Joint Appendix JA3

Appendix JA3 – Time Dependent Valuation (TDV)

JA3.1 Scope and Purpose

Time dependent valuation (TDV) is the currency used to compare energy performance when the performance compliance method is used. TDV is also used to evaluate the cost effectiveness of measures and to perform other codes analysis. TDV replaces source energy, which was used to compare performance prior to the 2005 Standards.

TDV consists of large data sets that convert electricity, gas or propane to TDV energy. The rate of conversion varies for each hour of the year, for each climate zone and for each energy type (electricity, natural gas or propane). The conversion factors also vary by building type: low-rise residential and other building types, including nonresidential, hotel/motel and high-rise residential.~~-~~ There are a total of 144 hourly data sets (16 climate zones x 3 fuel types x 3 building types) where the 3 building types are residential 30 year, nonresidential 15 year, nonresidential 30 year. ~~There are a total of 96 hourly data sets (16 climates x 3 energy types x 2 building types).~~ The actual TDV data may be downloaded from http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/general_cec_documents/2011_TDV_v3_110112.xlsx.~~http://www.energy.ca.gov/title24/2008standards/ or by writing to:~~

~~Time Dependent Valuation (TDV) Data~~
~~Energy Efficiency and Demand Analysis Division~~
~~California Energy Commission~~
~~1516 Ninth St., MS-28~~
~~Sacramento, CA 95814-5512~~

~~The tables to be used are those without externalities.~~ Because of the length, the actual data is not published in this appendix.

JA3.2 Summary of Data

Table 3-1 through Table 3-3 give a statistical summary of the TDV conversion factors for electricity, natural gas and propane. Each table has the annual minimum, maximum, and average for each climate zone and building type.

- Table 3-1 – TDV Statistical Data – Electricity (kBtu/kWh)
- Table 3-2 – TDV Statistical Data – Natural Gas (kBtu/therm)
- Table 3-3 – TDV Statistical Data – Propane (kBtu/therm)

~~For electricity, there are nonresidential conversion factors for both a 15-year and a 30-year life-cycle. The 30-year factors are used to evaluate cost-effectiveness of building envelope measures; 15-year conversion factors are used to evaluate other building measures and for compliance runs. Figure 3-1 through Figure 3-8 show typical variation in the TDV conversion factors for climate zone 12 (Sacramento) for Residential and Nonresidential. Electricity variation is shown for the whole year (Figure 3-1 and Figure 3-3) and for the Month of July (Figure 3-2 and Figure 3-4). Variation is greatest for electricity. Figure 3-5 through Figure 3-8 show the annual variation for natural gas and propane; note that there is no daily or hourly variation, only monthly variation.~~

- ~~Figure 3-1 – Residential Electricity – Climate Zone 12 – Annual~~
- ~~Figure 3-2 – Residential Electricity – Climate Zone 12 – July~~
- ~~Figure 3-3 – Nonresidential Electricity – Climate Zone 12 – Annual~~
- ~~Figure 3-4 – Nonresidential Electricity – Climate Zone 12 – July~~
- ~~Figure 3-5 – Residential Natural Gas – Climate Zone 12 – Annual~~
- ~~Figure 3-6 – Nonresidential Natural Gas – Climate Zone 12 – Annual~~
- ~~Figure 3-7 – Residential Propane – Climate Zone 12 – Annual~~
- ~~Figure 3-8 – Nonresidential Propane – Climate Zone 12 – Annual~~

Table 3-1 – TDV Statistical Data – Electricity (kBtu/kWh)

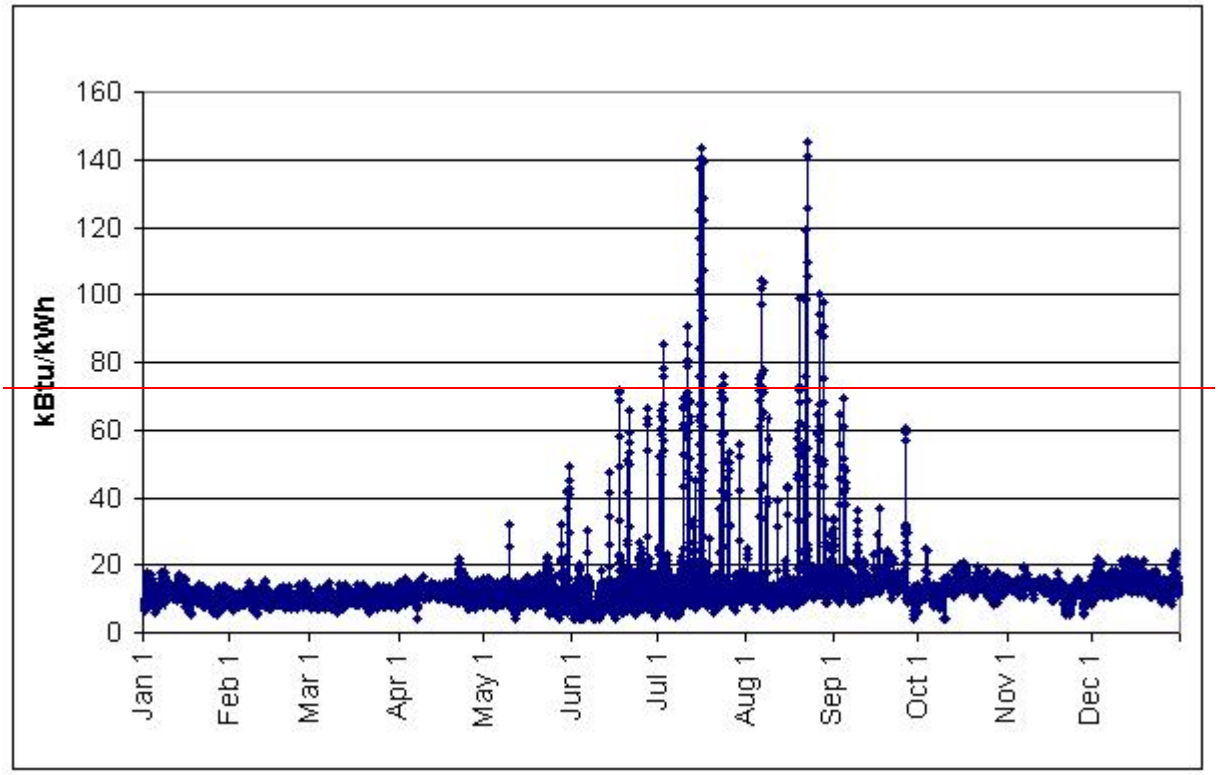
	Residential			Nonresidential (15yr)			Nonresidential (30 yr)		
Climate Zone	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
1	~~3.95~~10.68	~~13.93~~21.26	~~138.65~~165.87	~~7.61~~9.40	~~18.61~~20.89	~~172.92~~188.25	~~6.20~~10.02	~~17.43~~21.92	~~157.69~~184.56
2	10.68~~4.04~~	~~13.94~~21.26	~~137.55~~237.74	~~7.68~~9.35	~~18.58~~20.83	~~172.99~~271.49	~~6.27~~9.96	~~17.40~~21.86	~~156.41~~265.33
3	10.68~~4.28~~	~~13.97~~21.26	~~137.78~~276.54	~~8.06~~9.36	~~18.70~~20.84	~~173.37~~317.49	~~6.62~~9.97	~~17.52~~21.87	~~156.76~~308.99
4	~~4.17~~10.68	~~13.96~~21.26	~~166.14~~254.19	~~7.89~~9.35	~~18.66~~20.84	~~201.27~~290.99	~~6.47~~9.97	~~17.48~~21.87	~~188.63~~283.84
5	~~4.17~~10.67	~~13.95~~21.26	~~137.67~~203.75	~~7.98~~9.42	~~18.73~~20.90	~~173.29~~231.55	~~6.55~~10.03	~~17.55~~21.93	~~156.69~~227.17
6	~~4.07~~9.99	~~14.00~~20.53	~~120.77~~343.04	~~10.32~~9.31	~~21.20~~20.75	~~157.36~~397.14	~~8.80~~9.92	~~19.97~~21.77	~~140.05~~384.48
7	~~7.02~~10.78	~~17.64~~21.32	~~165.65~~308.10	~~3.86~~9.71	~~15.57~~21.15	~~200.08~~352.22	~~2.78~~10.33	~~14.72~~22.18	~~181.20~~344.71
8	~~4.06~~10.02	~~13.98~~20.56	~~131.80~~240.70	~~10.32~~9.32	~~21.18~~20.76	~~164.84~~275.83	~~8.78~~9.94	~~19.94~~21.79	~~152.45~~269.38
9	~~4.00~~9.87	~~13.95~~20.41	~~184.00~~317.59	~~10.22~~9.22	~~21.13~~20.66	~~221.40~~367.04	~~8.71~~9.84	~~19.90~~21.70	~~211.15~~355.93
10	~~3.94~~9.86	~~13.92~~20.40	~~120.64~~241.73	~~10.10~~9.20	~~21.08~~20.64	~~157.13~~277.34	~~8.64~~9.82	~~19.87~~21.68	~~139.89~~270.60
11	~~3.91~~9.86	~~13.93~~21.26	~~182.19~~245.82	~~7.48~~9.37	~~18.53~~20.85	~~226.28~~281.60	~~6.07~~9.98	~~17.35~~21.89	~~206.59~~274.44
12	~~4.01~~10.67	~~13.94~~21.26	~~145.38~~208.46	~~7.62~~9.38	~~18.56~~20.86	~~176.48~~236.81	~~6.20~~9.99	~~17.38~~21.89	~~165.20~~232.43
13	~~4.25~~10.68	~~13.97~~21.26	~~155.19~~175.5	~~8.00~~9.36	~~18.68~~20.84	~~194.14~~197.73	~~6.57~~9.97	~~17.50~~21.87	~~176.33~~195.34
14	~~3.93~~9.85	~~13.92~~20.39	~~153.08~~153.52	~~10.10~~9.20	~~21.08~~20.64	~~195.18~~172.81	~~8.63~~9.82	~~19.87~~21.68	~~176.37~~171.40
15	~~3.92~~9.87	~~13.92~~20.40	~~133.70~~156.97	~~10.08~~9.23	~~21.08~~20.67	~~170.12~~176.90	~~8.62~~9.85	~~19.87~~21.70	~~154.58~~175.29
16	~~3.85~~9.81	~~13.93~~20.35	~~156.86~~225.15	~~7.43~~9.17	~~18.54~~20.61	~~188.67~~257.72	~~6.03~~9.80	~~17.37~~21.65	~~178.11~~251.97

Table 3-2 – TDV Statistical Data – Natural Gas (kBtu/therm)

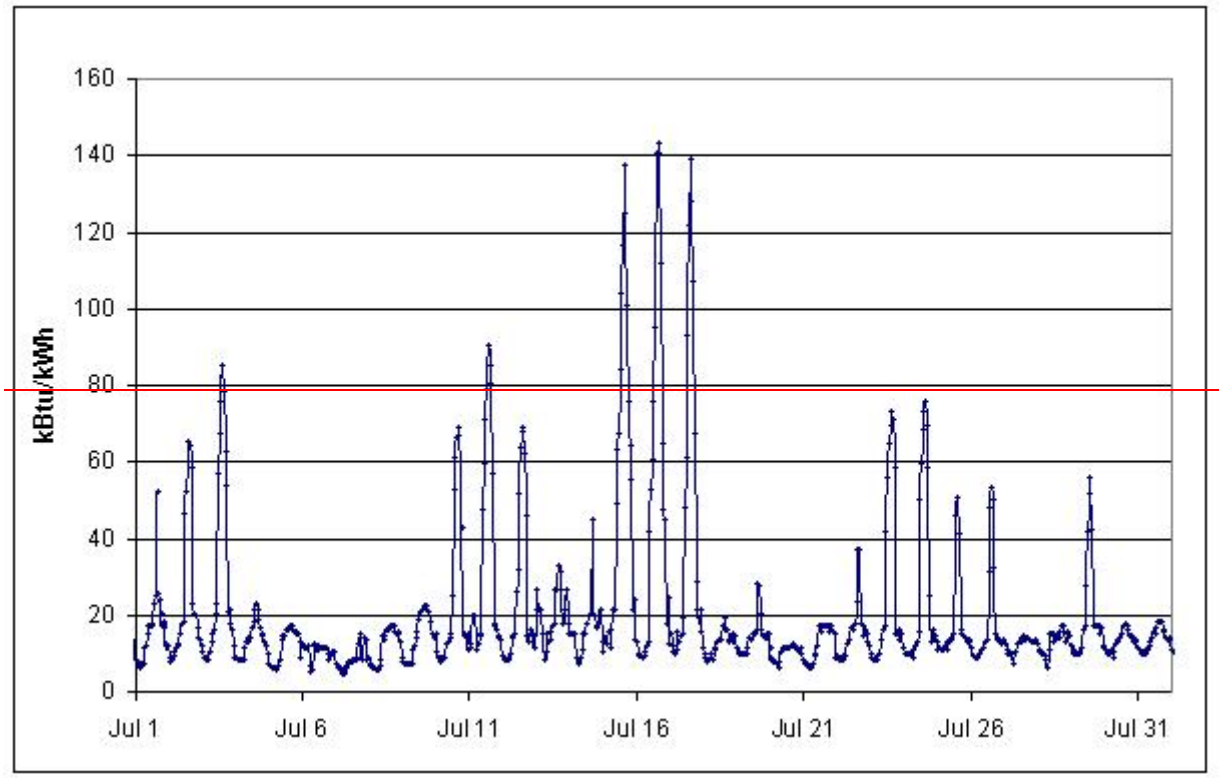
	Residential			Nonresidential (15yr)			Nonresidential (30 year)		
Climate Zone	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
1	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
2	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
3	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
4	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
5	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
6	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~
7	~~138.60~~140.43	~~148.11~~157.62	~~165.73~~181.62	~~141.49~~142.70	~~150.74~~165.49	~~167.87~~197.38	~~153.60~~147.54	~~163.24~~170.12	201.70~~181.08~~
8	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~
9	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~
10	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~
11	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
12	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~16.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
13	~~138.60~~140.86	~~148.11~~159.51	~~165.73~~185.55	~~141.49~~142.20	~~150.74~~163.33	~~167.87~~192.87	~~153.60~~147.02	~~163.24~~167.98	197.27~~181.08~~
14	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~
15	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~
16	~~138.60~~141.14	~~148.11~~160.45	~~165.73~~187.44	~~141.49~~142.50	~~150.74~~164.40	~~167.87~~195.04	~~153.60~~147.33	~~163.24~~169.04	199.40~~181.08~~

Table 3-3 – TDV Statistical Data – Propane (kBtu/therm)

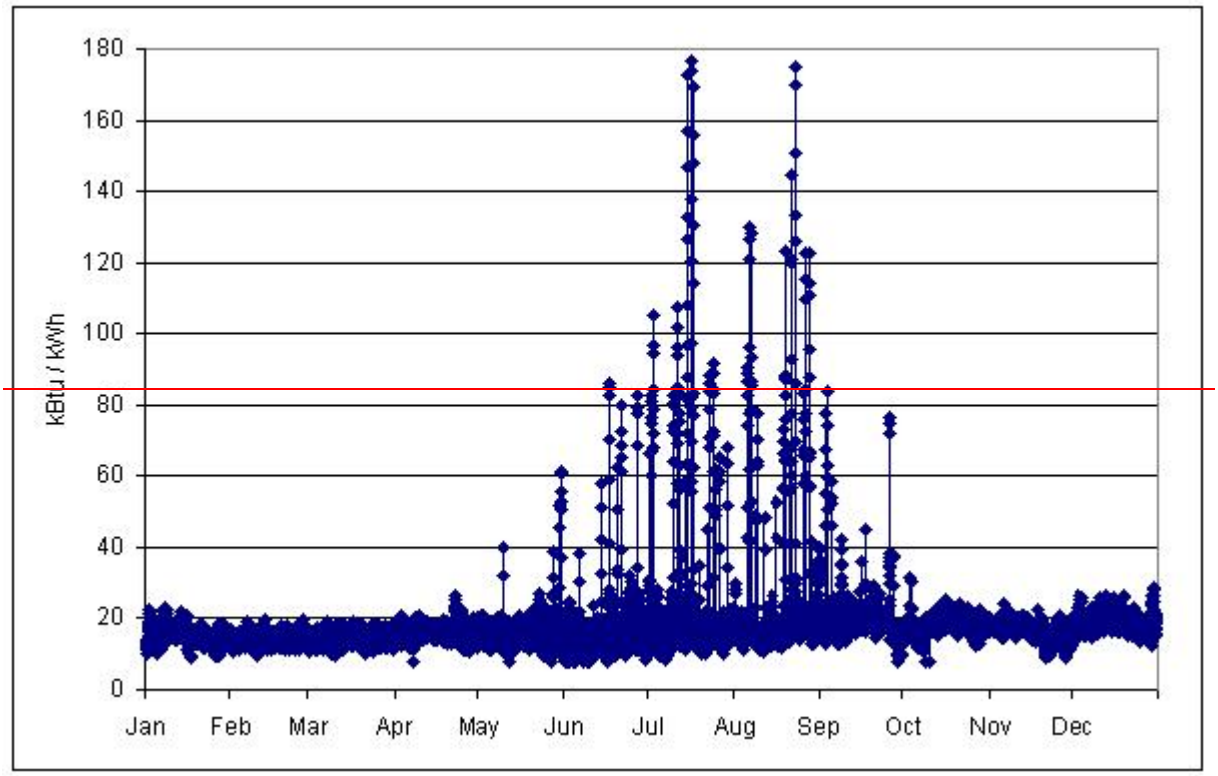
	Residential			Nonresidential (15yr)			Nonresidential (30 year)		
Climate Zone	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum
1	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	~~188.86~~374.89	~~221.92~~438.49	~~160.19~~311.42	~~202.31~~389.24	~~237.72~~454.66
2	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
3	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
4	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
5	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
6	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
7	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
8	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
9	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
10	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
11	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
12	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
13	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
14	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
15	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~
16	328.06~~150.07~~	410.71~~189.53~~	480.19~~222.69~~	299.23~~149.55~~	374.89~~188.86~~	438.49~~221.92~~	311.42~~160.19~~	389.24~~202.31~~	454.66~~237.72~~



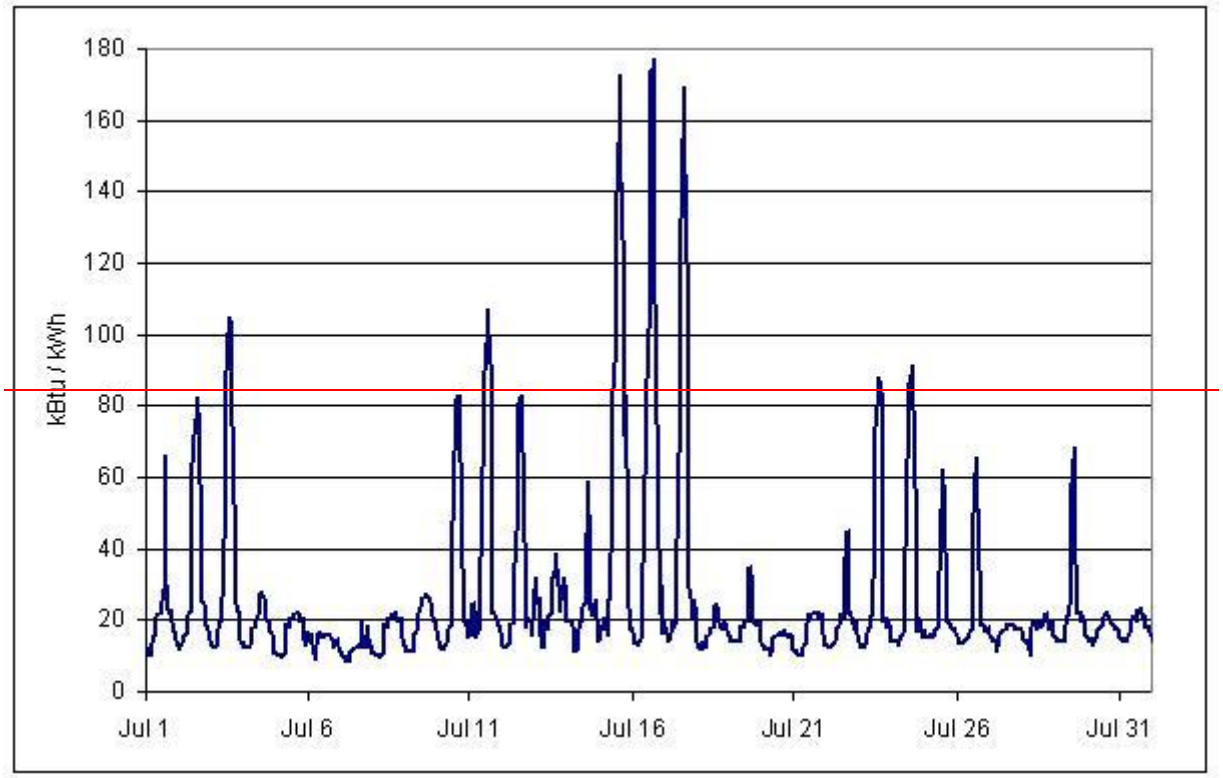
~~*Figure 3-1 – Residential Electricity – Climate Zone 12 – Annual*~~



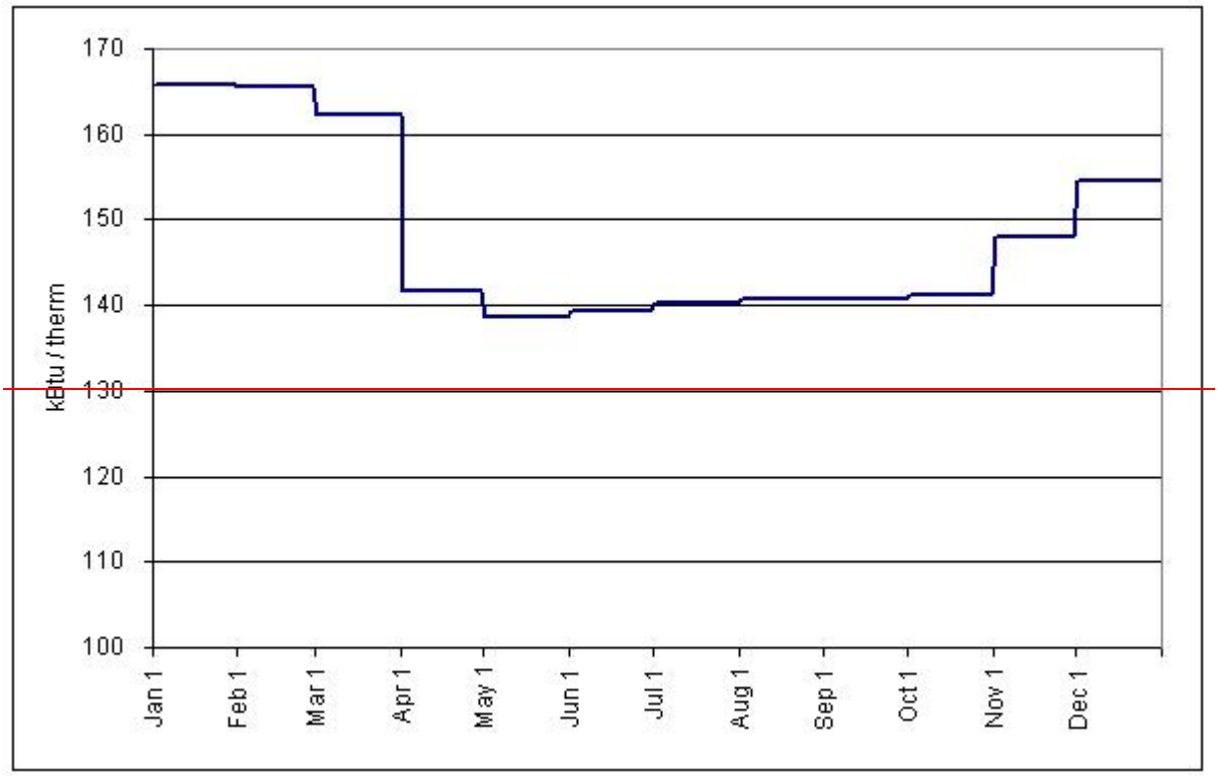
~~Figure 3-2 – Residential Electricity – Climate Zone 12 – July~~



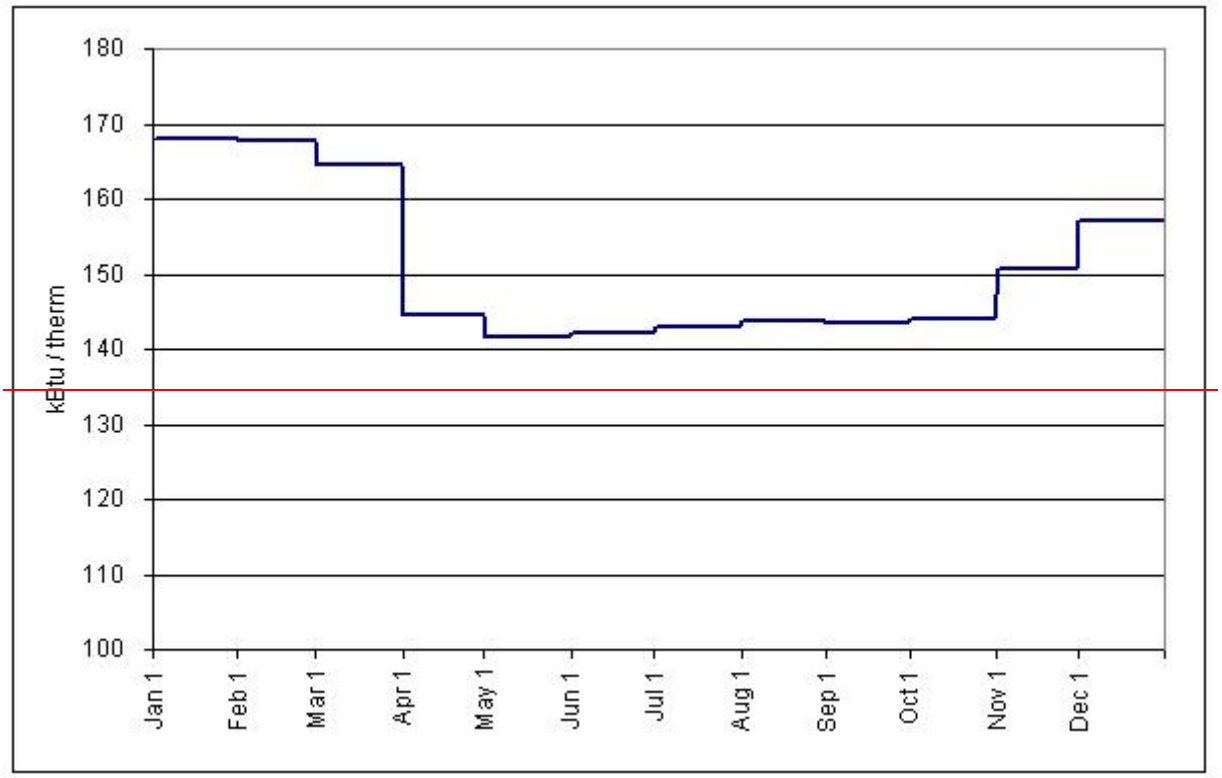
~~*Figure 3-3 – Nonresidential Electricity – Climate Zone 12 – Annual*~~



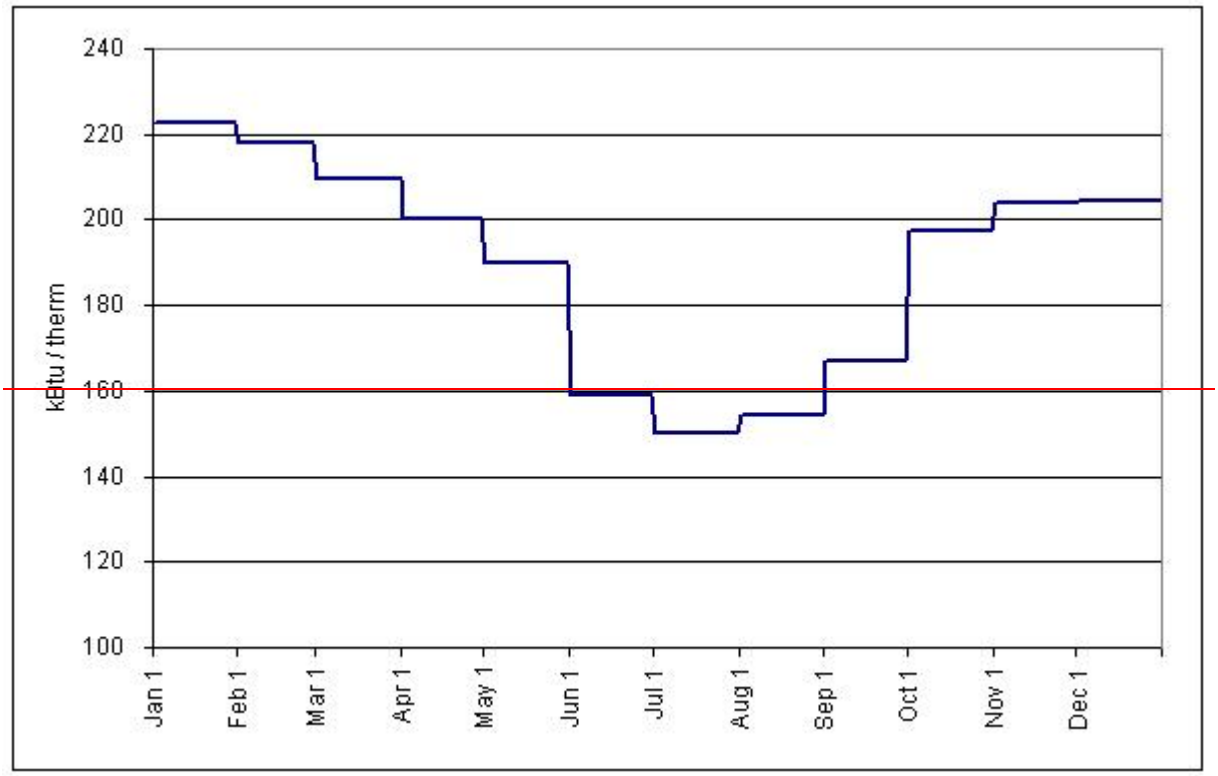
~~Figure 3-4 – Nonresidential Electricity – Climate Zone 12 – July~~



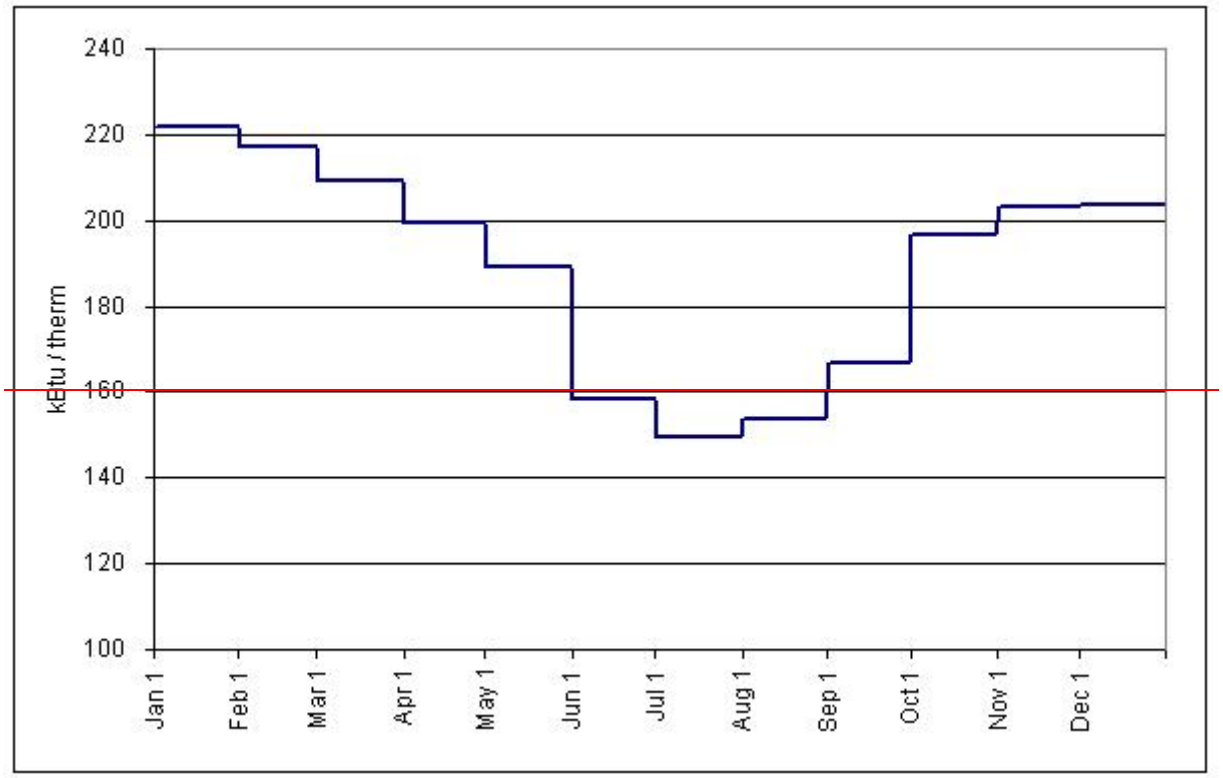
~~*Figure 3-5 – Residential Natural Gas – Climate Zone 12 – Annual*~~



~~*Figure 3-6 – Nonresidential Natural Gas – Climate Zone 12 – Annual*~~



~~*Figure 3-7 – Residential Propane – Climate Zone 12 – Annual*~~



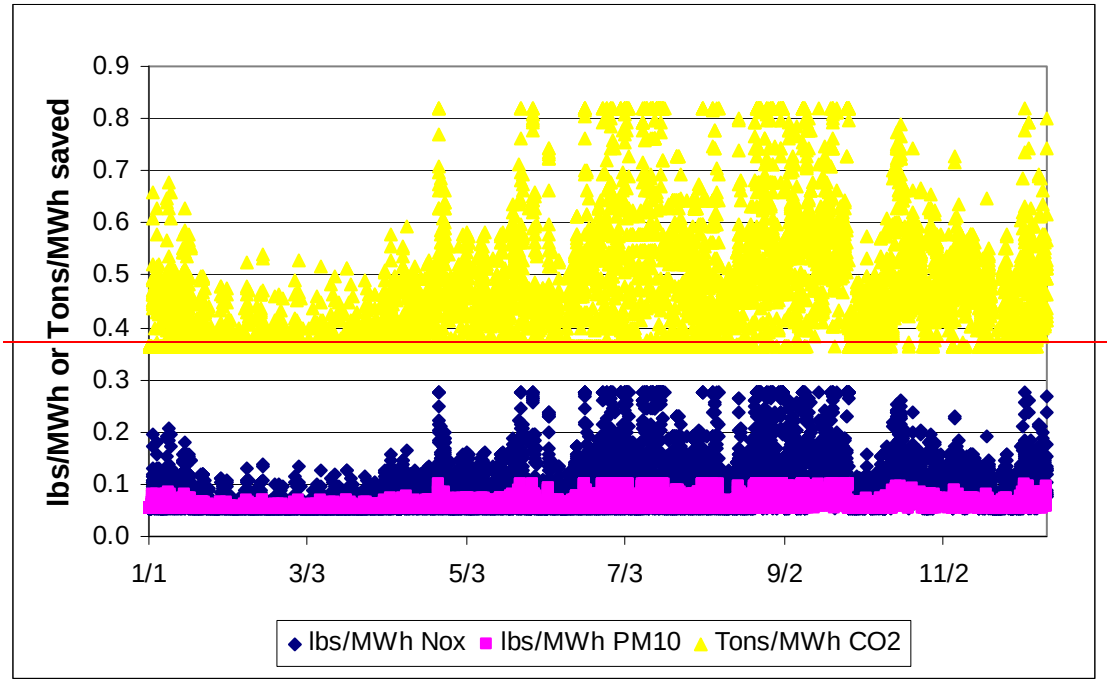
~~*Figure 3-8 – Nonresidential Propane – Climate Zone 12 – Annual*~~

~~*JA3.3 Hourly Emissions Data*~~

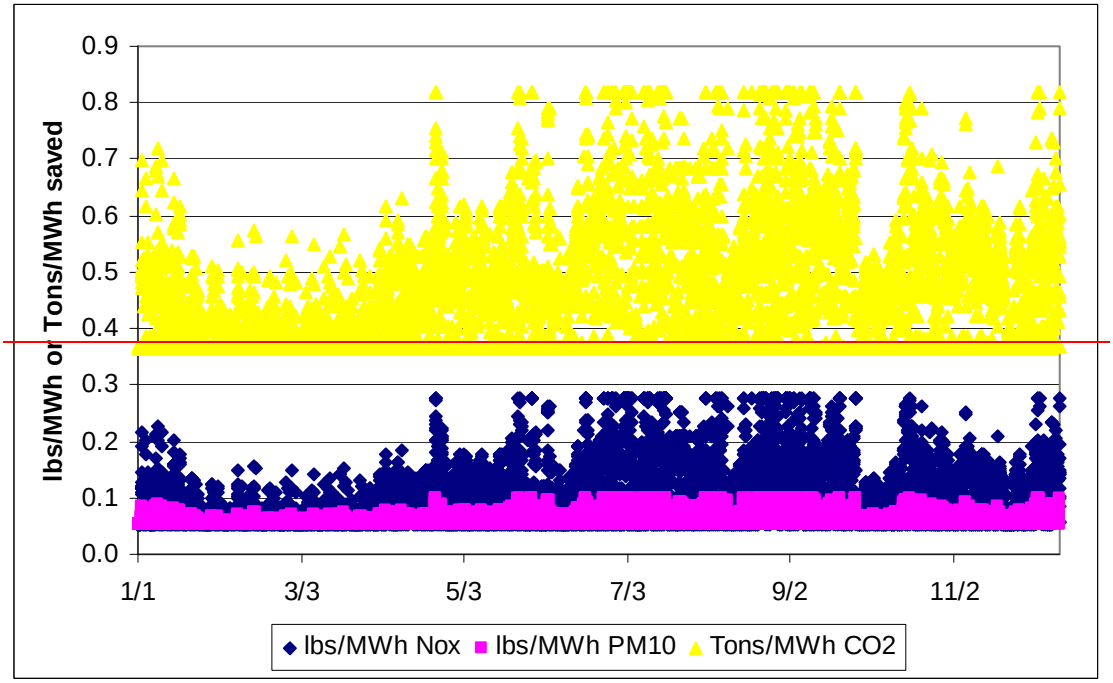
~~Through the development of time dependent valuation hourly data for the 2008 Standards, hourly emissions rates were also determined. Hourly emission rates were not determined by climate zone, but instead by Northern and Southern California regions.~~

~~*Table 3-4 – Hourly Emissions Summary for Electricity Use*~~

	~~Climate Zones (6, 7, 8, 9, 10, 15)~~			~~Climate Zones (1, 2, 3, 4, 5, 11, 12, 13, 16)~~		
	~~lbs/MWh Nox~~	~~lbs/MWh PM10~~	~~Tons/MWh CO2~~	~~lbs/MWh Nox~~	~~lbs/MWh PM10~~	~~Tons/MWh CO2~~
~~Max~~	~~0.2746~~	~~0.0985~~	~~0.8190~~	~~0.2746~~	~~0.0985~~	~~0.8190~~
~~Min~~	~~0.0541~~	~~0.0525~~	~~0.3650~~	~~0.0541~~	~~0.0525~~	~~0.3650~~
~~Average~~	~~0.1030~~	~~0.0627~~	~~0.4656~~	~~0.0993~~	~~0.0619~~	~~0.4579~~



~~]Figure 3-9 – Hourly Emissions Rates for Northern California (CZ 1-5, 11-13, 16)~~



~~Figure 3-10 – Hourly Emissions Rates for Southern California (CZ 6-10, 15)~~