector Price		
	Electricity	Fuel Oil	Natural Gas
0 to 4	1.06	1.02	1.03
5 to 9	0.97	0.95	1.10
10 to 19	0.90	0.91	0.90
20 to 49	0.86	1.01	0.88
50 to 99	0.79	0.99	0.84
100 or more	0.76	1.01	0.83

Source: E.H. Pechan based on the Commercial Buildings Energy Consumption Survey.

Tables 20 and 21 present 2002 energy price information for small and large electric generation sector facilities as developed from EIA data sources.[14] These tables indicate that small utilities in this sector did not generally face energy price disadvantages. (Although a small price disadvantage existed for coal purchases, average natural gas prices were slightly lower for small utilities.)

Table 20. Energy Prices by Fuel Type and Size Category in the Electric Generation Sector, 2002

Size Category	Cents per Million Btu			
	Bituminous Coal	Subbituminous Coal	Distillate Fuel Oil	Natural Gas
Small	167.6	119.0	544.3	345.3
Large	146.0	110.6	537.9	384.4
Sector average	146.3	110.7	538.0	383.7

Notes: Small entities are defined as those that generate no more than 4 million megawatt hours of electricity.
Source: E.H. Pechan based on the U.S. Department of Energy, Energy Information Administration.

Table 21. Comparison of Size Category Price and Average Sector Price in the Electric Generation Sector, 2002

Size Category	Ratio of Size Category Price to Average Sector Price			
	Bituminous Coal	Subbituminous Coal	Distillate Fuel Oil	Natural Gas
Small	1.15	1.07	1.01	0.90
Large	1.00	1.00	1.00	1.00

Notes: Small entities are defined as those that generate no more than 4 million megawatt hours of electricity.
Source: E.H. Pechan based on the U.S. Department of Energy, Energy Information Administration.

[14] See the electric generation (NAICS code 2211) section of Appendix A for a discussion of the development of utility energy prices.

E. SUMMARY/RECOMMENDATIONS FOR FUTURE RESEARCH

Profit margins will be reduced or even eliminated when firms are forced to absorb energy price increases. Reduced profits generally result in cash flow impacts, which may in turn affect firms' access to capital for investments. This is likely to be a particular concern for small firms which have more difficulty in obtaining necessary capital.

This study identifies the industries and energy types for which energy price increases are likely to result in the largest small entity impacts. It finds that small energy price impacts are expected to be most significant in the manufacturing and commercial sectors; the data also indicate that small entities pay substantially higher prices for the major types of energy used in these sectors.

A suggested area for future research is a survey of representative firms in the sectors that have been identified as most severely affected by potential energy price increases. Such a study would seek to determine how firms coped with past energy price increases, what challenges they see ahead from potential future price increases, and how they would plan to respond to various hypothetical percentage increases in energy prices. Such information would provide a better understanding of the unique challenges that small businesses face during times of rising energy prices.

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[15] See the Appendix for the references used to compile this study's energy expenditure estimates.

APPENDIX. ENERGY EXPENDITURE ESTIMATION PROCEDURES

This appendix provides a detailed discussion of the data sources and methods used to characterize energy costs by NAICS code. This discussion is organized by major economic sector.

Agriculture (NAICS codes 111 - 112)

Unlike the manufacturing and commercial sectors, which tend to use number of employees to determine small business status, agricultural NAICS codes generally use revenue data. Therefore, the author computed energy data by revenue size category rather than employee size category.

Steps

(1) Using data from Table 57 (Summary of Combined Government Payments and Market Value of Agricultural Products Sold: 2002) from the 2002 Census of Agriculture, the author computed the proportion of sales by individual revenue category for each reported agricultural sector (e.g., “grains, oilseeds, dry beans, and dry peas” for the $1 million+ revenue category = $5.2 billion / $39.9 billion = 0.1304). Before calculating proportions for the “horses, ponies, mules, burros, and donkeys” sector, the author first added the 2005 total sales values for animal aquaculture from the 2005 Census of Agriculture. (The 2002 Census did not report these data.) This was necessary because the next step requires linking the 2002 Census of Agriculture Table 57 data to Table 59 NAICS code revenue data, and the Table 59 data is reported for the sum of NAICS code 1129 (horses, ponies, mules, burros, and donkeys) and NAICS code 1125 (animal aquaculture) rather than for each individual NAICS code.

(2) The proportions from step 1 were applied to the total revenue estimates by NAICS code found in Table 59 of the 2002 Census of Agriculture. Step 2 results in revenue estimates by agricultural NAICS code for each of 11 revenue size categories.

(3) Compiled NAICS code-level expenditure data representing “total farm production expenses” and “gasoline, fuels, and oils” from Table 59 of the 2002 Census of Agriculture.

(4) Compiled the following data by each of 12 reported farm production specialties (e.g., general cash grains) and economic class ($1 million or greater) from the U.S. Department of Agriculture (USDA)’s “Farm & Operator Households: Structure & Finance,” (downloaded from http://www.ers.usda.gov/Data/ARMS/app/Farm.aspx), which is a compilation of data obtained from the Agricultural Resource Management Survey (ARMS): (a) number of farms; (b) gross cash income ($); (c) total cash expenses ($); (d) utilities ($); and (e) fuels and oils ($). the income and expenditure values are reported on a per farm basis.

(5) Using the data compiled in step 4, calculated production specialty/economic class totals by multiplying each per farm income/expenditure value by the applicable number of farms (a).

(6) Summed the income and expenditure category value totals computed in step 5 across economic class to yield income/expense category totals by production specialty.

(7) Where necessary, the author next summed the production specialty-level income and expenditure category estimates computed in step 6 to the Census of Agriculture–reported NAICS code level.

(8) Computed the proportion of total fuels and oils expenditures in each economic class (e.g., 1 million or greater) as computed in step 5 to total fuels and oils expenditures as computed in step 6. For example, assuming that total fuels and oils expenditures are $100 million for the "tobacco, cotton, peanuts" production specialty, and that expenditures from the $500,000 to $999,999 economic class for this specialty are $23 million, then $23 million/$100 million = 0.23 would be the proportion for the $500,000 to $999,999 economic class for the "tobacco, cotton, peanuts" production specialty.

(9) Computed similar economic class proportions to those in step 8 using the "total cash expenses" data computed in step 5.

(10) Applied the proportions computed in step 8 to the "gasoline, fuels, and oils" expenditure totals by NAICS compiled in step 3 to yield estimated expenditures for fuels and oils by NAICS and each of five economic classes. Also, applied the proportions computed in step 9 to the "total farm production expenses" totals by NAICS code as computed in step 3. This yielded estimates for total farm expenses by each of 70 Agricultural Census category/economic class combinations (14 Census categories x 5 economic classes = 70 combinations).

(11) Using the data from step 7, for each Census category/economic class combination, computed the proportion of "total cash expenses" that are "utilities" expenses. This step yielded five economic class proportions for each of the fourteen Census of Agriculture categories.

(12) Applied the proportions from step 11 to the "total farm production expenses" by Census category/economic class combination as computed in step 10 to yield estimates of "utilities" expenditures by Census category/economic class combination.

(13) Summed the NAICS code-level revenue estimates for each of eleven revenue size categories computed in step 2 to match the five economic classes ARMS data first described in step 4.

(14) Computed the following percentages for each Agricultural Census category and economic class combination: (a) total farm production expenses as a percentage of total

revenue; (b) "gasoline, fuels, and oils" expenditures as a percentage of total revenue; and (c) "utilities" expenditures as a percentage of total revenue. Also, prepared the following additional values: total electricity expenditures and the proportion of fuels/oils expenditures by type of fuel/oil.

In addition, the author estimated electricity expenditures by NAICS and economic size class using the following steps:

(1) Compiled the following data for each Agricultural sector NAICS code from the 1997 Census of Agriculture (1997 Census data were used because 2002 Census did not report the necessary data): (a) electricity expenditures ($1,000s); and (b) petroleum products expenditures ($1,000s).

(2) Computed the ratio of electricity expenditures/petroleum product expenditures for each NAICS code.

(3) Multiplied the ratios computed in step 2 by the gas, fuels, and oils expenditures values by NAICS code that were compiled earlier from the 2002 Census of Agriculture. This step yields 2002 estimates of electricity expenditures by NAICS code.

(4) Computed proportions by economic size class from the "utilities" expenditure values that were previously compiled in steps 4 through 6 of the earlier agricultural sector instructions described above.

(5) Multiplied the 2002 electricity expenditure estimates by NAICS code from step 3 by the utilities expenditure proportions from step 4 to yield estimates of electricity expenditures by economic class.

Furthermore, the author estimated fuels/oils expenditures by type of fuel/oil using the following steps:

(1) From the 1997 Census of Agriculture, compiled NAICS-level expenditures for each of the petroleum product subcategories -- i.e.: (a) gasoline and gasohol; (b) diesel fuel; (c) natural gas; and (d) LP gas, fuel oil, kerosene, motor oil, grease, etc. and computed the proportion of total expenditures by subcategory by NAICS code.

(2) For each NAICS code, multiplied the step 1 proportions by the total petroleum products expenditures compiled in step 1 of the electricity expenditures calculation steps.

Mining (NAICS codes 211 - 213)

For 3-digit NAICS code in the mining sector (211, 212, 213), the author:

(1) Compiled the following values by employment size category from the 2002 Census of Mining: (a) total shipments & receipts for services, and (b) total cost of supplies.

(2) Compiled the following values from the 2002 Census of Mining: (a) total cost of supplies, (b) purchased fuels consumed, and (c) purchased electricity. Summed the purchased fuels and purchased electricity values to represent “total energy costs.”

(3) Computed the proportion of total cost of supplies that are total energy costs.

(4) Multiplied the proportions from step 3 by the cost of supplies values by employment size category as compiled from step 1. The result is estimated total energy cost by 3-digit NAICS code and employment size category.

(5) Computed the ratios of total energy cost (step 4) to total shipments & receipts for services (from step 1) for each NAICS code/employment size category.

Construction (NAICS codes 236 - 238)

For 3–digit NAICS codes in the Construction sector (236, 237, 238):

(1) Compiled the following values by receipts size category from the 2002 Census of Construction: (a) value of business done, and (b) cost of materials, components, supplies, and fuels.

(2) Compiled the following values by NAICS code from the 2002 Census of Construction: (a) cost of materials, components, and supplies, (b) total cost of power/fuels/lube (this entry does not include cost of on-highway or off-highway fuel), (c) on-highway fuel, and (d) off-highway fuel. values for (a) and (b) were summed together to yield values that match the step 1 receipts size category values reported as "cost of materials, components, supplies, and fuels."

(3) Using the data from step 2, computed the proportion of total cost of power/fuels/lube to total cost of materials, components, supplies and fuels for each NAICS code.

(4) Multiplied the proportions from step 3 by the cost of materials, components, supplies, and fuels values by employment size category as compiled from step 1. This step estimates initial total energy cost (excluding on- and off-highway fuel) by 3-digit NAICS code and receipts size category.

(5) Summed total cost of power/fuels/lube with on-highway fuel and off-highway fuel expenditures from data compiled in step 2, and computed the ratio of total cost of power/fuels/lube to the sum of these three values (hereafter referred to as final total energy cost) for each NAICS code.

(6) Multiplied the ratios from step 5 by the initial total energy cost (excluding on- and off-highway fuel) by NAICS code and receipts size category computed in step 4 to yield final total energy cost by NAICS code and receipts size category.

(7) Computed the ratios of final total energy cost (from step 6) to total value of business done from step 1 for each NAICS code/receipts size category.

(8) Compiled available detailed energy expenditure data from the 2002 Census of Construction by NAICS code, and computed the proportion of final total energy cost by NAICS code for the following (note that data are not available to identify potential energy cost differences by receipts size category): purchased electricity; natural/manufactured gas; gasoline/diesel from other establishments/companies; on-highway fuel; and off-highway fuel.

Electric Generation (NAICS code 2211)

The author computed fuel cost estimates for each individual utility with net electricity generation greater than zero. For public utilities, reflects municipalities, political subdivisions, States, and Federal entities engaged in the generation of electricity that had at least 150,000 megawatthours (MWh) of sales to ultimate consumers and/or at least 150,000 MWh of sales for resale for each of two years prior to 2002. For private utilities, reflects all power plants with a generating capacity of at least one megawatt.

Public and Private Utilities

For utilities with net generation values >0, compiled utility ownership, net generation, and total revenues for 2002 from the Energy Information Administration's Form EIA-861 ("Annual Electric Power Industry Report") database for 2002, accessed from http://www.eia.doe.gov/cneaf/electricity/page/eia861.html.

Public Utilities

(1) Compiled from Form EIA-412 ("Annual Electric Industry Financial Report") database, Schedule 7 ("Electric Operation and Maintenance Costs"), accessed from http://www.eia.doe.gov/cneaf/electricity/page/eia412.html, the following 2002 data: (a) steam power generation fuel cost, and (b) other power generation fuel cost (did not compile nuclear fuel cost information for consistency with private utility data, which does not have this information available).

(2) For each public utility, summed the steam power generation fuel cost with the other power generation fuel cost to yield total fuel cost.

(3) Summed the utility-specific revenue and fuel cost information into two totals: one for utilities with net generation >0 but no more than 4 million megawatthours (SBA definition of small entity for NAICS 2211), and one with utilities >4 million megawatthours. Computed a cost-to-revenue ratio for small utilities and a cost-revenue for large utilities. [Also, computed cost-to-revenue ratios for each individual public utility.]

Private Utilities

(1) Compiled from Form EIA-906 ("Power Plant Report) database (accessed from http://www.eia.doe.gov/cneaf/electricity/page/eia906_920.html), monthly and annual fuel consumption by fuel type for each private utility.

(2) Compiled from Form EIA-423 ("Monthly Cost and Quality of Fuels for Electric Plants Report") monthly fuel cost data for each electric power producer (this form is used to obtain data for each electric generating plants whose total steam turbine electric generating capacity and/or combined-cycle generating capacity is 50 or more megawatts.)

(3) Computed the average annual price by utility for the fuel types reported on Form EIA-906 by calculating the average as a weighted average of the Form EIA-423 monthly price values, where the monthly prices are weighted by the Form EIA-423 quantity purchased in each month. In some cases, there was some judgment necessary to assign Form EIA-423 fuel types to Form EIA-906 fuel types.

(4) For Form EIA-906 utility/fuel type combinations for which Form EIA-423 price information was not available, the author developed price estimates. In particular, the author defaulted to price information from one of two sources, listed in order of preference: the June 29, 2006 EIA report "Cost and Quality of Fuels for Electric Plants, 2002 and 2003" or average prices computed from the Form EIA-423 utility specific price data. When the EIA report was used, the author assigned the average fuel price for the state in which the utility is located unless state-level price information was not available, in which case, a regional average price was assigned. If both a state and a regional price were not available, then the author assigned the national average reported price. In cases where no price information was available in the EIA report, the author developed and applied a State-level average price from the Form EIA-423 database information. If the appropriate State was not available from the Form EIA-423 database, the author developed and applied a National-level average price computed from the Form EIA-423 database.

(5) Multiplied the annual fuel price information developed in steps (3) and (4) by the annual fuel consumption estimates compiled in step 1. This step yields fuel costs by utility/fuel type.

(6) Summed the utility-specific revenue and fuel cost information into two totals: one for utilities with net generation >0 but no more than 4 million megawatthours (SBA definition of small entity for NAICS 2211), and one with utilities >4 million megawatthours. Computed a cost-to-revenue ratio for small utilities and a cost-revenue for large utilities. (Also, computed cost-to-revenue ratios for each individual public utility.)

Using the utility-specific cost-to-revenue ratios computed as described above in the Public Utilities and Private Utilities subsections, the author also computed overall electric generation sector cost-to-revenue ratios for the following size categories: (a) 4 million megawatthours or less; and (b) >4 million megawatthours.

Manufacturing (NAICS codes 311 - 339)

Steps used to characterize Manufacturing sector energy costs for 3–digit NAICS codes in the Manufacturing sector (311 - 319):

(1) Compiled data from Table 5 of the 2002 Census of Manufacturers (Census) on the number of employees, value added, value of shipments, and number of establishments by employment size category (1 to 4; 5 to 9; 10 to 19; 20 to 49; 50 to 99; 100 to 249; 250 to 499; 500 to 999; 1,000 to 2,499; 2,500 or more; and total) by 3-digit NAICS code.

(2) Compiled NAICS level data from Table 6.4 of 2002 Manufacturing Energy Consumption Survey (MECS) on total fuel consumption (in Btu) per employee, per dollar of value added, and per value of shipments by employment size category (< 50; 50 to 99; 100 to 249; 250 to 499; 500 to 999; 1,000 and above; and total).

(3) Multiplied each of the fuel use estimates from step 2 by the number of employees, value added, and value of shipments estimates from step 1. Calculated the average of the three estimates and used as the estimate of total fuel use (in Btu) by each of the employment size categories listed above in step 1. For NAICS codes where employment data were withheld, only used the MECS per employee fuel data to estimate fuel consumption (see discussion below of steps used to estimate withheld data).

<u>Estimation of Withheld Employment Data</u>: The Census reports “All Establishments” totals. For all the missing employment categories except the 2,500+ category, the author multiplied the reported number of establishments by the midpoint of the employment range (e.g., NAICS 322 for employment category 1 to 4 employees--multiplied 814 establishments by 2.5 employees = 2,035). For the 2,500+ category, the author used the mid-point associated with the Census’s “Number of employees flag” (e.g., NAICS code 322 = 7,499.5). Next, the author subtracted the employment for the employment size categories for which there is no withheld data from the total employees for the NAICS code. This calculation yields total employment for the missing categories. This employment value was then allocated to the missing categories in proportion to the initial employment estimates calculated from the midpoint procedures noted above.

For example, if total employment for NAICS code 322 was 100,000 and the employment for all the categories that are not withheld is 90,000, then 10,000 employees are associated with the withheld employment categories. For the 1 to 4 employment category, 0.213435 of the 10,000 employees would be allocated to this category based on the proportion of employees calculated from the initial employment estimates from each size category [i.e., 2,035 / (2,035 + 7,499.5)]. This procedure would result in an estimated 2,134.35 employees (10,000 * 0.213435 = 2,134.35, rounded = 2,134).

(4) Adjusted the Total fuel consumption estimates computed in step 3 to match the PURCHASED QUANTITY estimates reported in the first column in MECS Table 7.6.

This step was accomplished by multiplying the values in step 3 by the NAICS-level ratios of Table 7.6 “Total Purchased Quantity” values to the NAICS-level sum of total fuel consumption values calculated in step 3.

(5) Estimated Table 7.6 PURCHASED QUANTITY values for each fuel type in trillion Btu terms by multiplying the Table 7.6 physical unit-based values by Btu conversion factors. These Btu conversion factors were as follows: electricity - 0.00342; residual fuel oil - 6.287; distillate fuel oil - 5.825; natural gas - 1.029; LPG and NGL - 3.612; coal - 22.489; and coke and breeze - 22.3. before applying these factors, first estimated the withheld Table 7.6 PURCHASED QUANTITY electricity values (i.e., for NAICS codes 311, 322, 331, 335, and 336) by allocating the total electricity withheld across all NAICS (342,114 million kWh) to these five NAICS based on the proportions represented by the First Use of Energy Net Electricity Btu values reported in MECS Table 1.2.

(6) Computed the proportions of total NAICS-level PURCHASED QUANTITY values for each fuel type from the Btu-based values computed in step 5. In cases where these values are reported as * or W or Q, treated as if 0.

(7) Multiplied the values from step 4 by the proportions from step 6 by linking on NAICS code to estimate NAICS/Fuel Type/Employment Category level fuel PURCHASED QUANTITY estimates in Btu terms.

(8) Estimated the dollars spent on each fuel type by NAICS/Fuel Type/Employment Category using the price per Btu by employment size category data from Table 7.5 in the 2002 MECS.

(9) Using the estimates from step 8, computed proportions by NAICS/fuel type combination of the $ spent by each Employment Size Category.

(10) Multiplied the proportions from step 9 by the Expenditures for Purchased Energy data in Table 7.9 by linking the two data sets on NAICS code and fuel type.

Commercial (NAICS codes 423 - 813)

Economic Census Data

From the various sector specific publications for NAICS codes 42-81 (e.g., Wholesale Trade), the author compiled from AmericanFactFinder (http://factfinder.census.gov/servlet/IBQTable?_bm=y&-ds_name=BE0200I101&-_lang=en) by 3-digit NAICS code and following employment size categories: All; All operated entire year, 1, 2, 3 or 4, 5 or 6, 7 to 9, 10 to 14, 15 to 19, 20 to 49, 50 to 99, 100+ employees, and establishments not operated all year (all but NAICS code 55 have data reported for these categories), the following data: (1) Number of Establishments; (2) Sales; and (3) Number of paid employees for pay period including March 12. The author then aggregated/retained these data for the following employment size categories: a) All operated entire year; b) 0 to 4 employees; c) 5-9 employees; d) 10-19 employees; e) 20-49 employees; f) 50-99 employees; and g) 100+ employees.

The author developed energy cost per sales ratios for the NAICS code/employment size categories where Census data were withheld. The author also compiled from the 2002 *Business Expenses Survey* (http://www.census.gov/csd/bes/), values by 3-digit NAICS code for:

(1) Sales
(2) Total Operating Expenses
(3) Cost of purchased electricity
(4) Cost of purchased fuels, excluding motor fuels

Next, the author compared the total sales data between the two data sets to ensure they matched (note that the author did not develop small establishment energy cost information for any NAICS where sales data were provided in the Census, but not in the BES, nor the one case - NAICS 514, where we had sales information from BES, but not from Census). To address discrepancies between sales estimates reported in the 2002 Economic Census and those reported in the 2002 Business Expense Survey (BES), the author adjusted the Census sales estimates to match the BES estimates since the total expenditure and energy expenditure estimates reflect the values reported in the BES. The following identifies the reasons for/approaches used to address these discrepancies.

(a) NAICS codes 423 and 424 - the reason for the large discrepancy is that BES excludes data from manufacturer sales branches and offices (MSBO), while the Census includes these data. Therefore, the author applied the ratio of BES total sales to Census total sales by NAICS code to the Census's employment size category sales estimates (i.e., sales for 0 to 4 employees; c) 5-9 employees; d) 10-19 employees; e) 20-49 employees; f) 50-99 employees; and g) 100+ employees).

(b) With exception of NAICS code 813, all other NAICS codes where sales data are reported in both the Census and the BES have somewhat higher sales estimates in BES than the Census. The reason is that the BES includes establishments without payroll, while the Census does not include these establishments. Again, the author applied the ratio of BES total sales to Census total sales by NAICS code to the Census's employment size category sales estimates to yield sales estimates that match the BES reported values. The resulting values will be somewhat higher than the Census values.

(c) NAICS code 813 – as a conservative assumption, the author did not make an adjustment to the Census estimates -- even though, unlike Census, BES includes establishments without payroll, Census reported sales greater than BES reported sales (there may have been a revision to estimates that was reflected in one publication, but not the other).

d) All other NAICS codes have sales estimates reported in one publication, but not the other--in all but one case, values are reported in the Census, but not BES. This is generally because either the BES did not include the NAICS within its scope or the BES expenditure estimates did not meet the Bureau of Census's standards. The one exception is NAICS code 514 -- reason why it is in BES, but not Census is because the NAICS was substantially changed between 1997 and 2002, and NAICS code 514 is now comprised of NAICS 51 (partial), 518 (all), and 519 (all). the author did not apply the BES data for 514 to NAICS 516, 518, 519 because it is not an exact match and because these NAICS have very small energy costs as percentage of total operating expenses (electricity is 0.37 percent of total; purchased fuels is 0.03 percent).

Note that after performing the above, and comparing the results to the total BES sales data (which should match), there were four NAICS codes that were not matching (492, 622, 623, 624). This is due to there being withheld data at the employment size category level. The author estimated the sales/establishment for a given employment size category via interpolation or extrapolation of surrounding values, and multiplied this ratio by the reported number of establishments in the size category to yield initial estimated sales by withheld category, and then adjusted these initial estimates to yield values that sum to the total NAICS code sales value.

Commercial Buildings Energy Consumption Survey (CBECS) Microdata

The author compiled detailed data from files 01, 15, and 16 of the 2003 CBECS, which is available from:
http://www.eia.doe.gov/emeu/cbecs/cbecs2003/public_use_2003/cbecs_pudata2003.html.
Because these data provide records that report estimates from a surveyed group of buildings, and the ADJWT8 field contains weighting factors to represent the national number of buildings associated with each record, the author multiplied the reported data for a given record by the value in the ADJWT8 field (e.g., national electricity expenditures are obtained by multiplying the ELEXP8 field values by the ADJWT8 field values). The individual CBECS files are linked together using values in the PUBID8 field.

The author analyzed the CBECS microdata as follows:

(1) The author added two new fields to the File 01 data -- (1) to contain the estimated number of employees per establishment rounded to the nearest integer; and (2) a flag field to identify employment size per establishment category. For any values from step 1 that may result in errors because NOCC8 field values are 0, the author set the number of

employees per establishment to 0. Next, the author entered the following codes to reflect the values calculated in the first step: 1 = <5 employees/establishment; 2 = 5 to 9 employees/establishment; 3 = 10 to 19 employees/establishment; 4 = 20 to 49 employees/establishment; 5 = 50 to 99 employees/establishment; 6 = 100 or more employees/establishment.

(2) Calculated price per unit of energy by the employment/establishment size categories noted above. Specifically, calculated from File 15 – ELEXP8/ELBTU8 ($ per thousand Btu of electricity); from File 16 – NGEXP8/NGBTU8 ($ per thousand Btu of natural gas), FKEXP8/FKBTU8 ($ per thousand Btu of fuel oil), and DHEXP8/DHBTU8 ($ per thousand Btu of district heat) by employment size category.

(3) Deleted all vacant building records (where the PBA8 field equal to '01'), and all records that report "0" in the number of businesses field (NOCC8).

(4) Calculated the proportion of electricity expenditures by employment size category within each primary business activity (PBA). The author then applied these proportions to the NAICS-level electricity values compiled from the *Business Expenses Survey* (linked PBAs to NAICS codes via the crosswalk table displayed at the end of these steps—using the PBA identified with an '*' to identify the PBA for each 3-digit NAICS code). The result is electricity expenditures by NAICS and employment size category.

(5) Calculated the proportion of the sum of (natural gas expenditures + fuel oil expenditures) by employment size category within each PBA. Multiplied these proportions to the NAICS code-level cost of purchased fuels, excluding motor fuels data compiled from the Business Expenses Survey (note that because CBECS excludes coal, LPG, and biomass, this allocation procedure does not reflect about 5 percent of total commercial sector cost of purchased non-motor fuels). Result is the cost of non-motor fuels by NAICS code and employment size category.

(6) Calculated the proportion of the sum of (natural gas expenditures + fuel oil expenditures) from natural gas expenditures and fuel oil expenditures by PBA. After linking the PBA's to NAICS codes, The author multiplied the estimates from step 5 by these proportions to estimate natural gas expenditures by NAICS code and employment size category, and fuel oil expenditures by NAICS code and employment size category (note that national commercial sector fuel oil expenditures are 85.81 percent distillate; 10.14 percent residual fuel; and 4.04 percent kerosene).

(7) Developed commercial sector energy expenditure estimates by NAICS code and employment size category, and by NAICS code, fuel type, and employment size category.

(8) Developed commercial sector energy consumption expenditures per dollar of sales by NAICS code and employment size category.

Table A-1. Crosswalk Between CBECS Building Types and NAICS Industries

	CBECS Principal Building Activity (PBA) [Category with Asterisk Indicates Most Likely]														
NAICS Code/Description	Education	Food Sales	Food Service	Inpatient Health Care	Outpatient Health Care	Lodging	Retail (non-mall)	Retail (mall)	Office	Public Assembly	Public Order/ Safety	Religious Worship	Service	Warehouse/ Storage	Other
423/durables wholesalers									X					X*	
424/nondurables wholesalers		X							X					X*	
441/motor vehicles & parts dealers							X*	X	X				X	X	
442/furniture/home furnishings stores							X*	X						X	
443/electronics & appliance stores							X*	X						X	
444/building & garden eqpt./supplies							X*	X						X	
445/food & beverage stores		X*													
446/health & personal care stores							X	X*							
447/gasoline stations		X											X*		
448/clothing & accessories stores							X	X*							
451/sports, hobby, book, music stores							X*	X							
452/general merchandise stores							X*	X							
453/other store retailers							X*	X						X	
454/nonstore retailers									X*					X	X
481/air transportation									X	X*			X	X	X
482/rail transportation									X	X*			X	X	
483/water transportation									X	X			X*	X	
484/truck transportation									X				X*	X	
485/transit & ground passenger									X	X*			X	X	
486/pipeline transportation									X*				X	X	
487/scenic & sightseeing transport									X	X*			X	X	
488/transportation support activities									X	X			X*	X	X
491/postal service													X*		
492/couriers and messengers									X				X*	X	
493/warehousing and storage									X					X*	
511/publishing industries									X*					X	
512/motion picture & sound recording									X	X*				X	X
515/broadcasting excluding internet									X	X*					X
516/internet publishing and broadcasting									X*				X	X	
517/telecommunications							X	X	X*				X	X	X
518/internet service providers, etc							X		X*				X	X	X

Table A-1. Crosswalk Between CBECS Building Types and NAICS Industries

NAICS Code/Description	CBECS Principal Building Activity (PBA) [Category with Asterisk Indicates Most Likely]														
	Education	Food Sales	Food Service	Inpatient Health Care	Outpatient Health Care	Lodging	Retail (non-mall)	Retail (mall)	Office	Public Assembly	Public Order/ Safety	Religious Worship	Service	Warehouse/ Storage	Other
519/other information services									X*	X				X	
521/central bank									X*					X	
522/credit intermediation etc.									X*						
523/securities, investments, contracts									X*						
524/insurance carriers etc.									X*						
525/funds, trusts, and other financial									X*						
531/real estate									X*					X	
532/rental & leasing services							X*		X				X	X	
533/lessors of nonfinancial intangibles									X*						
541/professional, scientific, tech services									X*				X		X
551/management of companies etc.									X*						
561/administrative & support services									X*						
562/waste management & remediation									X				X	X	X*
611/educational services	X*	X	X	X	X	X	X		X	X	X	X	X	X	X
621/ambulatory health care services				X	X*				X						
622/hospitals				X*											
623/nursing & residential care facilities						X*									
624/social assistance	X		X		X	X			X*						
711/performing arts, spectator sports etc									X	X*					
712/museums, historical sites, etc.		X	X				X		X	X*					
713/amusement, gambling, recreation		X	X			X	X		X	X*					
721/accommodation			X			X*				X					
722/food services and drinking places			X*												
811/repair and maintenance									X				X*	X	
812/personal and laundry services									X	X			X*		
813/religious, grantmaking, civic, etc.									X			X*			
814/private households															
921/executive, legislative, other gov't.									X*	X	X			X	
922/justice, order, and safety activities									X		X*				
923/administration of programs									X*						
924/administration of environ. programs									X*						

Table A-1. Crosswalk Between CBECS Building Types and NAICS Industries

	CBECS Principal Building Activity (PBA) [Category with Asterisk Indicates Most Likely]														
NAICS Code/Description	Education	Food Sales	Food Service	Inpatient Health Care	Outpatient Health Care	Lodging	Retail (non-mall)	Retail (mall)	Office	Public Assembly	Public Order/ Safety	Religious Worship	Service	Warehouse/ Storage	Other
925/administration of HUD									X*						
926/administration of economic programs									X*						
927/space research and technology									X					X	X*
928/national security & int’l affairs	X	X	X		X				X*					X	X

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PG&E Food Service Technology Center is the industry leader in commercial kitchen energy efficiency and appliance-performance testing as well as a leading source of expertise in commercial kitchen ventilation and sustainable building design.

National Restaurant Association's Conserve initiative explores conservation efforts in restaurants around the nation and offers suggestions and resources to help operators reduce their costs and improve their environmental performance.

ACKNOWLEDGEMENTS

This best-practices guide was created with the assistance of California's four investor-owned utilities (Southern California Gas Company, Pacific Gas and Electric Company, San Diego Gas and Electric Company, and Southern California Edison). These energy suppliers are working together to provide comprehensive energy efficiency resources for California's food service industry, including, but not limited to, the following resources: rebates for cooking and refrigeration equipment, food service specific seminars and workshops, Web tools, energy audits, appliance testing, and energy education centers. The California energy-efficiency research and educational programs are funded by California ratepayers under the auspices of the California Public Utilities Commission and are administered by the four investor-owned utilities.

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Disclaimer: all energy, water, and monetary savings listed in this document are based upon average savings for end users and are provided for educational purposes only. Actual energy savings might vary based on use and other factors.

FIVE EASY STEPS TO SAVE ENERGY AND WATER

1 *Install compact fluorescent lamps* (CFLs) in your walk-in refrigerators and kitchen ventilation hoods (and throughout your restaurant where appropriate).

2 *Install a high-efficiency pre-rinse spray valve* in your dishroom and save hundreds of dollars a year!

3 *Fix water leaks immediately*—especially hot water leaks: wasted water, sewer, and water heating costs can add up to hundreds of dollars a year.

4 *Perform walk-in refrigerator maintenance:* check and replace door gaskets; clean evaporator and condenser coils; check refrigerant charge.

5 *Replace worn-out cooking and refrigeration equipment* with ENERGY STAR qualified models!

Get additional easy to implement tips at: http://conserve.restaurant.org

Energy efficiency is a sound business practice that improves profitability, reduces greenhouse gas emissions, and conserves resources. This guide is designed to help your restaurant save energy and water, protect our Earth, and boost your bottom line.

ENERGY EFFICIENCY AND YOUR RESTAURANT

Restaurants use about 2.5 times more energy per square foot than other commercial buildings.

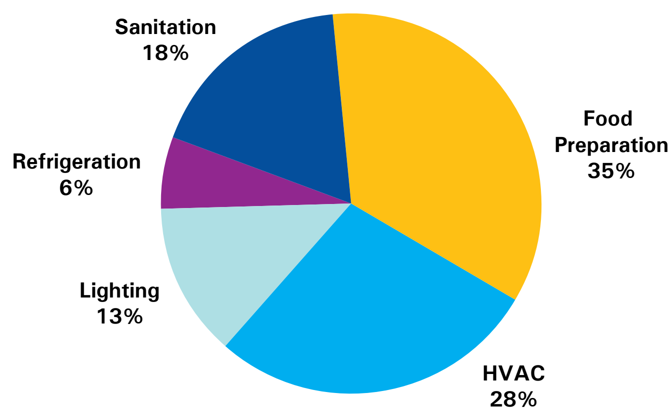
Most commercial kitchen appliances are energy intensive. For instance, a typical electric deep fat fryer uses more than 11,000 kilowatt-hours (kWh) of energy per year which could cost you more than $1,000 in electricity.

As energy costs increase, investing in energy efficiency is the best way to protect your business against these rising prices.

You can reduce your restaurant's energy consumption by following the **Cost Saving Tips** outlined below and throughout this guide:

- Buy ENERGY STAR qualified appliances. If you're in the market for new equipment, think in terms of life-cycle costs, which include purchase price, annual energy costs, and other long-term costs associated with the equipment. High-efficiency appliances could cost more upfront, but significantly lower utility bills can make up for the price difference. Be sure to ask your dealer or kitchen designer to supply you with ENERGY STAR qualified equipment.
- Cut idle time. If you leave your equipment ON when it is not performing useful work, it costs you money. Implement a startup/shutdown plan to make sure you are using only the equipment that you need, when you need it.
- Maintain and repair. Leaky walk-in refrigerator gaskets, freezer doors that do not shut, cooking appliances that have lost their knobs—all these "energy leaks" add up to money wasted each month. Don't let everyday wear and tear drive up your energy bills.

Example of the Average Energy Consumption in a Full-service Restaurant
(British Thermal Units [Btu])



- Cook wisely. Ovens tend to be more efficient than rotisseries; griddles tend to be more efficient than broilers. Examine your cooking methods and menu; find ways to rely on your more energy-efficient appliances to cook for your customers.
- Recalibrate to stay efficient. The performance of your kitchen equipment changes over time. Thermostats and control systems can fail, fall out of calibration, or be readjusted. Take the time to do a regular thermostat check on your appliances, refrigeration, dish machines, and hot water heaters and reset them to the correct operating temperature.

COOKING APPLIANCES

When replacing old appliances or buying new ones, look beyond the sticker price. Buying and installing equipment that has earned the ENERGY STAR could trim hundreds of dollars from your annual utility bills. In order to realize the most savings from your ENERGY STAR qualified equipment you must train your staff to use energy wisely by following good operating practices such as those in the **Cost-Saving Tips** that follow.

Steamers

Steam cookers provide an effective way to batch-cook food but generating steam is an energy-intensive process. ENERGY STAR qualified steamers have a sealed cooking cavity that consumes a fraction of the energy and water required by traditional open systems. In many cases the dollar savings are so great that it makes sense to replace an existing steamer with an ENERGY STAR qualified one.

Cost-Saving Tips

- Look for the ENERGY STAR
- Close the door
- Use the timer
- Cut idle time
- Maintain & repair

Good practices can save:

$250 to $350 in annual energy costs for a traditional, electric, open-system steamer by eliminating an hour of idle time per day.

Buy an ENERGY STAR qualified connectionless steamer and save:

- $1,000 for water and sewer costs annually
- $1,100 in gas or electricity annually (gas or electric steamers)

Equating to an average $2,100 total savings (some restaurants with high commercial sewer costs can save hundreds of dollars more annually).

Fryers

Energy-efficient fryers that have earned the ENERGY STAR offer shorter cook times, faster temperature recovery times, and ultimately higher pound-per-hour production rates through advanced burner and heat exchanger designs. Some models also offer an insulated fry pot, which reduces standby losses, giving the fryer a lower idle energy rate.

Cost-Saving Tips

- Look for the ENERGY STAR
- Cut idle time & turn off back-up fryers when possible
- Recalibrate

Good practices can save:

$250 annually for a gas fryer by cutting four hours of idle time per day.

Buy an ENERGY STAR qualified fryer and save:

- $100 for electricity annually (electric fryer), or
- $450 for gas annually (gas fryer)

Convection Ovens

Convection ovens are the industry standard due to faster cook-times produced by increased hot air movement inside the oven cavity. In addition, convection ovens are now eligible for ENERGY STAR qualification.

Cost-Saving Tips

- Look for the ENERGY STAR
- Cut idle time & turn off back-up ovens when possible
- Fully load the oven when cooking
- Replace seals & tighten hinges

Buy an ENERGY STAR qualified convection oven and save:

- $190 for electricity annually (electric oven), or
- $360 for gas annually (gas oven)

Griddles

Griddles are a versatile piece of equipment and a workhorse appliance found on most kitchen lines. Variations in efficiency, production capacity, and temperature uniformity make it important to choose wisely when shopping for a griddle. Many energy-efficient griddles can deliver both high production capacity and excellent temperature uniformity.

Cost-Saving Tips

- Look for the ENERGY STAR
- Cut idle time
- Recalibrate

Good practices can save:

$250 annually from a gas griddle by cutting three hours of idle time per day.

Buy an ENERGY STAR qualified griddle and save:

- $190 for electricity annually (electric griddle), or
- $175 for gas annually (gas griddle)

Holding Cabinets

ENERGY STAR hot food holding cabinets typically feature improved insulation, so heat stays in the cabinet and out of the kitchen. An insulated ENERGY STAR holding cabinet uses about half the energy consumed by an uninsulated cabinet. Other available features that could potentially save energy include magnetic door gaskets, auto-door closers, and dutch doors.

Cost-Saving Tips

- Look for the ENERGY STAR
- Shut off overnight
- Use the timer
- Replace missing or worn out control knobs

Good practices can save:

$500 annually by turning off an uninsulated holding cabinet when the kitchen is closed.

Buy an ENERGY STAR qualified holding cabinet and save:

- $310 to $880 annually for electricity

Combination Ovens

The combination oven is an extremely versatile cooking platform with the added bonus of a self-cleaning feature. Operating a combination oven in “steam” or “combination” mode typically uses more energy and water than operating in traditional convection mode. Use the oven’s programming capabilities to properly control different cooking modes to maximize energy efficiency and cost savings. Do your homework when buying a combination oven: the most efficient models will use about half as much energy and water as the inefficient models.

Good practices can save:

$400 to $800 annually off an electric combination oven by cutting out two hours of idle time per day.

If ENERGY STAR qualified models don’t exist for the type of equipment you’re looking for don’t worry: you still have options. Ask distributors and manufacturers for energy use information, and check online for equipment reviews. The California commercial food service incentive program is also a third-party resource because, like ENERGY STAR, appliances that qualify must meet designated efficiency standards. The list of qualifying appliances can be found at: www.fishnick.com/saveenergy/rebates.

Broilers

Broilers are true kitchen workhorses but their dependability and simplicity come at a price: searing heat requires a great deal of energy and broilers have simple, non-thermostatic controls. This combination can make the broiler the most energy intensive appliance in the kitchen. For example, one gas broiler can use more energy than six gas fryers. A new generation of broilers incorporates better radiant designs, allowing the broiler to get the job done while consuming about 25 percent less energy.

Cost-Saving Tips

- Cut preheat time
- Turn off unneeded sections
- Reduce idle time
- Replace missing knobs

Good practices can save:

$600 annually by cutting out three hours of idle time per day.

Ranges

The range top is one of the most widely used pieces of equipment in restaurant kitchens. Ranges are manually controlled and can be energy guzzlers depending on how you operate them. A potential alternative to traditional range tops are induction ranges; they are more expensive but offer very high efficiency, rapid heat up, precise controls, and low maintenance.

Cost-Saving Tips

- Maintain and adjust burners
- Use a lid
- Cut idle time

REFRIGERATION SYSTEMS AND ICE MACHINES

Reach-In Refrigerators and Freezers

Compared to standard models, ENERGY STAR qualified commercial refrigerators and freezers can lead to energy savings of as much as 30 percent. Glass door refrigerators and freezers can now earn the ENERGY STAR too! Features that could potentially save energy include improved insulation and components such as high-efficiency compressors and motors.

Cost-Saving Tips

- Look for the ENERGY STAR
- Turn off door heaters when possible
- Clean coils
- Set defrost timers
- Replace worn gaskets

Buy ENERGY STAR qualified equipment and save:

- $55 for electricity annually (per solid door refrigerator) or $70 annually (per glass door refrigerator)
- $175 for electricity annually (per solid door freezer) or $325 annually (per glass door freezer)

Walk-In Refrigerators

Walk-in refrigerators are extremely important to any successful restaurant. Improve this equipment's energy performance with a few inexpensive upgrades and good practices, such as:

- Swapping out incandescent light bulbs for low-temperature ENERGY STAR qualified compact fluorescent lamps (CFLs) can reduce the lamps' heat output by 75 percent! (Look for the lowest possible "minimum start temperature" on the CFL box, e.g., zero degrees Fahrenheit.)
- Adding strip curtains and automatic door closers to your walk-in refrigerator: *they are inexpensive and easy-to-install.* Strip curtains can cut outside air infiltration by about 75 percent!
- Installing electronically commutated motors (ECM) on the evaporator and condenser fans reduces fan energy consumption by approximately two-thirds.

Cost-Saving Tips

- Allow air circulation
- Insulate suction lines
- Check refrigerant charge
- Repair and realign doors
- Clean coils

Ice Machines

Commercial ice machines that earn the ENERGY STAR are on average 15 percent more energy efficient and 10 percent more water efficient than standard models.

- Cut down on your daytime electricity demand by installing a timer and shifting ice production to nighttime off-peak hours.
- Bigger ice machines are typically more efficient than smaller ones, yet the price difference is usually not very large. Choose wisely and you could get twice the ice capacity at half the energy cost per pound of ice.
- Avoid water-cooled ice machines because of their high water cost, which make them significantly more expensive to operate. *Note: water-cooled ice machines do not currently qualify for ENERGY STAR.*

Cost-Saving Tips

- Look for the ENERGY STAR
- Clean the coils
- Keep the lid closed
- Adjust the purge water timer

Buy an ENERGY STAR qualified ice machine and save:

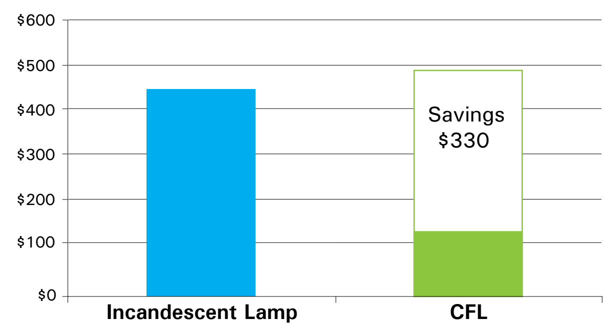
- $130 for electricity annually
- $18 for water annually

LAMPS AND LIGHTING FIXTURES

In a typical restaurant, lights are usually on for 16 to 20 hours a day. For many areas in your restaurant, high-efficiency ENERGY STAR CFLs and lighting fixtures are your ticket to savings.

- Install ENERGY STAR qualified fixtures and CFLs in your dining area and reduce energy consumption and heat output by 75 percent.
- Install occupancy sensors in closets, storage rooms, break rooms, restrooms, and even walk-in refrigerators. Look for sealed, low-temperature-specific sensors for refrigerated environments.
- If your restaurant features linear fluorescent lighting with T12 lamps and magnetic ballasts it is time to upgrade. Switch to more efficient T8 or T5 lamps with electronic ballasts. Electronic ballasts typically have faster on-times and do not hum or flicker. Look for utility incentives for lighting upgrades in your area.
- Swap your old Open/Closed and EXIT signs with LED technology for electricity savings up to 80 percent.
- Visit www.energystar.gov/lighting for more cost-saving information.

Annual Savings After Replacing Eight Incandescent Lamps with Eight CFLs



CFL vs. Incandescent Light Bulbs

If each of the 945,000 restaurants in the United States replaced only one incandescent light bulb with a CFL, more than 630 million pounds of CO_2 emissions could be avoided each year (the annual greenhouse gas emissions from more than 52,000 passenger vehicles*), and the restaurant industry could save about $42.5 million annually.

*Source: EPA Greenhouse Gas Equivalencies Calculator: www.epa.gov/cleanenergy/energy-resources/calculator.html

Mercury and CFLs

CFLs contain a very small amount of mercury sealed within the glass tubing (approximately 4 milligrams). By comparison, older thermometers contain about 500 milligrams of mercury—an amount equal to the mercury in 125 CFLs. No mercury is released when the bulbs are intact (not broken) or in use. For more information about recycling and disposing of CFLs visit: www.energystar.gov/mercury.

HEATING, COOLING AND VENTILATION

Making smart decisions about your restaurant's heating, ventilating, and air conditioning (HVAC) system can have a big effect on your utility bills—and your customers' comfort.

Heating and Cooling Systems

Heating and cooling systems account for a large portion of your restaurant's annual energy use. For many restaurants, heating and cooling is second only to food preparation in terms of annual energy consumption.

Energy use falls by 4 to 5 percent for every degree that you raise your cooling thermostat setpoint. Easing back on central cooling by only 3°F could trim air conditioning costs by 12 to 15 percent. Improve customer comfort by using an efficient ENERGY STAR qualified ceiling fan to compensate for the difference in air temperature. Ensure that your heating and cooling equipment is included in the start-up and shut down schedule to save even more.

Cost-Saving Tips

- Look for the ENERGY STAR
- Clean heat-transfer coils
- Replace air filters
- Consider an Energy Management System
- Repair broken duct work
- Recommission economizers

Don't forget about the restroom! ENERGY STAR qualified ventilating fans use 70 percent less energy than standard models.

Buy ENERGY STAR qualified equipment and save:

- $1.70 per square foot over the life of the HVAC equipment ($4,250 for a 2,500 square foot restaurant; or $430 annually)
- $15 annually for electricity costs per ceiling fan
- $75 annually for electricity costs for ventilating fans that are run continuously

According to the Consortium for Energy Efficiency (CEE), at least 25 percent of all rooftop HVAC units are oversized, resulting in increased energy costs and equipment wear. Properly sized equipment dramatically cuts energy costs, increases the life of the equipment, and reduces greenhouse gas emissions.

Kitchen Ventilation

An unbalanced or poorly designed kitchen exhaust system can allow heat and smoke to spill into your kitchen, spelling trouble both for your restaurant's air quality and for your utility bills. Spillage leads to a hot, uncomfortable working environment and higher energy bills for air-conditioned kitchens.

- Cut down on spillage by adding inexpensive side panels to hoods.
- Push each cooking appliance as far back against the wall as possible to maximize hood overhang and close the air gap between the appliance and the wall.
- Install a demand-based exhaust control. It uses sensors to monitor your cooking and varies the exhaust fan speed to match your ventilation needs. Demand ventilation controls could reduce your exhaust system costs by anywhere from 30 to 50 percent and can be installed on either new equipment or retrofitted to existing hoods.

Learning More About Kitchen Ventilation

If you're getting ready to design a new kitchen or renovate an old one, check out "Improving Commercial Kitchen Ventilation System Performance," a two-part kitchen ventilation design guide written by the experts at PG&E FSTC and available at: www.fishnick.com/equipment/ckv/designguides.

Windows

Applying a clear, heat rejecting window film will help cut your cooling costs while making your dining room more comfortable. Use only high quality window film installed by a qualified professional.

Patio Heaters

The best approach to saving money with patio heaters is to cut back their use—both for hours of operation and for the number of patio heaters running at any given time. Patio heaters are radiant devices that heat up quickly so there is no reason to leave them running if a seating area is temporarily empty.

Good practices can save:

$530 per heater annually by cutting three hours of use per day

WATER AND WASTE MANAGEMENT

Water Use

Using water more efficiently preserves water supplies, saves money, and protects the environment. By conserving hot water you trim not one but two bills: one for the water and sewer and another for the electricity or natural gas used to heat the water used in bathroom faucets, kitchen sinks, and dishwashers.

Cost-Saving Tips

- Look for the ENERGY STAR and WaterSense label
- Add aerators
- Install WaterSense labeled toilets
- Repair leaks
- Reduce sink and tap usage

Similar to the ENERGY STAR, the WaterSense® label identifies water-efficient products and programs. WaterSense is a partnership program sponsored by EPA and additional information is available at: www.epa.gov/watersense.

look for WaterSense Meets EPA Criteria

Good practices can save:

$1,000 annually by turning down dipper wells and making sure they are OFF when the kitchen is closed

$1,000 annually by fixing leaks in sinks, mop-stations, and dishmachines

Look for WaterSense labeled equipment and use WaterSense irrigation partners to landscape your restaurant:

Bathroom faucets are 30 percent more water efficient

Landscaping with WaterSense irrigation partner could save you 15 percent compared to average watering bills

High-Efficiency Pre-Rinse Spray Valves

A high-efficiency, or low-flow, pre-rinse spray valve is one of the most cost-effective energy saving devices available to the foodservice operator. And it is easy to install! Just unscrew your old spray valve and screw in your new, water-efficient one.

In addition to minimizing hot water consumption, you can reduce both your water-heating and sewer expenditures per month. How? Typical spray valves can release hot water at a rate of three to four gallons of water per minute (gpm), while common high-efficiency units spray only 1.6 gpm or less without sacrificing cleaning power!

Buy a 1.6 gpm spray valve and save:

$300 to $350 annually for water, sewer, and natural gas costs annually (used one hour a day and compared to 3 gpm sprayer).

Additional information is available at: www.fishnick.com/equipment/sprayvalves.

Dishwashers

From an operational standpoint, dishwashers are one of the most expensive pieces of equipment in your kitchen. Commercial dishwashers that have earned the ENERGY STAR are on average 25 percent more energy and water efficient than standard models.

- Run fully loaded dish racks through the dish machine. Cutting wash cycles could save you hundreds of dollars annually.
- Pay attention to your dishwasher's pressure gauge—if it's showing pressure above 25 psi, there is a good chance you are using much more water than is necessary. Most dishwashers require only around 20 psi.
- If you have a conveyor-style dishwasher, make sure you are using it in auto mode, which saves electricity by running the conveyor motor only when needed.

Cost-Saving Tips

- Look for the ENERGY STAR
- Turn off at night
- Replace torn wash curtains
- Repair leaks
- Replace worn spray heads

Buy an ENERGY STAR qualified dishwasher and save:

- $720 for electricity annually
- $300 for water annually

Waste Reduction Is Good Business

Waste reduction leads to increased operating efficiency and cost savings. Decreased solid waste generation reduces collection and disposal costs just as reducing electricity and water consumption reduces utility bills. Waste minimization also may reduce your purchasing costs for restaurant supplies.

Using recycling and composting bins, sustainable take-out containers, and "green" signage are all excellent ways to announce and to demonstrate to your customers your efforts to be more environmentally sustainable and aware.

For help identifying waste reduction opportunities please visit www.epa.gov/wastewise.

BEGIN THE PROCESS, LEARN MORE AND SAVE!

The best first step is to perform an energy audit on your facility. Energy service providers (utilities), state energy offices, and private sector product and service providers can assist you in identifying a trained professional to conduct your audit. However, comprehensive, affordable energy audits are not available everywhere in the country for commercial food service businesses.

To help address the lack of energy audits in many communities, ENERGY STAR provides free online tools and information to achieve energy savings. ENERGY STAR's basic guidance for self-assessments is part of the Guidelines for Energy Management, "Step 2: Assess Performance," at: www.energystar.gov/guidelines.

In addition, ENERGY STAR's Portfolio Manager software is designed to help businesses "benchmark" and track energy use, costs, and greenhouse gas emissions. Portfolio Manager also offers the option to track water use and renewable energy credits—all in a password protected online file. Portfolio Manager users can track multiple facilities independently or aggregate all the business locations into one file. Your restaurant can generate a Statement of Energy Performance which includes a "weather-normalized" kBtu/ft^2 energy use intensity calculation, associated greenhouse gas emissions and a national average for similar building types. Access to the software and free online training in use of Portfolio Manager is available at: www.energystar.gov/benchmark.

Once you have identified the areas of potential energy savings, decide which energy efficiency upgrades you want to install and what practices to initiate. If your finances and operating schedule make it impractical to perform all the upgrades at once, you can take a staged approached and install them as time and money allow.

Remember, having your **restaurant manager** 100 percent on board is absolutely key to saving your restaurant money and protecting the environment! Your best-laid energy-saving plans are only as good as the staff that is implementing them!

For more information, please consult the following online resources:

- ENERGY STAR Commercial Food Service: www.energystar.gov/cfs
- ENERGY STAR Restaurants: www.energystar.gov/restaurants
- ENERGY STAR Portfolio Manager: www.energystar.gov/benchmark
- PG&E Food Service Technology Center: www.fishnick.com
- National Restaurant Association Conserve: http://conserve.restaurant.org
- EPA WaterSense: www.epa.gov/watersense
- EPA WasteWise: www.epa.gov/wastewise

Find Monetary Incentives

ENERGY STAR CFS Incentive Finder: go to www.energystar.gov/cfs and click on "Special Offers" or go to www.energystar.gov/cfsrebate _ locator

November 2010

EPA 430-R-09-030

For more information visit www.energystar.gov.

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