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Marginal Energy Prices – RECS97 Update

The original estimation of residential marginal energy prices at the individual household level (as reported in the Marginal Energy Prices Report, http://www.eren.doe.gov/buildings/codes_standards/applbrf/pdfs/marginal_energy_price.pdf) was based on household energy billing data from EIA's 1993 RECS survey. When the 1997 RECS survey data became available, LBNL updated its estimation of residential marginal energy prices at the individual household level using that data. In addition, LBNL incorporated several refinements (as described below) to the marginal price estimation method it had originally developed.

Presented below are the:

- RECS97-based results.
- Refinements to LBNL's marginal price estimation method.
- RECS93-based results re-calculated using the refined marginal price estimation method that was applied to the RECS97 data.

Marginal Energy Prices – Summary of RECS97 Results

Table 1. Marginal Residential Electricity Prices - RECS97

Electricity – RECS97		Prices (¢/kWh, in 1997$) (Weighted Mean)		% Difference between Marginal Price and Average Price	
		MARGINAL	Annual AVERAGE	Weighted Mean	Range
Households w/Acceptable Seasonal Prices	Summer	9.1	9.4	-2.5%	-76.1% to +288.9%
	Non-Summer	8.5		-10.0%	-72.2% to +73.3%
Households w/o Acceptable Seasonal Prices		9.0	9.6	-4.5%	-55.3% to +397.5%
All Households		8.7	9.4	-6.9%	

Table 2. Marginal Residential Natural Gas Prices - RECS97

Natural Gas – RECS97		Prices (¢/ccf, in 1997$) (Weighted Mean)		% Difference between Marginal Price and Average Price	
		MARGINAL	Annual AVERAGE	Weighted Mean	Range
Households w/Acceptable Seasonal Prices	Winter	70.1	76.5	-4.4%	-96.5% to +179.4%
	Non-Winter	63.7		-15.3%	-81.6% to +57.9%
Households w/o Acceptable Seasonal Prices		66.4	82.4	-14.5%	-90.8% to +33.7%
All Households		66.0	78.5	-12.6%	

Note for Tables 1 and 2: For any household, a negative percent difference between marginal price and average price indicates that the household's marginal price is smaller than the household's average price. A positive percent difference between marginal price and average price indicates that the household's marginal price is larger than the household's average price.

Refinements to LBNL's Marginal Price Estimation Process

For RECS97, LBNL made several refinements to its marginal price estimation process in the following areas:

- seasonal prices for gas as well as electric
- criterion for accepting regression line slopes
- source of average household prices

Each of these three refinements is explained below.

1) Seasonal prices for gas as well as electric:

   For RECS97, natural gas billing data was split into seasons in a manner parallel to electricity data. The "peak" winter season was defined as those billing periods whose midpoint fell in any of the following four months: November, December, January, February. The remaining eight months constitute the non-winter season.

   For RECS93, natural gas prices were estimated on an annual basis only; that is, seasonal data were not examined.

2) Criterion for accepting regression line slopes:

   For RECS97, the criterion for accepting regression line slopes as marginal prices was established using an r^2 cutoff of 0.90. That is, regression slopes of household billing data were not accepted as household marginal prices unless the r^2 value was at least 0.90. This criterion was used with both the electricity and natural gas billing data.

   For RECS93, the criterion for accepting regression line slopes was based on rejecting extreme values of the regression slopes themselves. For electricity, regression line slopes were rejected if they were either less than or equal to zero or if they were greater than 22 cents/kWh. For natural gas, regression line slopes were rejected if they were either less than or equal to zero or if they were greater than $3.20/therm.

3) Source of average household prices:

   For RECS97, average prices were calculated for each RECS household using the available billing data for that household. Those average prices were then used to calculate the percent difference between marginal price and average price for that household. Weighted means of the percent difference between marginal price and average price were also calculated for the set of households with acceptable seasonal prices, the set of households without acceptable seasonal prices, and for all of the households.

   For RECS93, the average price *reported* in the RECS database for each RECS household was used; individual household average prices were not calculated using the RECS billing data itself. The average price *reported* in the RECS database for each household is the average price for the local utility, not the household's own average price. Use of these *reported* average prices in the calculation of the percent difference between marginal price and average price does not yield as accurate a value of the percent difference between marginal price and average price as does use of each household's own directly-calculated average price.

Marginal Energy Prices – Summary of RECS93 Results, Re-calculated Using LBNL's Refined Marginal Price Estimation Method

For comparison purposes, we have re-calculated marginal and average prices and the percent difference between marginal price and average price for the RECS93 households using our refined marginal price estimation process.

Table 3. Marginal Residential Electricity Prices - RECS93

Electricity – RECS93		Prices (¢/kWh) (Weighted Mean)				% Difference between Marginal Price and Average Price	
		MARGINAL		Annual AVERAGE		Weighted Mean	Range
		1993$	1997$	1993$	1997$		
Households w/Acceptable Seasonal Prices	Summer	9.0	9.1	9.2	9.4	-2.0%	-239.4% to +176.7%
	Non-Summer	8.5	8.6			-8.6%	-72.2% to +70.5%
Households w/o Acceptable Seasonal Prices		8.7	8.8	9.2	9.3	-5.3%	-76.6% to +136.4%
All Households		8.7	8.8	9.2	9.4	-6.1%	

The factor that converts electricity prices in 1993$ to electricity prices in 1997$ is 1.013.

Table 4. Marginal Residential Natural Gas Prices - RECS93

Natural Gas – RECS93		Prices (¢/ccf) (Weighted Mean)				% Difference between Marginal Price and Average Price	
		MARGINAL		Annual AVERAGE		Weighted Mean	Range
		1993$	1997$	1993$	1997$		
Households w/Acceptable Seasonal Prices	Winter	57.9	65.2	65.8	74.1	-10.2%	-79.7% to +54.2%
	Non-Winter	55.1	62.1			-14.7%	--78.9% to +38.0%
Households w/o Acceptable Seasonal Prices		57.6	64.9	71.4	80.5	-14.1%	-89.0% to +27.5%
All Households		56.3	63.5	66.9	75.3	-13.4%	

The factor that converts natural gas prices in 1993$ to natural gas prices in 1997$ is 1.127.

Note for Tables 3 and 4: For any household, a negative percent difference between marginal price and average price indicates that the household's marginal price is smaller than the household's average price. A positive percent difference between marginal price and average price indicates that the household's marginal price is larger than the household's average price.