

**Freus Energy Savings
Under California Title 24 and
Federal Tax Credit Rules**

For

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By

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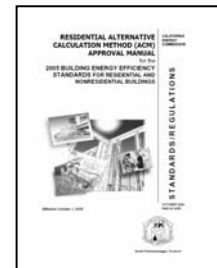
Summary

This report compares calculated energy savings for a prototype home to study issues related to the use of the Freus evaporative condenser under California Title 24 Building Energy Standards and the Federal Tax Credits. On a statewide basis:

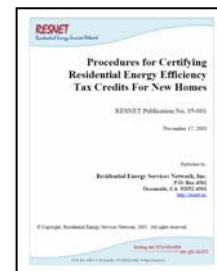
1. The Freus 15 EERa /17 EERb unit provides a compliance savings of 39% of the cooling and 18% of the total TDV compliance budgets.
2. The Freus 15 EERa /17 EERb unit provides an early retirement savings of 48% of the cooling kWh. In comparison, the early retirement savings of a 13 SEER air conditioner is 16%.
3. The Freus 15 EERa /17 EERb unit combined with a home meeting California Prescriptive requirements provides a tax credit savings of 59% of the cooling and 41% of the total kBtu/ft2 tax credit budgets. A savings of 50% of the total is needed to meet tax credit criteria. Improving the Freus unit to a 16 EERa /18 EERb improved the tax credit savings to 61% of the cooling and 42% of the total. In most cases, it does not appear that a higher efficiency Freus unit alone will be enough to meet tax credit criteria.

Software

Two versions of MICROPAS® are used in this analysis. Runs using the 2005 Title 24 rules use the most recent version approved by the California Energy Commission (CEC) following the requirements of the Alternative Calculation Methods (ACM) manual¹. The metric used in the 2005 Title 24 standards is the “Time Dependent Valuation” where electrical energy used at on peak conditions is valued at a higher rate than that used at off peak times.



Runs using the IECC rules use a revised MICROPAS Tax Credit version that follows the rules in the corrected Residential Energy Services Network (RESNET) Publication No. 06-001². The correction uses the RESNET “Normalized Modified Loads” metric to determine the energy savings. The software was also updated to be compliant with RESNET Technical Interpretation 2007-01.

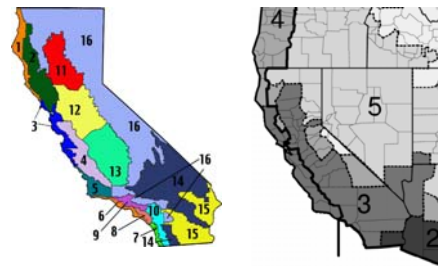


¹ See <http://www.energy.ca.gov/title24/2005standards>

² See http://www.natresnet.org/standards/tax_credits

Climate Zones and Housing Starts

California has very diverse climates that significantly impact energy use. Recognizing this, Title 24 has divided the state into 16 unique climate zones. Under IECC, climate zones are set by county boundaries. Most of California is in IECC climate zone 3. This study uses the CEC weather data for each of the 16 climate zones.



Since the energy use patterns and construction activity differ significantly by climate zone, the CEC often uses housing starts to weight the results into statewide values. Table 1 shows the climate zone mapping and the 2005 single family housing starts used to weight the results in this study.

Table 1 – Climate Zones and Housing Starts

Climate Zones and Housing Starts				
Title 24 Climate Zone	IECC Climate Zone		Starts	Percent
1	4 Marine		350	0.2%
2	3		2816	1.8%
3	3		4853	3.1%
4	3		4158	2.7%
5	3		1172	0.8%
6	3		6313	4.1%
7	3		4203	2.7%
8	3		3377	2.2%
9	3		4336	2.8%
10	3		23819	15.4%
11	3		10382	6.7%
12	3		32062	20.7%
13	3		19015	12.3%
14	3		15606	10.1%
15	2		14034	9.1%
16	5		8338	5.4%
Total			154834	100.00%

Prototype

The runs described in this report were completed for a 2689 ft² two story slab on grade prototype home. The home is modeled with:

- Window area equal to 20% (a key amount in the Title-24 standard) of the floor area and the windows equally distributed on the north, east, south and west.
- Gas space heating and water heating normally found in new construction in the region.
- 3 tons of cooling except in the hotter climate zones 13, 14 and 15 where a 4 ton system was used.



Results

Results are tabulated four ways:

1. TDV/ft² or kBtu/ft² – TDV/ft² is the measurement used for compliance. Normalized Modified loads expressed in units of kBtu/ft² is the measurement used for Tax Credits.
2. kWh – the electrical energy used for space cooling and space heating fans in accordance with Title 24 rules.
3. Time-of-Use kWh – Shows the kWh used binned into off peak, mid peak and on peak categories using the definitions that PG&E uses. On peak is between 1pm and 8pm from May through October.
4. Average Grid Impact kWh – the average grid impact from 2-5pm of the three consecutive weekday periods containing the hottest weekday of the year.

The values at the bottom of the tables in pink or yellow are the most relevant statewide results.

What are the Compliance Savings for Freus 15/17?

To answer this question, the prototype with exactly the Title-24 prescriptive requirements was run in the Title 24 version of MICROPAS. The home was then run in each climate zone with a Freus 15 EERa / 17 EERb system.

Table 2 – Compliance Savings for Freus 15/17 – TDV/ft2

Title 24 Compliance Savings (TDV/ft2) California Prescriptive Packages with Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(TDV/ft2)											
	Standard				Freus 15/17				Savings			
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total
1	18.59	0.16	9.83	28.58	18.59	0.12	9.83	28.54	0%	25%	0%	0%
2	22.15	8.66	9.52	40.33	22.15	5.61	9.52	37.28	0%	35%	0%	8%
3	13.64	2.94	9.51	26.09	13.64	2.20	9.51	25.35	0%	25%	0%	3%
4	16.60	3.51	9.39	29.50	16.60	2.67	9.39	28.66	0%	24%	0%	3%
5	12.98	3.21	9.49	25.68	12.98	2.34	9.49	24.81	0%	27%	0%	3%
6	5.34	3.54	10.17	19.05	5.34	2.68	10.17	18.19	0%	24%	0%	5%
7	5.81	2.61	10.15	18.57	5.81	2.06	10.15	18.02	0%	21%	0%	3%
8	6.95	8.65	10.03	25.63	6.95	6.19	10.03	23.17	0%	28%	0%	10%
9	7.15	14.00	9.96	31.11	7.15	9.68	9.96	26.79	0%	31%	0%	14%
10	9.20	22.07	9.95	41.22	9.20	14.05	9.95	33.20	0%	36%	0%	19%
11	19.36	19.94	9.23	48.53	19.36	12.28	9.23	40.87	0%	38%	0%	16%
12	17.58	13.73	9.34	40.65	17.58	8.81	9.34	35.73	0%	36%	0%	12%
13	13.49	30.26	8.97	52.72	13.49	18.77	8.97	41.23	0%	38%	0%	22%
14	18.85	30.58	10.14	59.57	18.85	17.53	10.14	46.52	0%	43%	0%	22%
15	2.88	65.71	8.99	77.58	2.88	38.07	8.99	49.94	0%	42%	0%	36%
16	37.61	8.75	10.10	56.46	37.61	6.03	10.10	53.74	0%	31%	0%	5%
Average	14.26	14.90	9.67	38.83	14.26	9.32	9.67	33.25	0%	37%	0%	14%
Weighted	14.34	21.97	9.57	45.88	14.34	13.49	9.57	37.40	0%	39%	0%	18%

Table 3 – Compliance Savings for Freus 15/17 – kWh

Title 24 Compliance Savings (kWh) California Prescriptive Packages with Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(kWh)											
	Standard				Freus 15/17				Savings			
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total
1	192	13	0	205	192	11	0	202	0%	20%	0%	1%
2	228	927	0	1156	228	615	0	843	0%	34%	0%	27%
3	139	292	0	431	139	218	0	357	0%	25%	0%	17%
4	171	399	0	570	171	310	0	481	0%	22%	0%	16%
5	134	334	0	467	134	244	0	378	0%	27%	0%	19%
6	53	381	0	433	53	289	0	341	0%	24%	0%	21%
7	58	263	0	320	58	205	0	263	0%	22%	0%	18%
8	71	812	0	882	71	591	0	662	0%	27%	0%	25%
9	71	1468	0	1539	71	1035	0	1106	0%	30%	0%	28%
10	92	2322	0	2414	92	1526	0	1618	0%	34%	0%	33%
11	197	2421	0	2618	197	1523	0	1720	0%	37%	0%	34%
12	179	1450	0	1628	179	966	0	1145	0%	33%	0%	30%
13	137	3803	0	3939	137	2392	0	2529	0%	37%	0%	36%
14	189	3285	0	3475	189	1917	0	2106	0%	42%	0%	39%
15	29	8987	0	9016	29	5297	0	5326	0%	41%	0%	41%
16	386	1001	0	1387	386	699	0	1085	0%	30%	0%	22%
Average	145	1760	0	1905	145	1115	0	1260	0%	37%	0%	34%
Weighted	145	2607	0	2752	145	1629	0	1775	0%	38%	0%	36%

Table 4 – Compliance Savings for Freus 15/17 – Time-of-Use kWh

Title 24 Compliance Savings (Time-of-Use kWh) California Prescriptive Packages with Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(Time-of-Use kWh)											
	Standard				Freus 15/17				Savings			
	Off	Mid	On	Total	Off	Mid	On	Total	Off	Mid	On	Total
1	186	12	9	207	185	12	7	204	1%	0%	22%	1%
2	414	94	645	1153	345	69	429	843	17%	27%	33%	27%
3	250	25	156	431	221	20	118	359	12%	20%	24%	17%
4	259	50	259	568	236	41	203	480	9%	18%	22%	15%
5	252	51	163	466	220	38	120	378	13%	25%	26%	19%
6	249	9	177	435	197	7	138	342	21%	22%	22%	21%
7	115	8	197	320	102	6	155	263	11%	25%	21%	18%
8	282	67	532	881	220	48	393	661	22%	28%	26%	25%
9	621	125	794	1540	452	91	563	1106	27%	27%	29%	28%
10	742	318	1355	2415	524	209	884	1617	29%	34%	35%	33%
11	712	402	1504	2618	508	269	944	1721	29%	33%	37%	34%
12	486	173	970	1629	377	125	643	1145	22%	28%	34%	30%
13	1034	636	2269	3939	701	417	1411	2529	32%	34%	38%	36%
14	954	539	1981	3474	634	322	1150	2106	34%	40%	42%	39%
15	3266	2113	3638	9017	1996	1242	2087	5325	39%	41%	43%	41%
16	551	104	732	1387	491	82	513	1086	11%	21%	30%	22%
Average	648	295	961	1905	463	187	610	1260	29%	37%	37%	34%
Weighted	873	451	1429	2753	600	284	890	1774	31%	37%	38%	36%

Table 5 – Compliance Savings for Freus 15/17 – Average Grid Impact kWh

Title 24 Compliance Savings (Average Grid Impact 2-5 pm kWh) California Prescriptive Packages with Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(Average Grid Impact 2-5 pm kWh)											
	Standard				Freus 15/17				Savings			
	Day1	Day2	Day3	Ave	Day1	Day2	Day3	Ave	Day1	Day2	Day3	Ave
1	3.6	0.0	0.0	0.4	2.7	0.0	0.0	0.3	26%	0%	0%	26%
2	13.0	13.3	11.4	4.2	7.7	8.1	7.7	2.6	41%	39%	33%	38%
3	5.3	8.7	9.7	2.6	4.3	7.0	7.4	2.1	19%	20%	23%	21%
4	6.0	11.0	7.3	2.7	4.9	8.0	6.0	2.1	19%	28%	17%	22%
5	9.9	10.5	2.1	2.5	7.3	7.1	1.5	1.8	26%	32%	28%	29%
6	0.0	9.2	0.0	1.0	0.0	7.3	0.0	0.8	0%	20%	0%	20%
7	2.8	2.7	0.0	0.6	2.2	2.0	0.0	0.5	19%	27%	0%	23%
8	9.6	12.0	11.4	3.7	6.4	7.5	7.3	2.3	33%	38%	36%	36%
9	4.7	9.7	13.4	3.1	3.6	6.8	8.2	2.1	25%	30%	38%	33%
10	13.9	13.7	13.1	4.5	7.8	7.8	7.9	2.6	43%	43%	40%	42%
11	14.5	12.9	12.7	4.5	7.6	8.2	8.2	2.7	47%	36%	35%	40%
12	13.9	14.1	12.3	4.5	8.0	8.4	8.2	2.7	43%	40%	33%	39%
13	19.1	17.7	18.5	6.1	10.2	10.0	10.6	3.4	47%	44%	43%	44%
14	18.8	19.2	19.5	6.4	10.1	10.2	10.0	3.4	46%	47%	49%	47%
15	20.5	21.4	19.8	6.9	11.1	11.0	10.4	3.6	46%	49%	48%	47%
16	12.2	13.5	12.7	4.3	7.7	8.0	7.7	2.6	37%	40%	39%	39%
Average	10.5	11.8	10.2	3.6	6.3	7.3	6.3	2.2	39%	38%	38%	39%
Weighted	13.8	14.5	13.5	4.6	7.8	8.5	8.1	2.7	43%	41%	40%	42%

What are the Early Retirement Savings for Freus 15/17?

To answer this question, the prototype with the Title-24 prescriptive requirements was run in the Title 24 version of MICROPAS except for:

1. A 10 SEER / 9 EER air conditioner was included in the standard case
2. Neither case included credits for duct testing or a TXV that would require third party verification under Title 24

The home was then run in each climate zone with a Freus 15 EERa / 17 EERb system.

Table 6 – Early Retirement Savings for Freus 15/17 – TDV/ft2

Early Retirement Savings (TDV/ft2) California Prescriptive Packages without Verification and Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(TDV/ft2)											
	AC 10/9				Freus 15/17				Savings			
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total
1	21.64	0.20	9.83	31.67	21.64	0.11	9.83	31.58	0%	45%	0%	0%
2	25.29	11.79	9.52	46.60	25.29	6.30	9.52	41.11	0%	47%	0%	12%
3	15.74	3.98	9.51	29.23	15.74	2.32	9.51	27.57	0%	42%	0%	6%
4	18.87	4.62	9.39	32.88	18.87	2.78	9.39	31.04	0%	40%	0%	6%
5	15.12	4.36	9.49	28.97	15.12	2.47	9.49	27.08	0%	43%	0%	7%
6	6.21	4.74	10.17	21.12	6.21	2.77	10.17	19.15	0%	42%	0%	9%
7	6.66	3.53	10.15	20.34	6.66	2.16	10.15	18.97	0%	39%	0%	7%
8	7.92	11.95	10.03	29.90	7.92	6.87	10.03	24.82	0%	43%	0%	17%
9	8.20	19.10	9.96	37.26	8.20	10.83	9.96	28.99	0%	43%	0%	22%
10	10.54	29.63	9.95	50.12	10.54	15.77	9.95	36.26	0%	47%	0%	28%
11	22.32	26.73	9.23	58.28	22.32	13.88	9.23	45.43	0%	48%	0%	22%
12	20.21	18.35	9.34	47.90	20.21	9.86	9.34	39.41	0%	46%	0%	18%
13	15.55	41.13	8.97	65.65	15.55	21.66	8.97	46.18	0%	47%	0%	30%
14	22.11	42.31	10.14	74.56	22.11	20.63	10.14	52.88	0%	51%	0%	29%
15	3.41	91.58	8.99	103.98	3.41	44.93	8.99	57.33	0%	51%	0%	45%
16	44.79	11.54	10.10	66.43	44.79	6.31	10.10	61.20	0%	45%	0%	8%
Average	16.54	20.35	9.67	46.56	16.54	10.60	9.67	36.81	0%	48%	0%	21%
Weighted	16.62	29.97	9.57	56.16	16.62	15.46	9.57	41.65	0%	48%	0%	26%

Table 7 – Early Retirement Savings for Freus 15/17 – kWh

Early Retirement Savings (kWh) California Prescriptive Packages without Verification and Freus 15/17 2689 ft2 Two Story													
Title 24 Climate Zone	(kWh)												
	AC 10/9				Freus 15/17				Savings				
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	
1	226	18	0	244	226	11	0	236	0%	43%	0%	3%	
2	260	1287	0	1547	260	696	0	956	0%	46%	0%	38%	
3	160	391	0	552	160	228	0	389	0%	42%	0%	30%	
4	194	525	0	720	194	318	0	512	0%	40%	0%	29%	
5	158	449	0	607	158	255	0	412	0%	43%	0%	32%	
6	63	509	0	573	63	297	0	360	0%	42%	0%	37%	
7	66	352	0	418	66	215	0	281	0%	39%	0%	33%	
8	79	1129	0	1208	79	654	0	733	0%	42%	0%	39%	
9	81	2046	0	2127	81	1163	0	1245	0%	43%	0%	41%	
10	105	3199	0	3304	105	1731	0	1836	0%	46%	0%	44%	
11	228	3335	0	3564	228	1752	0	1980	0%	47%	0%	44%	
12	205	2004	0	2209	205	1100	0	1305	0%	45%	0%	41%	
13	158	5260	0	5418	158	2792	0	2949	0%	47%	0%	46%	
14	221	4641	0	4861	221	2285	0	2505	0%	51%	0%	48%	
15	34	12787	0	12821	34	6366	0	6400	0%	50%	0%	50%	
16	462	1339	0	1802	462	735	0	1198	0%	45%	0%	34%	
Average	169	2455	0	2623	169	1287	0	1456	0%	48%	0%	44%	
Weighted	168	3641	0	3809	168	1896	0	2065	0%	48%	0%	46%	

Table 8 – Early Retirement Savings for Freus 15/17 – Time-of-Use kWh

Early Retirement Savings (Time-of-Use kWh) California Prescriptive Packages without Verification and Freus 15/17 2689 ft2 Two Story													
Title 24 Climate Zone	(Time-of-Use kWh)												
	AC 10/9				Freus 15/17				Savings				
	Off	Mid	On	Total	Off	Mid	On	Total	Off	Mid	On	Total	
1	217	15	11	243	214	14	6	234	1%	7%	45%	4%	
2	517	137	894	1548	391	81	483	955	24%	41%	46%	38%	
3	310	33	211	554	245	22	123	390	21%	33%	42%	30%	
4	313	64	340	717	261	42	208	511	17%	34%	39%	29%	
5	318	70	220	608	246	41	125	412	23%	41%	43%	32%	
6	329	10	234	573	212	6	140	358	36%	40%	40%	38%	
7	143	10	265	418	112	7	162	281	22%	30%	39%	33%	
8	374	95	740	1209	245	55	433	733	34%	42%	41%	39%	
9	841	185	1102	2128	507	108	630	1245	40%	42%	43%	41%	
10	1004	477	1824	3305	589	260	988	1837	41%	45%	46%	44%	
11	930	630	2004	3564	583	346	1051	1980	37%	45%	48%	44%	
12	623	269	1317	2209	428	157	720	1305	31%	42%	45%	41%	
13	1385	947	3086	5418	807	519	1624	2950	42%	45%	47%	46%	
14	1292	825	2744	4861	745	414	1347	2506	42%	50%	51%	48%	
15	4709	3260	4852	12821	2396	1629	2375	6400	49%	50%	51%	50%	
16	681	140	979	1800	564	93	540	1197	17%	34%	45%	34%	
Average	874	448	1301	2624	534	237	685	1456	39%	47%	47%	45%	
Weighted	1189	688	1933	3810	695	362	1007	2065	42%	47%	48%	46%	

Table 9 – Early Retirement Savings for Freus 15/17 – Average Grid Impact kWh

Early Retirement Savings (Average Grid Impact 2-5 pm kWh) California Prescriptive Packages without Verification and Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(Average Grid Impact 2-5 pm kWh)											
	AC 10/9				Freus 15/17				Savings			
	Day1	Day2	Day3	Ave	Day1	Day2	Day3	Ave	Day1	Day2	Day3	Ave
1	4.8	0.0	0.0	0.5	2.7	0.0	0.0	0.3	43%	0%	0%	43%
2	16.1	16.4	14.9	5.3	8.2	8.7	8.2	2.8	49%	47%	45%	47%
3	7.2	11.8	13.1	3.6	4.5	7.3	7.7	2.2	38%	38%	41%	39%
4	8.3	14.8	10.0	3.7	5.2	8.8	6.5	2.3	37%	40%	35%	38%
5	13.4	14.0	2.9	3.4	7.7	7.4	1.6	1.9	43%	47%	44%	45%
6	0.0	12.6	0.0	1.4	0.0	7.7	0.0	0.9	0%	39%	0%	39%
7	3.7	3.6	0.0	0.8	2.3	2.1	0.0	0.5	38%	43%	0%	40%
8	13.5	15.3	15.1	4.9	7.2	8.0	7.9	2.6	47%	48%	47%	47%
9	6.8	13.8	16.5	4.1	3.9	7.8	8.8	2.3	42%	44%	47%	45%
10	17.2	16.9	16.2	5.6	8.4	8.3	8.4	2.8	51%	51%	48%	50%
11	18.2	15.9	15.7	5.5	8.2	8.8	8.7	2.9	55%	45%	44%	48%
12	17.2	17.6	15.5	5.6	8.5	9.0	8.8	2.9	51%	49%	43%	48%
13	23.9	22.0	23.0	7.6	10.9	10.8	11.4	3.7	54%	51%	51%	52%
14	23.4	24.1	24.7	8.0	10.8	10.9	10.7	3.6	54%	55%	56%	55%
15	26.2	27.9	25.1	8.8	11.9	11.7	11.1	3.9	55%	58%	56%	56%
16	14.9	15.7	15.2	5.1	7.7	8.0	7.7	2.6	48%	49%	49%	49%
Average	13.4	15.2	13.0	4.6	6.8	7.8	6.7	2.4	50%	48%	48%	49%
Weighted	17.3	18.3	16.9	5.8	8.3	9.1	8.6	2.9	52%	50%	49%	50%

What are the Early Retirement Savings for AC 13/10?

To answer this question, the same runs done to estimate the early retirement savings for the Freus 15/17 were rerun using a split system air conditioner with a 13 SEER / 10 EER. This set of runs were done to show a comparison to upgrading an older system with a regular air conditioner compared to a Freus unit.

Table 10 – Early Retirement Savings for AC 13/10 – TDV/ft2

Early Retirement Savings (TDV/ft2) California Prescriptive Packages without Verification and AC 13/10 2689 ft2 Two Story												
Title 24 Climate Zone	(TDV/ft2)											
	AC 10/9				AC 13/10				Savings			
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total
1	21.64	0.20	9.83	31.67	21.64	0.15	9.83	31.62	0%	25%	0%	0%
2	25.29	11.79	9.52	46.60	25.29	9.71	9.52	44.52	0%	18%	0%	4%
3	15.74	3.98	9.51	29.23	15.74	3.09	9.51	28.34	0%	22%	0%	3%
4	18.87	4.62	9.39	32.88	18.87	3.67	9.39	31.93	0%	21%	0%	3%
5	15.12	4.36	9.49	28.97	15.12	3.39	9.49	28.00	0%	22%	0%	3%
6	6.21	4.74	10.17	21.12	6.21	3.65	10.17	20.03	0%	23%	0%	5%
7	6.66	3.53	10.15	20.34	6.66	2.73	10.15	19.54	0%	23%	0%	4%
8	7.92	11.95	10.03	29.90	7.92	9.61	10.03	27.56	0%	20%	0%	8%
9	8.20	19.10	9.96	37.26	8.20	15.67	9.96	33.83	0%	18%	0%	9%
10	10.54	29.63	9.95	50.12	10.54	24.73	9.95	45.22	0%	17%	0%	10%
11	22.32	26.73	9.23	58.28	22.32	22.48	9.23	54.03	0%	16%	0%	7%
12	20.21	18.35	9.34	47.90	20.21	15.36	9.34	44.91	0%	16%	0%	6%
13	15.55	41.13	8.97	65.65	15.55	34.94	8.97	59.46	0%	15%	0%	9%
14	22.11	42.31	10.14	74.56	22.11	36.00	10.14	68.25	0%	15%	0%	8%
15	3.41	91.58	8.99	103.98	3.41	77.73	8.99	90.13	0%	15%	0%	13%
16	44.79	11.54	10.10	66.43	44.79	9.15	10.10	64.04	0%	21%	0%	4%
Average	16.54	20.35	9.67	46.56	16.54	17.00	9.67	43.21	0%	16%	0%	7%
Weighted	16.62	29.97	9.57	56.16	16.62	25.22	9.57	51.41	0%	16%	0%	8%

Table 11 – Early Retirement Savings for AC 13/10 – kWh

Early Retirement Savings (kWh) California Prescriptive Packages without Verification and AC 13/10 2689 ft2 Two Story													
Title 24 Climate Zone	(kWh)												
	AC 10/9				AC 13/10				Savings				
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	
1	226	18	0	244	226	13	0	239	0%	29%	0%	2%	
2	260	1287	0	1547	260	1045	0	1305	0%	19%	0%	16%	
3	160	391	0	552	160	305	0	465	0%	22%	0%	16%	
4	194	525	0	720	194	410	0	604	0%	22%	0%	16%	
5	158	449	0	607	158	347	0	504	0%	23%	0%	17%	
6	63	509	0	573	63	394	0	457	0%	23%	0%	20%	
7	66	352	0	418	66	273	0	339	0%	22%	0%	19%	
8	79	1129	0	1208	79	896	0	974	0%	21%	0%	19%	
9	81	2046	0	2127	81	1649	0	1731	0%	19%	0%	19%	
10	105	3199	0	3304	105	2629	0	2734	0%	18%	0%	17%	
11	228	3335	0	3564	228	2773	0	3002	0%	17%	0%	16%	
12	205	2004	0	2209	205	1647	0	1851	0%	18%	0%	16%	
13	158	5260	0	5418	158	4436	0	4593	0%	16%	0%	15%	
14	221	4641	0	4861	221	3916	0	4136	0%	16%	0%	15%	
15	34	12787	0	12821	34	10817	0	10852	0%	15%	0%	15%	
16	462	1339	0	1802	462	1050	0	1513	0%	22%	0%	16%	
Average	169	2455	0	2623	169	2037	0	2206	0%	17%	0%	16%	
Weighted	168	3641	0	3809	168	3039	0	3208	0%	17%	0%	16%	

Table 12 – Early Retirement Savings for AC 13/10 – Time-of-Use kWh

Early Retirement Savings (Time-of-Use kWh) California Prescriptive Packages without Verification and AC 13/10 2689 ft2 Two Story													
Title 24 Climate Zone	(Time-of-Use kWh)												
	AC 10/9				AC 13/10				Savings				
	Off	Mid	On	Total	Off	Mid	On	Total	Off	Mid	On	Total	
1	217	15	11	243	215	14	8	237	1%	7%	27%	2%	
2	517	137	894	1548	468	111	726	1305	9%	19%	19%	16%	
3	310	33	211	554	276	27	164	467	11%	18%	22%	16%	
4	313	64	340	717	286	51	266	603	9%	20%	22%	16%	
5	318	70	220	608	280	55	169	504	12%	21%	23%	17%	
6	329	10	234	573	268	8	180	456	19%	20%	23%	20%	
7	143	10	265	418	126	8	205	339	12%	20%	23%	19%	
8	374	95	740	1209	312	78	586	976	17%	18%	21%	19%	
9	841	185	1102	2128	697	149	887	1733	17%	19%	20%	19%	
10	1004	477	1824	3305	834	393	1508	2735	17%	18%	17%	17%	
11	930	630	2004	3564	815	514	1672	3001	12%	18%	17%	16%	
12	623	269	1317	2209	550	217	1085	1852	12%	19%	18%	16%	
13	1385	947	3086	5418	1190	794	2610	4594	14%	16%	15%	15%	
14	1292	825	2744	4861	1122	695	2321	4138	13%	16%	15%	15%	
15	4709	3260	4852	12821	3929	2778	4144	10851	17%	15%	15%	15%	
16	681	140	979	1800	626	116	769	1511	8%	17%	21%	16%	
Average	874	448	1301	2624	750	376	1081	2206	14%	16%	17%	16%	
Weighted	1189	688	1933	3810	1014	577	1618	3208	15%	16%	16%	16%	

Table 13 – Early Retirement Savings for AC 13/10 – Average Grid Impact kWh

Early Retirement Savings (Average Grid Impact 2-5 pm kWh) California Prescriptive Packages without Verification and AC 13/10 2689 ft2 Two Story													
Title 24 Climate Zone	(Average Grid Impact 2-5 pm kWh)												
	AC 10/9				AC 13/10				Savings				
	Day1	Day2	Day3	Ave	Day1	Day2	Day3	Ave	Day1	Day2	Day3	Ave	
1	4.8	0.0	0.0	0.5	3.7	0.0	0.0	0.4	23%	0%	0%	23%	
2	16.1	16.4	14.9	5.3	13.9	14.2	12.2	4.5	13%	13%	18%	15%	
3	7.2	11.8	13.1	3.6	5.6	9.1	10.1	2.8	23%	23%	23%	23%	
4	8.3	14.8	10.0	3.7	6.5	12.2	7.8	3.0	21%	17%	22%	20%	
5	13.4	14.0	2.9	3.4	10.4	10.9	2.2	2.6	23%	23%	23%	23%	
6	0.0	12.6	0.0	1.4	0.0	9.7	0.0	1.1	0%	23%	0%	23%	
7	3.7	3.6	0.0	0.8	2.8	2.8	0.0	0.6	23%	22%	0%	22%	
8	13.5	15.3	15.1	4.9	10.7	12.8	12.4	4.0	20%	16%	18%	18%	
9	6.8	13.8	16.5	4.1	5.2	11.1	14.3	3.4	23%	20%	13%	17%	
10	17.2	16.9	16.2	5.6	14.9	14.7	14.0	4.8	13%	13%	13%	13%	
11	18.2	15.9	15.7	5.5	15.6	13.8	13.5	4.8	14%	13%	14%	14%	
12	17.2	17.6	15.5	5.6	14.9	15.2	13.2	4.8	13%	14%	15%	14%	
13	23.9	22.0	23.0	7.6	20.5	19.2	19.9	6.6	14%	13%	13%	13%	
14	23.4	24.1	24.7	8.0	20.2	20.7	21.1	6.9	14%	14%	14%	14%	
15	26.2	27.9	25.1	8.8	22.2	23.3	21.4	7.4	15%	16%	15%	16%	
16	14.9	15.7	15.2	5.1	12.2	13.5	12.7	4.3	18%	14%	17%	16%	
Average	13.4	15.2	13.0	4.6	11.2	12.7	10.9	3.9	16%	16%	16%	16%	
Weighted	17.3	18.3	16.9	5.8	14.8	15.6	14.4	5.0	15%	15%	15%	15%	

What are the Tax Credit Savings for Freus 15/17 and Freus 16/18?

To answer these questions, the prototype with exactly the Title-24 prescriptive requirements was run in the Tax Credit version of MICROPAS. The home was then run in each climate zone with a Freus 15 EERa / 17 EERb system and then a 16/18 system. A savings of 50% of the total is needed to meet tax credit criteria. Note that water heating (DHW) is not included in tax credit calculations for new construction.

Table 14 – Tax Credit Savings for Freus 15/17 – kBtu/ft2

Tax Credit Savings (Normalized Modified Loads kBtu/ft2) California Prescriptive Packages with Freus 15/17 2689 ft2 Two Story												
Title 24 Climate Zone	(Normalized Modified Loads kBtu/ft2)											
	Reference				Freus 15/17				Savings			
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total
1	7.84	0.05	0.00	7.89	12.35	0.05	0.00	12.40	-58%	0%	0%	-57%
2	14.62	4.22	0.00	18.84	11.38	1.93	0.00	13.31	22%	54%	0%	29%
3	10.72	0.64	0.00	11.36	7.28	0.83	0.00	8.11	32%	-30%	0%	29%
4	11.05	2.66	0.00	13.71	8.85	1.36	0.00	10.21	20%	49%	0%	26%
5	10.09	0.75	0.00	10.84	6.79	0.93	0.00	7.72	33%	-24%	0%	29%
6	5.39	1.07	0.00	6.46	3.08	1.14	0.00	4.22	43%	-7%	0%	35%
7	4.94	1.91	0.00	6.85	3.34	1.03	0.00	4.37	32%	46%	0%	36%
8	6.01	4.21	0.00	10.22	3.98	1.97	0.00	5.95	34%	53%	0%	42%
9	5.89	6.23	0.00	12.12	4.10	2.91	0.00	7.01	30%	53%	0%	42%
10	7.60	8.64	0.00	16.24	5.04	3.85	0.00	8.89	34%	55%	0%	45%
11	14.32	9.79	0.00	24.11	11.07	3.85	0.00	14.92	23%	61%	0%	38%
12	13.71	6.99	0.00	20.70	9.93	2.79	0.00	12.72	28%	60%	0%	39%
13	10.73	13.49	0.00	24.22	7.81	5.65	0.00	13.46	27%	58%	0%	44%
14	14.05	12.16	0.00	26.21	10.18	4.53	0.00	14.71	28%	63%	0%	44%
15	3.74	29.40	0.00	33.14	1.53	10.90	0.00	12.43	59%	63%	0%	62%
16	19.26	2.74	0.00	22.00	22.10	2.02	0.00	24.12	-15%	26%	0%	-10%
Average	10.00	6.56	0.00	16.56	8.05	2.86	0.00	10.91	19%	56%	0%	34%
Weighted	10.72	9.66	0.00	20.38	8.06	3.98	0.00	12.04	25%	59%	0%	41%

Table 15 – Tax Credit Savings for Freus 16/18 – kBtu/ft2

Tax Credit Savings (Normalized Modified Loads kBtu/ft2) California Prescriptive Packages with Freus 16/18 2689 ft2 Two Story												
Title 24 Climate Zone	(Normalized Modified Loads kBtu/ft2)											
	Reference				Freus 16/18				Savings			
	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total	Heat	Cool	DHW	Total
1	7.84	0.05	0.00	7.89	12.35	0.05	0.00	12.40	-58%	0%	0%	-57%
2	14.62	4.22	0.00	18.84	11.38	1.83	0.00	13.21	22%	57%	0%	30%
3	10.72	0.64	0.00	11.36	7.28	0.79	0.00	8.07	32%	-23%	0%	29%
4	11.05	2.66	0.00	13.71	8.85	1.28	0.00	10.13	20%	52%	0%	26%
5	10.09	0.75	0.00	10.84	6.79	0.88	0.00	7.67	33%	-17%	0%	29%
6	5.39	1.07	0.00	6.46	3.08	1.07	0.00	4.15	43%	0%	0%	36%
7	4.94	1.91	0.00	6.85	3.34	0.97	0.00	4.31	32%	49%	0%	37%
8	6.01	4.21	0.00	10.22	3.98	1.87	0.00	5.85	34%	56%	0%	43%
9	5.89	6.23	0.00	12.12	4.10	2.73	0.00	6.83	30%	56%	0%	44%
10	7.60	8.64	0.00	16.24	5.04	3.63	0.00	8.67	34%	58%	0%	47%
11	14.32	9.79	0.00	24.11	11.07	3.64	0.00	14.71	23%	63%	0%	39%
12	13.71	6.99	0.00	20.70	9.93	2.63	0.00	12.56	28%	62%	0%	39%
13	10.73	13.49	0.00	24.22	7.81	5.33	0.00	13.14	27%	60%	0%	46%
14	14.05	12.16	0.00	26.21	10.18	4.29	0.00	14.47	28%	65%	0%	45%
15	3.74	29.40	0.00	33.14	1.53	10.30	0.00	11.83	59%	65%	0%	64%
16	19.26	2.74	0.00	22.00	22.10	1.92	0.00	24.02	-15%	30%	0%	-9%
Average	10.00	6.56	0.00	16.56	8.05	2.70	0.00	10.75	19%	59%	0%	35%
Weighted	10.72	9.66	0.00	20.38	8.06	3.76	0.00	11.82	25%	61%	0%	42%