

Emission Factors and Energy Prices
for Leonardo Academy's
Cleaner and Greener[®] Program

Prepared by Leonardo Academy Inc.
For the Multiple Pollutant Emission Reduction Reporting System (MPERRS)

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Emission Factor Background Discussion

Average All Generation and Fossil Fuel-Based Electric Generation Emissions Factors for Pollutants for Each State

Different emissions factors are appropriate for different purposes.

For calculating total emissions caused by a consumer's electricity use, average all generation emission rates are appropriate. Average all generation emissions rates are calculated by dividing the emissions from all generation by the total amount of electricity generated in the state.

For calculating the emission reduction caused by an energy efficiency or renewable energy project, the fossil fuel generation only emission rates are appropriate. Fossil fuel generation emissions rates are calculated by dividing the emissions from the fossil fuel generation by the amount of electricity generated by fossil fuel generation in the state. Leonardo Academy believes that fossil fuel generation only emission factors provide more accurate estimates of emission reductions from energy efficiency. This is because low operating cost generation like hydroelectric generation and nuclear generation will run whenever they are available because of their low position in the generation loading order, regardless of decreases in overall energy consumption. As a result, a decrease in energy consumption from increased energy efficiency will have little or no impact on the total output of nuclear and renewable-based generation.

The U.S. DOE EIA 1605(b) program [4] CO₂ emission factors are average all generation emission factors. As such, Leonardo Academy believes the U.S. DOE EIA 1605(b) emission factors are best suited for calculating the total emissions from a consumer's electricity use.

How location-specific should electric generation emissions factors be?

Another issue in selecting emissions factors is how location-specific to make them. Because of the interconnected nature of the electric transmission and generation system, it is uncertain where the electricity used by a specific customer is actually generated. For this reason, using some kind of regional average is appropriate. Since it is likely that much of the electricity used by a consumer is produced relatively nearby, it is reasonable to use emission factors that reflect the generation mix in various regions of the country. Using emissions factors for each state or for regions that include several states is probably a reasonable compromise. Also, because many regulatory programs are implemented through State Implementation Plans, using state-based emission factors makes sense.

Using emission factors calculated based on areas smaller than a state probably does not improve the accuracy of emissions reduction estimates due to the uncertainty of where the electricity being used was actually generated. In unusual circumstances such as off grid, isolated generation and customer groups, site-specific emission factors would be appropriate.

Leonardo Academy developed what we thought were accurate emission factors for electricity emissions for our Multiple Pollutant Emission Reduction Reporting System (MPERRS) project. This project used different emission factors than those recommended by the U.S. DOE EIA for 1605(b) reporting, in order to also account for emission reductions from energy efficiency and renewable energy projects.

In the end, the final decision on what are the appropriate emission factors for reporters of emissions reductions will be made by the U.S. EPA and state EPAs, with input from other affected parties. This will happen when emission reduction reporting moves from a voluntary to a regulator specified system, as each pollutant is included in a regulator mandated trading program.

Emission Factor Methodology

In summary, the emission factors were calculated as follows.

The emission factors for CO₂, SO₂, NO_x, and Hg emissions in both Table 1 [State Level Electricity Emissions Factors for Calculation of Emission Reduction Benefits of Energy Efficiency and Renewable Energy (lb/kWh)] and Table 3 [State Level Electricity Emissions Factors for Calculation of Emission Footprints (lb/kWh)] were taken directly from the U.S. EPA's Emissions & Generation Resource Integrated Database's (eGRID) State Data MS-Excel tables. eGRID2006 version 2.1^[1] provides emissions and generation information for different strata of the power system, using data from the year 2004. eGRID2006 data can be aggregated by power plant, state, company, power control area, eGRID subregion, NERC region, or United States total.

eGRID calculated state average annual output emission rates (lbs/MWh) for the year 2004 by dividing annual net generation by state by annual emissions by pollutant type. eGRID calculated state fossil fuel annual output emission rates (lbs/MWh) for 2004 by dividing annual fossil fuel net generation by state by annual emissions by pollutant type.

Because the eGRID's output emission rates (lb/Mwh) are applied at the retail source level (i.e., by assigning emissions to usage by retail customers), emissions factors were revised upwards by a factor of 7.2% for Leonardo Academy's Cleaner and Greener Program to reflect transmission and distribution line losses.

State imports and exports of electricity were not considered in the emission factors compiled in Tables 1 and 3 in this reporting guide. There is too much uncertainty within eGRID regarding where imports originated and where imports were going. Because electricity flows are not usually measured on State borders, net imports and exports in eGRID for states are estimated indirectly. Thus, all net imports values reported in eGRID are estimates rather than measured values. Also, there is the added uncertainty of the actual generation mix of state imports and exports. Due to this uncertainty, it was determined that the possible increased accuracy to the state emission factors does not justify the additional workload necessary to incorporate imports and exports into the model. Also, State Implementation Plans are only interested at looking at emissions that are emitted within a given state and are not concerned with State imports or exports.

CO₂ all generation emission factors from the US DOE EIA 1605(b) reporting system [4] are also included as a reference. Emission factors for the different fuel types listed in Tables 4, 5, and 6 were calculated using US EPA Document AP – 42 [3] and the US DOE EIA 1605(b) reporting system [5].

Table 1: State Level Electricity Emissions Factors for Calculation of Emission Reduction Benefits from Energy Efficiency and Renewable Energy (kWh) (Annual Non-BaseLoad Output Emission Rates, Including 7.2% Transmission and Distribution Line Losses)

STATE	CO2_NB* lb./kWh	NOx_NB lb./kWh	SO2_NB lb./kWh	Hg_NB lb./kWh	Hg_NB lb./mg
Alabama	1.811	0.002849	0.008581	3.97E-08	0.017991
Alaska	1.540	0.006220	0.002572	0.00E+00	0.000000
Arizona	1.657	0.001523	0.000956	7.50E-09	0.003404
Arkansas	1.947	0.002328	0.003876	1.82E-08	0.008266
California	1.343	0.000464	0.000069	0.00E+00	0.000000
Colorado	1.788	0.002311	0.002063	9.65E-09	0.004376
Connecticut	1.901	0.001332	0.001483	1.07E-09	0.000486
Delaware	1.809	0.003009	0.009145	4.29E-08	0.019450
DC	3.874	0.005409	0.010184	6.65E-08	0.030148
Florida	1.601	0.002429	0.004380	6.43E-09	0.002918
Georgia	1.999	0.002949	0.013881	3.00E-08	0.013615
Hawaii	1.820	0.005459	0.004989	1.29E-08	0.005835
Idaho	0.710	0.000501	0.000794	N/A	N/A
Illinois	2.391	0.003267	0.008430	9.65E-08	0.043763
Indiana	2.306	0.004154	0.015361	4.07E-08	0.018478
Iowa	2.564	0.005178	0.008861	6.11E-08	0.027716
Kansas	2.528	0.005641	0.009681	2.89E-08	0.013129
Kentucky	2.286	0.003749	0.013296	4.18E-08	0.018964
Louisiana	1.455	0.002067	0.002339	7.50E-09	0.003404
Maine	1.009	0.001424	0.002476	1.07E-09	0.000486
Maryland	2.112	0.004244	0.019568	6.65E-08	0.030148
Massachusetts	1.529	0.001294	0.003836	8.58E-09	0.003890
Michigan	2.115	0.003180	0.009043	4.07E-08	0.018478
Minnesota	2.186	0.006522	0.007718	3.64E-08	0.016533
Mississippi	1.901	0.003473	0.006089	9.65E-09	0.004376
Missouri	2.275	0.003623	0.008812	4.18E-08	0.018964
Montana	2.511	0.004356	0.002834	1.07E-09	0.000486
Nebraska	2.456	0.004761	0.009398	4.72E-08	0.021395
Nevada	1.400	0.001691	0.001249	4.29E-09	0.001945
New Hampshire	1.427	0.001396	0.006785	2.14E-09	0.000973
New Jersey	1.548	0.002379	0.005199	1.07E-08	0.004863
New Mexico	1.762	0.003603	0.001307	3.32E-08	0.015074
New York	1.810	0.002114	0.006141	1.29E-08	0.005835
North Carolina	2.127	0.003630	0.012795	4.72E-08	0.021395
North Dakota	2.796	0.007870	0.015727	8.04E-08	0.036469
Ohio	2.191	0.004590	0.022355	7.50E-08	0.034038
Oklahoma	1.618	0.002585	0.002332	1.61E-08	0.007294
Oregon	1.193	0.001308	0.001325	6.43E-09	0.002918
Pennsylvania	2.104	0.003099	0.015604	6.11E-08	0.027716
Rhode Island	1.251	0.000479	0.000103	N/A	N/A
South Carolina	1.953	0.003187	0.011871	2.79E-08	0.012643
South Dakota	2.553	0.006786	0.005565	0.00E+00	0.000000
Tennessee	2.247	0.004431	0.016584	5.47E-08	0.024799
Texas	1.434	0.000867	0.000825	4.29E-09	0.001945
Utah	2.154	0.005542	0.004984	1.18E-08	0.005349
Vermont	0.255	0.002974	0.000478	N/A	N/A

STATE	CO2_NB* lb./kWh	NOx_NB lb./kWh	SO2_NB lb./kWh	Hg_NB lb./kWh	Hg_NB lb./mg
Virginia	2.058	0.003176	0.010827	2.79E-08	0.012643
Washington	1.643	0.001848	0.000708	2.25E-08	0.010211
West Virginia	2.152	0.004545	0.015017	5.79E-08	0.026258
Wisconsin	2.211	0.003963	0.009299	3.64E-08	0.016533
Wyoming	2.480	0.005170	0.003290	4.29E-08	0.019450
U.S. Average	1.838	0.002692	0.007469	2.79E-08	0.012643

*Note: NB = Non Baseload generation emission factors (Updated: 06/01/07)

*These emission factors include the generation backed off by renewable energy or energy efficiency.

Table 2: US DOE EIA for 1605(b) CO2 Emission Factors

<u>State</u>	<u>CO2</u> lb/kWh	<u>State</u>	<u>CO2</u> lb/kWh	<u>State</u>	<u>CO2</u> lb/kWh
Alabama	1.31	Kentucky	2.01	North Dakota	2.24
Alaska	1.38	Louisiana	1.18	Ohio	1.80
Arizona	1.05	Maine	0.85	Oklahoma	1.72
Arkansas	1.29	Maryland	1.37	Oregon	0.28
California	0.61	Massachusetts	1.28	Pennsylvania	1.26
Colorado	1.93	Michigan	1.58	Rhode Island	1.05
Connecticut	0.94	Minnesota	1.52	South Carolina	0.83
DC	1.37	Mississippi	1.29	South Dakota	0.80
Delaware	1.83	Missouri	1.84	Tennessee	1.30
Florida	1.39	Montana	1.43	Texas	1.46
Georgia	1.37	Nebraska	1.40	Utah	1.93
Hawaii	1.66	Nevada	1.52	Vermont	0.03
Idaho	0.03	New Hampshire	0.68	Virginia	1.16
Illinois	1.16	New Jersey	0.71	Washington	0.25
Indiana	2.08	New Mexico	2.02	West Virginia	1.98
Iowa	1.88	New York	0.86	Wisconsin	1.64
Kansas	1.68	North Carolina	1.24	Wyoming	2.15
Updated: 04/15/02				U.S. Average	1.34

**Table 3: State Level Electricity Emissions Factors for Calculation of Emission Footprints (lb/kWh)
(All (Total) Generation, Including 7.2% Transmission and Distribution Line)**

STATE	CO2_TGE lb./kWh	NOx_TGE lb./kWh	SO2_TGE lb./kWh	Hg_TGE lb./kWh	Hg_TGE lb./mg
Alabama	1.392	0.002249	0.006616	4.01E-08	0.018186
Alaska	1.186	0.003944	0.001290	1.50E-09	0.000681
Arizona	1.307	0.001897	0.001321	1.53E-08	0.006953
Arkansas	1.372	0.001850	0.003622	2.26E-08	0.010260
California	0.751	0.000367	0.000137	1.39E-09	0.000632
Colorado	2.129	0.003218	0.002871	1.16E-08	0.005252
Connecticut	0.808	0.000775	0.000535	1.21E-08	0.005495
Delaware	1.934	0.003240	0.010563	4.92E-08	0.022319
DC	3.874	0.005409	0.010184	4.35E-08	0.019742
Florida	1.445	0.002500	0.004258	1.11E-08	0.005057
Georgia	1.488	0.001828	0.009766	2.88E-08	0.013080
Hawaii	1.774	0.004028	0.004492	1.25E-08	0.005689
Idaho	0.154	0.000159	0.000199	N/A	N/A
Illinois	1.238	0.001652	0.004239	4.44E-08	0.020131
Indiana	2.249	0.003874	0.014641	4.27E-08	0.019353
Iowa	2.083	0.004069	0.006914	5.60E-08	0.025382
Kansas	2.005	0.004282	0.005681	2.39E-08	0.010843
Kentucky	2.199	0.003767	0.011713	4.06E-08	0.018429
Louisiana	1.288	0.001785	0.002835	1.32E-08	0.005981
Maine	0.827	0.001031	0.000946	2.47E-09	0.001118
Maryland	1.386	0.002653	0.011830	4.35E-08	0.019742
Massachusetts	1.314	0.001411	0.003758	1.51E-08	0.006856
Michigan	1.514	0.002333	0.006357	2.95E-08	0.013372
Minnesota	1.702	0.003701	0.004464	3.04E-08	0.013810
Mississippi	1.510	0.002704	0.004709	1.30E-08	0.005884
Missouri	2.017	0.003168	0.007096	4.17E-08	0.018915
Montana	1.686	0.003051	0.001844	3.32E-09	0.001507
Nebraska	1.611	0.003287	0.005201	3.13E-08	0.014199
Nevada	1.686	0.002695	0.003121	9.97E-09	0.004522
New Hampshire	0.835	0.001053	0.005146	2.57E-09	0.001167
New Jersey	0.764	0.001071	0.002076	1.21E-08	0.005495
New Mexico	2.135	0.004875	0.002503	7.39E-08	0.033503
New York	0.972	0.001135	0.003726	1.21E-08	0.005495
North Carolina	1.306	0.002148	0.008175	2.84E-08	0.012886
North Dakota	2.558	0.005357	0.010279	8.36E-08	0.037928
Ohio	1.907	0.003955	0.016171	5.42E-08	0.024604
Oklahoma	1.850	0.002938	0.003726	4.95E-08	0.022465
Oregon	0.489	0.000566	0.000577	3.54E-09	0.001605
Pennsylvania	1.304	0.002026	0.010080	5.46E-08	0.024750
Rhode Island	1.148	0.000345	0.000080	N/A	N/A
South Carolina	0.981	0.001521	0.004999	1.37E-08	0.006224
South Dakota	1.303	0.005117	0.004287	1.66E-08	0.007537
Tennessee	1.357	0.002488	0.006828	2.56E-08	0.011621
Texas	1.578	0.001222	0.003361	3.04E-08	0.013810
Utah	2.274	0.004100	0.002057	8.04E-09	0.003647
Vermont	0.007	0.000227	0.000028	N/A	N/A
Virginia	1.298	0.002131	0.006226	1.70E-08	0.007731

STATE	CO2_TGE lb./kWh	NOx_TGE lb./kWh	SO2_TGE lb./kWh	Hg_TGE lb./kWh	PM10_TGE lb./kWh
Washington	0.386	0.000475	0.000174	6.97E-09	0.003161
West Virginia	2.131	0.004202	0.011463	5.74E-08	0.026014
Wisconsin	1.836	0.002887	0.006912	4.12E-08	0.018672
Wyoming	2.441	0.004526	0.004230	4.36E-08	0.019790
U.S. Averages	1.461	0.002254	0.005827	2.88E-08	0.013080

*Note: TGE = total generation emission factors (Updated: 06/01/07)

*These emission factors include all (total) generation.

Table 4: Emission Factors for Natural Gas

Emission Type	Emission Factor		
	lbs. per million Btu	lbs. per 1000 cf ³	lbs. per Therm
CO ₂	117.080	119.423	11.708
NO _x	0.150	0.153	0.015
N ₂ O	0.00216	0.00220	0.00022
SO ₂	0.00060	0.00061	0.00006
PM ₁₀	0.00186	0.00190	0.000186
VOC	0.00539	0.00550	0.000539
CO	0.0240	0.0245	0.0024
Hg	0/negligible	0/negligible	0/negligible

Notes on emission factors for different fuel types:

Emission levels for most emission types depend mainly upon the type of fuel that is being consumed. Burning coal will release more CO₂ and SO₂ into the atmosphere than will burning natural gas for example. NO_x and VOC emissions, on the other hand, are much more dependent on the combustion source and technology type or equipment used than the other emission types. Different end use appliances can release very different amounts of NO_x and VOC emissions for the same amount of fuel used for each unit.

The NO_x and VOC emission factors used for natural gas in this reporting guide provide a good magnitude of estimation for emission levels. However, better accuracy will always be obtained by using more specific emission factors consistent with your specific project. The U.S. EPA has been performing emissions testing on many end use equipment types in recent years through their AP42 Project. Reporters may be able to find emission factors for their specific project equipment through the AP42 web site (<http://www.epa.gov/ttn/chief/ap42/ap42supp.html>). Where applicable, reporters should use the regulatory specified approach for determining the appropriate emission factor to use for their reporting. Care should be exercised for smaller sources not covered under the regulatory specified approach, in order to be consistent and to provide the best available emission factors to meet your combustion source and technology type.

Table 5: Emission Factors for Propane

Emission Type	lbs. per gallon	lbs. per million Btu
CO ₂	12.5	139.18
NO _x	0.014	0.149
N ₂ O	0.0009	0.00957
SO ₂ *	0.0001S	0.00106S
PM-filterable	0.0004	0.00426
VOC(TOC)	0.0005	0.00532
CO	0.0019	0.02021
Hg	0/negligible	0/negligible

Table 6: Emission Factors for Butane

Emission Type	lbs. per gallon	lbs. per million Btu
CO ₂	14.3	152.13
NO _x	0.015	0.160
N ₂ O	0.0009	0.00957
SO ₂ *	0.00009S	0.00096S
PM-filterable	0.0005	0.00638
VOC(TOC)	0.0006	0.00638
CO	0.0021	0.02234
Hg	0/negligible	0/negligible

* For SO₂ emission factors for propane and butane, S equals the sulfur content expressed in gr/100 ft³ gas vapor. For example, if the butane sulfur content is 0.18 gr/100 ft³, the emission factor would be (0.00009 x 0.18) = 0.0000162 lb of SO₂/gal butane burned.

Table 7: Emission Factors for Distillate Fuels

Emission Type	No. 6 oil		No. 4 oil		Residential	
	lbs./gal	lbs./MMBtu	lbs./gal	lbs./MMBtu	lbs./gal	lbs./MMBtu
CO ₂	25.0	178.57	25.0	178.57	21.5	159.29
NO _x	0.055	0.393	0.020	0.143	0.018	0.129
SO ₂ *	0.157S	1.121S	0.150S	1.071S	0.142S	1.014S
PM-filterable	0.010	0.07143	0.007	0.05000	0.0004	0.00286
VOC(TOC)	0.002	0.01146	0.001	0.00397	0.002	0.00397
CO	0.005	0.03571	0.005	0.03571	0.005	0.03571
Hg	0/negligible		0/negligible		0/negligible	

*S indicates that the weight % of sulfur in the oil should be multiplied by the value given. For example, if the fuel is 1% sulfur, then S=1.

Table 8: Average Price of Electricity to End Customers, by Sector and State, 2005

2005 Price of Electricity	Residential (cents/kWh)	Commercial (cents/kWh)	Industrial (cents/kWh)
Alabama	8.00	7.50	4.52
Alaska	13.30	11.56	9.29
Arizona	8.86	7.40	5.85
Arkansas	8.00	6.18	4.74
California	12.51	11.92	9.55
Colorado	9.06	7.62	5.74
Connecticut	13.64	11.53	9.40
Delaware	9.01	7.60	6.21
District of Columbia	9.10	9.13	14.13
Florida	9.62	8.16	6.46
Georgia	8.64	7.67	5.28
Hawaii	20.70	19.04	15.79
Idaho	6.29	5.42	3.91
Illinois	8.34	7.75	4.61
Indiana	7.50	6.57	4.42
Iowa	9.27	6.95	4.56
Kansas	7.90	6.60	4.85
Kentucky	6.57	6.01	3.60
Louisiana	8.87	8.56	6.71
Maine	13.23	10.63	7.28
Maryland	8.46	8.97	7.01
Massachusetts	13.44	12.42	9.22
Michigan	8.40	7.84	5.32
Minnesota	8.28	6.59	5.02
Mississippi	8.71	8.48	5.37
Missouri	7.08	5.92	4.54
Montana	8.10	7.43	4.83
Nebraska	7.14	5.98	4.43
Nevada	10.20	9.48	7.71
New Hampshire	13.51	12.06	11.48
New Jersey	11.74	10.61	9.76
New Mexico	9.13	7.81	5.61
New York	15.72	14.36	8.23
North Carolina	8.65	6.86	5.04
North Dakota	6.99	6.11	4.32
Ohio	8.51	7.93	5.10
Oklahoma	7.95	7.00	5.11
Oregon	7.25	6.51	4.83
Pennsylvania	9.86	8.50	6.29
Rhode Island	13.04	11.71	10.01
South Carolina	8.67	7.39	4.55
South Dakota	7.77	6.20	4.95
Tennessee	6.98	7.17	4.73
Texas	10.93	8.85	7.14
Utah	7.52	6.07	4.24
Vermont	12.96	11.33	7.77
Virginia	8.16	6.05	4.46
Washington	6.54	6.33	4.27
West Virginia	6.21	5.53	3.85
Wisconsin	9.66	7.67	5.39
Wyoming	7.48	6.17	3.99
U.S. Total	9.45	8.67	5.73

*From U.S. DOE / EIA Electric Sales, Revenue, and Average Price 2005, Table 4. Average Retail Price for Bundled and Unbundled Consumers by Sector, Census Division, and State, 2005.^[2] Released Nov. 2006, Next Release Date: Nov. 2007.

Table 9: Average Price of Natural Gas Delivered to Residential Customers by State, 2006

2006 Price of Natural Gas	\$ per MCF	\$ per MMBtu*	\$ per therm
Alabama	19.03	19.98	1.998
Alaska	6.89	7.23	0.723
Arizona	16.35	17.17	1.717
Arkansas	14.14	14.85	1.485
California	11.82	12.41	1.241
Colorado**	11.17	11.73	1.173
Connecticut	17.61	18.49	1.849
Delaware	18.38	19.30	1.930
District of Columbia	16.96	17.81	1.781
Florida	22.00	23.10	2.310
Georgia	18.58	19.51	1.951
Hawaii	35.54	37.32	3.732
Idaho**	12.74	13.38	1.338
Illinois	11.23	11.79	1.179
Indiana	13.06	13.71	1.371
Iowa	12.44	13.06	1.306
Kansas	13.20	13.86	1.386
Kentucky**	14.92	15.66	1.566
Louisiana**	14.77	15.50	1.550
Maine	17.87	18.76	1.876
Maryland	16.39	17.21	1.721
Massachusetts	17.44	18.31	1.831
Michigan	11.66	12.24	1.224
Minnesota	11.62	12.20	1.220
Mississippi**	14.68	15.41	1.541
Missouri	14.29	15.00	1.500
Montana	11.32	11.89	1.189
Nebraska	11.40	11.97	1.197
Nevada	14.31	15.03	1.503
New Hampshire**	16.76	17.60	1.760
New Jersey	15.29	16.05	1.605
New Mexico	12.51	13.14	1.314
New York**	16.29	17.10	1.710
North Carolina	16.80	17.64	1.764
North Dakota**	12.16	12.77	1.277
Ohio	14.35	15.07	1.507
Oklahoma**	15.07	15.82	1.582
Oregon	14.53	15.26	1.526
Pennsylvania	16.45	17.27	1.727
Rhode Island	17.58	18.46	1.846
South Carolina	17.69	18.57	1.857
South Dakota	11.17	11.73	1.173
Tennessee	14.60	15.33	1.533
Texas	12.89	13.53	1.353
Utah	11.02	11.57	1.157
Vermont	14.17	14.88	1.488
Virginia**	17.56	18.44	1.844
Washington	13.37	14.04	1.404
West Virginia	15.83	16.62	1.662
Wisconsin**	12.38	13.00	1.300
Wyoming	11.36	11.93	1.193
United States	13.76	14.45	1.445

*From U.S. DOE / EIA Electric May 2007 Natural Gas Monthly, Table 19: Average Price of Natural Gas Sold to Residential Consumers, by State, 2005-2007.^[6]

**Used average of reported months

Table 10. Average Price of Natural Gas Delivered to Commercial Customers, by State, 2006

2006 Price of Natural Gas	\$ per MCF	\$ per MMBtu*	\$ per therm
Alabama	16.30	17.12	1.712
Alaska	6.17	6.48	0.648
Arizona	12.07	12.67	1.267
Arkansas	10.71	11.25	1.125
California	10.34	10.86	1.086
Colorado**	9.41	9.88	0.988
Connecticut	13.60	14.28	1.428
Delaware**	16.03	16.83	1.683
District of Columbia	14.48	15.20	1.520
Florida	13.81	14.50	1.450
Georgia	13.73	14.42	1.442
Hawaii	29.22	30.68	3.068
Idaho**	11.69	12.27	1.227
Illinois	10.96	11.51	1.151
Indiana	11.54	12.12	1.212
Iowa	10.37	10.89	1.089
Kansas	12.55	13.18	1.318
Kentucky	13.23	13.89	1.389
Louisiana**	11.47	12.04	1.204
Maine	15.66	16.44	1.644
Maryland	13.23	13.89	1.389
Massachusetts	15.47	16.24	1.624
Michigan	10.58	11.11	1.111
Minnesota**	9.77	10.26	1.026
Mississippi**	11.32	11.89	1.189
Missouri	13.14	13.80	1.380
Montana	11.28	11.84	1.184
Nebraska	9.70	10.19	1.019
Nevada	12.11	12.72	1.272
New Hampshire**	14.53	15.26	1.526
New Jersey	13.34	14.01	1.401
New Mexico	10.53	11.06	1.106
New York**	12.02	12.62	1.262
North Carolina	13.87	14.56	1.456
North Dakota**	9.82	10.31	1.031
Ohio	12.85	13.49	1.349
Oklahoma**	12.42	13.05	1.305
Oregon	12.23	12.84	1.284
Pennsylvania	14.30	15.02	1.502
Rhode Island	15.94	16.74	1.674
South Carolina**	13.47	14.14	1.414
South Dakota	9.50	9.98	0.998
Tennessee	12.85	13.49	1.349
Texas	10.12	10.63	1.063
Utah	9.60	10.08	1.008
Vermont	11.13	11.69	1.169
Virginia	12.42	13.04	1.304
Washington	11.97	12.57	1.257
West Virginia**	15.63	16.42	1.642
Wisconsin	10.33	10.85	1.085
Wyoming**	9.78	10.27	1.027
United States	11.97	12.57	1.257

*From U.S. DOE / EIA Electric May 2007 Natural Gas Monthly, Table 20: Average Price of Natural Gas Sold to Commercial Consumers, by State, 2005-2007.^[6]

**Used average of reported months

Table 11: Average Price of Natural Gas Delivered to Industrial Customers, by State, 2006

2006 Price of Natural Gas	\$ per MCF	\$ per MMBtu*	\$ per therm
Alabama	9.44	9.91	0.991
Alaska	3.82	4.01	0.401
Arizona	9.93	10.43	1.043
Arkansas	9.54	10.02	1.002
California	9.23	9.69	0.969
Colorado	10.88	11.42	1.142
Connecticut	10.88	11.42	1.142
Delaware**	12.85	13.49	1.349
District of Columbia***	12.90	13.55	1.355
Florida	11.77	12.36	1.236
Georgia	9.21	9.67	0.967
Hawaii	18.46	19.38	1.938
Idaho**	10.07	10.57	1.057
Illinois	9.45	9.92	0.992
Indiana	9.36	9.83	0.983
Iowa	8.41	8.83	0.883
Kansas	6.54	6.87	0.687
Kentucky	9.37	9.84	0.984
Louisiana	7.68	8.06	0.806
Maine	14.39	15.11	1.511
Maryland	12.90	13.55	1.355
Massachusetts	14.67	15.40	1.540
Michigan	9.99	10.49	1.049
Minnesota	8.35	8.77	0.877
Mississippi	9.18	9.64	0.964
Missouri	12.00	12.60	1.260
Montana	9.43	9.90	0.990
Nebraska**	7.95	8.35	0.835
Nevada	12.00	12.60	1.260
New Hampshire**	12.43	13.05	1.305
New Jersey**	10.03	10.53	1.053
New Mexico	9.16	9.62	0.962
New York	11.75	12.34	1.234
North Carolina**	8.34	8.76	0.876
North Dakota	6.54	6.87	0.687
Ohio**	11.34	11.90	1.190
Oklahoma	11.24	11.80	1.180
Oregon	9.16	9.62	0.962
Pennsylvania	12.01	12.61	1.261
Rhode Island	13.32	13.99	1.399
South Carolina**	9.18	9.64	0.964
South Dakota	9.38	9.85	0.985
Tennessee	9.76	10.25	1.025
Texas	6.80	7.14	0.714
Utah	8.02	8.42	0.842
Vermont	9.17	9.63	0.963
Virginia	10.74	11.28	1.128
Washington**	9.56	10.04	1.004
West Virginia	8.89	9.33	0.933
Wisconsin	9.56	10.04	1.004
Wyoming**	8.72	9.15	0.915
United States	7.89	8.28	0.828

*From U.S. DOE / EIA Electric May 2007 Natural Gas Monthly, Table 21: Average Price of Natural Gas Sold to Industrial Consumers, by State, 2005-2007.^[6]

**Used average of reported months

***Used Maryland

Notes for Natural Gas Price Tables

- *Used a typical heating value for natural gas of 1,050 Btu/scf per Appendix A, page 5 of U.S. EPA AP-42 Document
- Conversion = $\$/\text{Mcf} * (1000\text{scf} / 1\text{Mcf}) * (1050\text{Btu} / 1\text{scf}) * (1\text{MMBtu} / 1,000,000\text{Btu}) = \$/\text{Mmbtu}$
- Conversion = $\$/\text{Mmbtu} / 10 = \$/\text{therm}$

References

- [1] U.S. EPA eGRID2006 Version 2.1 State File (Year 2004 Data) Released May 2007. (<http://www.epa.gov/cleanenergy/egrid/index.htm>)
- [2] U.S. DOE / EIA Electric Sales, Revenue, and Average Price 2005, Table 4. Average Retail Price for Bundled and Unbundled Consumers by Sector, Census Division, and State, 2005 (cents per kilowatt hour) (http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html)
- [3] U.S. EPA Office of Air Quality Planning & Standards, AP - 42 Emission Factors Supplement Documents, Update 2006, Website (<http://www.epa.gov/ttn/chief/ap42/ap42supp.html>)
- [4] U.S. DOE / EIA 1605(b) Voluntary Reporting of Greenhouse Gases Appendix G. Adjusted Electricity Emission Factors by State, February, 2002
- [5] U.S. DOE / EIA 1605(b) Voluntary Reporting of Greenhouse Gases Appendix F. Fuel and Energy Source Codes and Emission Coefficients, February, 2002
- [6] U.S. DOE / EIA Electric May 2007 Natural Gas Monthly, Tables 19, 20, and 21. Average Price of Natural Gas Sold to Residential (19), Commercial (20), and Industrial (21) Consumers, by State, 2005-2007 (http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/natural_gas_monthly/ngm.html)

Contact Information:

Leonardo Academy Inc.
1526 Chandler Street
Madison, WI 53711

Telephone: 608.280.0255

FAX: 608.255.7202

Email: info@cleanerandgreener.org

Web Sites: www.leonardoacademy.org
www.cleanerandgreener.org

