LEONARDO ACADEMY
THE SUSTAINABILITY EXPERTS®

Leonardo Academy's Guide to Calculating Emissions

Including Emission Factors and Energy Prices

A White Paper

By Leonardo Academy Inc.

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This is a Leonardo Academy Inc.

White Paper

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PREFACE

This Leonardo Academy white paper provides U.S. emission factors for the following:

1. Electricity
    a. By state, eGRID region and NERC Region
    b. For calculations of total emission calculations
    c. For calculation of emission reductions from energy efficiency and renewable energy
2. Natural Gas combustion
3. Fuel Oil combustion
4. Coal combustion

The white paper also provides utility rates for electricity and natural gas by:

1. State average
2. U.S. national average

Please contact Leonardo Academy if you have any questions, comments, or suggestions on this white paper.

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SECTION 1: EMISSION FACTOR BACKGROUND DISCUSSION

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

Different emission factors are appropriate for different calculation purposes. In order to calculate total emissions resulting from a consumer's electricity use, average all generation emission rates are appropriate. Average all generation emissions rates are calculated by dividing the emissions resulting from all generation by the total amount of electricity generated in the same geographic region. In this case, state-level all generation emission rates are determined.

For calculating the emission reductions caused by an energy efficiency or renewable energy project, the non-baseload fossil fuel generation emission rates are appropriate. Non-baseload fossil fuel generation represents the generation most likely to be reduced by energy efficiency addition projects or renewable energy addition projects.

How non-baseload emissions factors are calculated:

1. Begin with electricity (kWh) produced by all types of generation and all resulting emissions
2. Remove all electricity (kWh) produced by renewable generation and the resulting emissions
3. Remove the electricity (kWh) generated by baseload generation (generation that runs 80% or more of the time) and the resulting emissions
4. This leaves the electricity (kWh) generated by non-baseload fossil fuel fired generation and the emissions resulting from this generation
    a. The non-baseload fossil fuel emission factors are derived from these numbers by dividing each type of emission from this remaining generation, by the electricity generated (kWh) by the remaining generation

Leonardo Academy believes that non-baseload fossil fuel generation emission factors, as defined above, provide accurate estimates of emission reductions from energy efficiency and renewable energy. This is because non-baseload fossil fuel generation encompasses the generation most likely to be reduced by energy efficiency addition projects or renewable energy addition projects. Specific reasons that non-baseload generation is likely to decrease include:

1. Baseload generation has low operating costs, and therefore runs most of the time. Its run time will not be changed by the addition of efficiency or renewable energy.
2. Renewable energy already on the electric system has low operating costs, and therefore runs whenever it can. As a result, its run time will not be changed by the addition of efficiency or renewable energy.

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. In some locations, particularly in states where a large volume of electricity is imported or exported, it may be preferable to use factors associated with the larger eGRID subregions or the even larger NERC regions. For this reason, this report includes state, eGRID subregion, and NERC region level emission factors. Maps of the eGRID subregion and NERC region divisions can be found at http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010_eGRID_subregions.jpg and http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2010_NERC_regions.jpg respectively.

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 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 CO_2, CH_4, N_2O, SO_2, NO_x, and Hg emissions in Tables 2-1 through 2-6 were taken directly from the U.S. EPA's Emissions & Generation Resource Integrated Database's (eGRID) MS-Excel Aggregation workbook[1] and converted to pounds per kilowatt-hour. eGRID2010 version 1.1 provides emissions and generation information for different strata of the power system using data from the year 2007. eGRID2010 data can be aggregated by power plant, generating company, parent company, state, power control area, eGRID subregion, NERC region, or United States total.

[1] U.S. EPA eGRID2010 Version 1.1 Year 2007 eGRID State, EGC Location (operator)-based, EGC Owner-based, Parent Company Location (operator)-*based*, Parent Company Owner-based, PCA, eGRID Subregion, NERC Region, and U.S. Data Files, Released May 5, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

eGRID calculated state average annual output emission rates (lbs/MWh or lbs/GWh) for the year 2007 by dividing annual net generation by state by annual emissions by pollutant type. eGRID calculated state non-baseload annual output emission rates (lbs/MWh or lbs/GWh) for 2007 by dividing annual non-baseload net generation by state by non-baseload annual emissions by pollutant type. Emission rates by eGRID subregion and NERC region were calculated in a similar fashion.

Because eGRID's output emission rates (lbs/MWh or lbs/GWh) are at the generation source level, but are applied at the retail source level (i.e., by assigning emissions to usage by retail customers) for the purposes of Leonardo Academy's Cleaner and Greener® Program, emission factors were revised upwards by a factor of 5.7% to reflect transmission and distribution line losses. This factor was determined by comparing total consumption to total generation in the U.S. for 2007[2].

Imports and exports of electricity were not considered in the emission factors compiled in Tables 2-1 through 2-6 in this reporting guide. Though eGRID does provide quantities of electricity imported and exported for each state, there is too much uncertainty within eGRID regarding where imports originated and where exports were going. Because electricity flows are not usually measured on state, eGRID subregion, or NERC region borders, net imports and exports in eGRID at each of these levels 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 imports and exports. Due to this uncertainty, it was determined that the possible increased accuracy to the 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.

Emission factors for the different fuel types listed in Section 3 were calculated using U.S. EPA Document AP 42[3].

[2] U.S. EPA eGRID2010 Version 1.1 U.S Generation and Consumption File (Years 2005, 2004 and 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[3] U.S. EPA Office of Air Quality Planning & Standards, AP 42 Fifth Edition: Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. Website: http://www.epa.gov/ttn/chief/ap42/index.html

SECTION 2: ELECTRICITY EMISSION FACTORS

Average All Generation Electricity Emission Factors

Tables 2-1 through 2-3 below contain electricity emission factors by state, eGRID subregion, and NERC region for the calculation of emissions footprints. While state-level emission factors are appropriate in most cases, as delineated above, buildings located in states with substantial imports or exports of electricity may find eGRID subregion- or NERC region-level factors to be more suitable. All factors are based on 2007 data, except Hg factors which are based on 2005 data.

Table 2-1: State-level all generation electricity emission factors for the calculation of emission footprints (Annual output emission rates, including 5.7% transmission and distribution loss)[4, 5]

State	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
Alabama	1.399	2.390E-05	2.282E-05	0.006671	0.001867	4.207E-08
Alaska	1.199	2.771E-05	7.235E-06	0.001237	0.003909	1.797E-09
Arizona	1.246	1.676E-05	1.645E-05	0.001078	0.001596	1.564E-08
Arkansas	1.268	2.681E-05	2.200E-05	0.003029	0.001570	2.251E-08
California	0.598	3.143E-05	4.478E-06	0.000432	0.000409	2.114E-09
Colorado	1.910	2.417E-05	2.813E-05	0.002678	0.002726	1.733E-08
Connecticut	0.730	6.302E-05	1.230E-05	0.002474	0.000869	1.670E-08
Delaware	1.907	2.598E-05	2.724E-05	0.008444	0.002784	4.207E-08
District of Columbia	2.940	1.264E-04	2.534E-05	0.010511	0.004487	N/A
Florida	1.329	4.340E-05	1.709E-05	0.003771	0.002132	1.099E-08
Georgia	1.483	2.102E-05	2.440E-05	0.009572	0.001644	2.896E-08
Hawaii	1.632	1.092E-04	2.232E-05	0.008315	0.005017	1.226E-08
Idaho	0.148	1.426E-05	2.631E-06	0.000266	0.000146	N/A
Illinois	1.170	1.365E-05	1.927E-05	0.003071	0.001295	4.513E-08
Indiana	2.168	2.513E-05	3.602E-05	0.011687	0.003265	4.757E-08
Iowa	1.883	2.219E-05	3.115E-05	0.006074	0.002429	5.338E-08
Kansas	1.819	2.121E-05	2.997E-05	0.004884	0.002974	4.693E-08
Kentucky	2.215	2.587E-05	3.740E-05	0.008270	0.003814	3.964E-08
Louisiana	1.144	2.446E-05	1.234E-05	0.002047	0.001431	1.342E-08
Maine	0.558	2.069E-04	2.975E-05	0.001969	0.001200	2.960E-09
Maryland	1.414	3.485E-05	2.447E-05	0.012732	0.002436	4.101E-08
Massachusetts	1.267	6.854E-05	1.733E-05	0.003965	0.001073	1.575E-08

[4] U.S. EPA eGRID2010 Version 1.1 State File (Year 2075 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[5] U.S. EPA eGRID2010 Version 1.1 United States File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

State	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
Michigan	1.498	3.001E-05	2.548E-05	0.006527	0.002154	3.277E-08
Minnesota	1.609	4.514E-05	2.914E-05	0.003761	0.003214	3.055E-08
Mississippi	1.305	2.320E-05	1.668E-05	0.003049	0.002096	1.385E-08
Missouri	1.884	2.188E-05	3.117E-05	0.006278	0.002530	4.535E-08
Montana	1.706	2.127E-05	2.913E-05	0.003245	0.003256	3.826E-08
Nebraska	1.509	1.752E-05	2.502E-05	0.004435	0.002667	2.347E-08
Nevada	1.228	1.965E-05	1.059E-05	0.000562	0.001499	1.575E-08
New Hampshire	0.701	6.577E-05	1.505E-05	0.004190	0.000681	2.643E-09
New Jersey	0.740	2.525E-05	9.147E-06	0.002816	0.000772	1.395E-08
New Mexico	1.891	2.325E-05	2.895E-05	0.001567	0.004223	6.754E-08
New York	0.796	2.827E-05	8.974E-06	0.002184	0.000824	1.163E-08
North Carolina	1.305	1.996E-05	2.224E-05	0.006400	0.001118	2.864E-08
North Dakota	2.358	2.551E-05	3.789E-05	0.009248	0.004778	7.558E-08
Ohio	1.911	2.292E-05	3.214E-05	0.013259	0.003313	5.095E-08
Oklahoma	1.570	2.283E-05	1.925E-05	0.003929	0.002543	2.928E-08
Oregon	0.434	1.828E-05	5.322E-06	0.000669	0.000542	3.805E-09
Pennsylvania	1.277	2.524E-05	2.114E-05	0.009934	0.001909	5.158E-08
Rhode Island	0.960	1.905E-05	1.934E-06	0.000031	0.000250	N/A
South Carolina	0.959	1.694E-05	1.633E-05	0.003644	0.001007	1.258E-08
South Dakota	1.297	1.565E-05	2.026E-05	0.003634	0.004114	1.501E-08
Tennessee	1.434	1.878E-05	2.464E-05	0.005388	0.002394	3.002E-08
Texas	1.382	2.010E-05	1.569E-05	0.002631	0.000907	2.590E-08
Utah	2.046	2.474E-05	3.242E-05	0.001399	0.003633	8.033E-09
Vermont	0.004	7.961E-05	1.062E-05	0.000016	0.000242	N/A
Virginia	1.203	3.794E-05	2.054E-05	0.005859	0.001994	1.681E-08
Washington	0.274	1.041E-05	4.585E-06	0.000132	0.000322	6.976E-09
West Virginia	2.079	2.367E-05	3.526E-05	0.009198	0.003535	5.655E-08
Wisconsin	1.682	2.847E-05	2.812E-05	0.005003	0.001985	3.932E-08
Wyoming	2.366	2.700E-05	3.998E-05	0.004033	0.003804	4.302E-08
US Average	1.367	2.649E-05	2.076E-05	0.004992	0.001873	2.875E-08

Note: EGRID2010, year 2007; except Hg which is for 2005 because 2007 data is not available

Table 2-2: eGRID subregion-level all generation electricity emission factors for the calculation of emission footprints (Annual output emission rates, including 5.7% transmission and distribution loss)[6, 7]

Subregion Acronym	Subregion Name	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
AKGD	ASCC Alaska Grid	1.358	2.865E-05	7.862E-06	0.001388	0.002952	2.220E-09
AKMS	ASCC Miscellaneous	0.566	2.394E-05	4.730E-06	0.000633	0.007729	N/A
ERCT	ERCOT All	1.324	1.877E-05	1.479E-05	0.002701	0.000780	2.600E-08
FRCC	FRCC All	1.290	4.354E-05	1.612E-05	0.003364	0.002096	9.724E-09
HIMS	HICC Miscellaneous	1.420	1.429E-04	2.295E-05	0.002182	0.005937	N/A
HIOA	HICC Oahu	1.713	9.624E-05	2.208E-05	0.010671	0.004663	1.681E-08
MROE	MRO East	1.789	3.043E-05	3.070E-05	0.006940	0.002435	2.896E-08
MROW	MRO West	1.821	3.062E-05	3.086E-05	0.005607	0.003243	4.334E-08
NYLI	NPCC Long Island	1.500	9.566E-05	1.385E-05	0.004263	0.002094	5.814E-09
NEWE	NPCC New England	0.875	8.137E-05	1.607E-05	0.003005	0.000888	1.057E-08
NYCW	NPCC NYC/Westchester	0.745	2.772E-05	3.541E-06	0.000576	0.000503	6.236E-09
NYUP	NPCC Upstate NY	0.722	1.841E-05	1.046E-05	0.002536	0.000761	1.480E-08
RFCE	RFC East	1.120	2.896E-05	1.800E-05	0.008376	0.001596	4.091E-08
RFCM	RFC Michigan	1.745	3.441E-05	2.937E-05	0.007653	0.002427	3.911E-08
RFCW	RFC West	1.640	1.942E-05	2.740E-05	0.009090	0.002643	4.683E-08
SRMW	SERC Midwest	1.881	2.174E-05	3.129E-05	0.005740	0.001901	4.820E-08
SRMV	SERC Mississippi Valley	1.061	2.304E-05	1.178E-05	0.001727	0.001249	1.057E-08
SRSO	SERC South	1.581	2.499E-05	2.597E-05	0.009042	0.002021	3.763E-08
SRTV	SERC Tennessee Valley	1.629	2.101E-05	2.693E-05	0.005627	0.002596	2.960E-08
SRVC	SERC Virginia/Carolina	1.182	2.352E-05	2.016E-05	0.005048	0.001324	2.304E-08
SPNO	SPP North	1.901	2.243E-05	3.086E-05	0.005375	0.003119	4.461E-08
SPSO	SPP South	1.717	2.592E-05	2.369E-05	0.003836	0.002366	3.277E-08
CAMX	WECC California	0.720	2.990E-05	6.587E-06	0.000448	0.000659	4.334E-09
NWPP	WECC Northwest	0.908	1.727E-05	1.442E-05	0.001360	0.001533	1.427E-08
RMPA	WECC Rockies	2.015	2.497E-05	3.054E-05	0.002645	0.002857	1.966E-08
AZNM	WECC Southwest	1.324	1.987E-05	1.751E-05	0.001019	0.001977	2.579E-08
US Average		1.367	2.649E-05	2.076E-05	0.004992	0.001873	2.875E-08

Note: EGRID 2010, year 2007; except Hg which is year 2005 because 2007 data is not available

[6] U.S. EPA eGRID2010 Version 1.1 Subregion Location (Operator)-based File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[7] U.S. EPA eGRID2010 Version 1.1 United States File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

Table 2-3: NERC region-level all generation electricity emission factors for the calculation of emission footprints (Annual output emission rates, including 5.7% transmission and distribution loss)[8, 9]

NERC Region Acronym	NERC Region Name	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
ASCC	Alaska Systems Coordinating Council	1.199	2.771E-05	7.235E-06	0.001237	0.003909	1.797E-09
FRCC	Florida Reliability Coordinating Council	1.290	4.354E-05	1.612E-05	0.003364	0.002096	9.724E-09
HICC	Hawaiian Islands Coordinating Council	1.632	1.092E-04	2.232E-05	0.008315	0.005017	1.226E-08
MRO	Midwest Reliability Organization	1.816	3.059E-05	3.084E-05	0.005790	0.003132	4.133E-08
NPCC	Northeast Power Coordinating Council	0.833	5.297E-05	1.217E-05	0.002530	0.000842	1.110E-08
RFC	Reliability First Corporation	1.510	2.341E-05	2.505E-05	0.008762	0.002340	4.439E-08
SERC	SERC Reliability Corporation	1.442	2.306E-05	2.316E-05	0.005742	0.001822	2.928E-08
SPP	Southwest Power Pool	1.778	2.477E-05	2.606E-05	0.004344	0.002614	3.636E-08
TRE	Texas Regional Entity	1.324	1.877E-05	1.479E-05	0.002701	0.000780	2.600E-08
WECC	Western Electricity Coordinating Council	1.051	2.237E-05	1.425E-05	0.001116	0.001497	1.427E-08
US Average		1.367	2.649E-05	2.076E-05	0.004992	0.001873	2.875E-08

Note: EGRID 2010, year 2007; except Hg which is year 2005 because 2007 data is not available

[8] U.S. EPA eGRID2010 Version 1.1 NERC Region Location (Operator)-based File (Year 2007 Data). Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[9] U.S. EPA eGRID2010 Version 1.1 United States File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

Non-Baseload Fossil Generation Electricity Emission Factors

Tables 2-4 through 2-6 below contain emission factors for non-baseload fossil generation electricity appropriate for determining emissions reductions from energy efficiency and renewable energy. Again, factors are provided at the state, eGRID subregion, and NERC region levels. All factors are based on 2007 data except for Hg factors that are based on 2005 data.

Table 2-4: State-level Non-baseload Fossil Generation Electricity Emission Factors

These emissions factors are for the calculation of emission reduction benefits from energy efficiency and renewable energy (Annual non-baseload fossil generation emission rates, including 5.7% transmission and distribution loss)[10, 11]

State	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
Alabama	1.631	3.256E-05	2.343E-05	0.007487	0.002081	4.112E-08
Alaska	1.460	4.225E-05	8.377E-06	0.001503	0.006425	0.000E+00
Arizona	1.259	2.082E-05	9.557E-06	0.000496	0.000798	1.004E-08
Arkansas	1.243	4.462E-05	1.663E-05	0.002163	0.001130	2.273E-08
California	1.106	4.261E-05	5.137E-06	0.000181	0.000379	2.114E-09
Colorado	1.615	2.424E-05	1.687E-05	0.001643	0.001807	1.226E-08
Connecticut	1.476	8.331E-05	1.853E-05	0.002524	0.001285	1.184E-08
Delaware	1.783	2.595E-05	2.338E-05	0.006992	0.002397	3.425E-08
District of Columbia	2.940	1.264E-04	2.534E-05	0.010511	0.004487	N/A
Florida	1.392	4.585E-05	1.322E-05	0.003170	0.001805	6.025E-09
Georgia	1.576	2.708E-05	2.080E-05	0.009554	0.002036	2.357E-08
Hawaii	1.729	1.178E-04	2.051E-05	0.004826	0.005330	1.311E-08
Idaho	0.785	5.889E-05	1.141E-05	0.001091	0.000648	N/A
Illinois	2.122	2.606E-05	3.275E-05	0.005693	0.002825	8.583E-08
Indiana	2.183	2.614E-05	3.453E-05	0.013393	0.003413	4.450E-08
Iowa	2.170	2.699E-05	3.439E-05	0.006856	0.002903	5.592E-08
Kansas	2.276	2.994E-05	3.145E-05	0.006052	0.004415	3.879E-08
Kentucky	2.242	2.705E-05	3.724E-05	0.009360	0.003854	3.964E-08
Louisiana	1.322	2.702E-05	9.310E-06	0.001787	0.001875	7.505E-09
Maine	0.899	1.204E-04	1.739E-05	0.001907	0.000855	1.480E-09
Maryland	2.093	4.640E-05	3.446E-05	0.019452	0.003707	5.919E-08
Massachusetts	1.368	4.854E-05	1.404E-05	0.003209	0.000854	8.033E-09
Michigan	1.935	3.429E-05	2.964E-05	0.007191	0.002464	3.784E-08

[10] U.S. EPA eGRID2010 Version 1.1 State File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[11] U.S. EPA eGRID2010 Version 1.1 United States File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

State	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
Minnesota	1.977	1.117E-04	3.753E-05	0.005431	0.005190	3.012E-08
Mississippi	1.451	2.598E-05	1.420E-05	0.002931	0.002315	1.300E-08
Missouri	1.995	2.473E-05	3.047E-05	0.007126	0.002865	3.573E-08
Montana	2.697	3.017E-05	3.567E-05	0.002382	0.010086	3.393E-08
Nebraska	2.105	2.686E-05	3.067E-05	0.005891	0.003180	3.731E-08
Nevada	1.192	2.135E-05	6.166E-06	0.000252	0.001303	6.236E-09
New Hampshire	1.165	5.439E-05	1.104E-05	0.003034	0.000571	2.220E-09
New Jersey	1.449	2.859E-05	1.455E-05	0.003329	0.001296	1.977E-08
New Mexico	1.640	2.421E-05	1.779E-05	0.001011	0.003003	2.040E-08
New York	1.436	3.939E-05	1.123E-05	0.003328	0.001362	1.300E-08
North Carolina	1.930	3.071E-05	2.998E-05	0.009407	0.002116	4.609E-08
North Dakota	2.472	3.075E-05	4.007E-05	0.013817	0.007841	8.403E-08
Ohio	2.108	2.579E-05	3.402E-05	0.017170	0.003684	6.458E-08
Oklahoma	1.402	2.391E-05	1.080E-05	0.001742	0.002094	1.142E-08
Oregon	0.844	5.524E-05	7.728E-06	0.000229	0.000470	6.976E-09
Pennsylvania	1.761	3.089E-05	2.351E-05	0.010862	0.002416	5.560E-08
Rhode Island	1.004	2.002E-05	2.043E-06	0.000041	0.000266	N/A
South Carolina	1.718	3.310E-05	2.450E-05	0.009158	0.002111	2.209E-08
South Dakota	2.278	3.001E-05	3.071E-05	0.005448	0.006413	1.681E-08
Tennessee	2.248	2.741E-05	3.789E-05	0.009750	0.003684	5.581E-08
Texas	1.203	2.185E-05	6.308E-06	0.000710	0.000682	4.651E-09
Utah	1.499	2.351E-05	1.407E-05	0.001057	0.002664	7.716E-09
Vermont	0.162	1.107E-03	1.480E-04	0.000154	0.002962	N/A
Virginia	1.646	5.279E-05	2.344E-05	0.007876	0.002403	2.389E-08
Washington	1.544	5.725E-05	2.383E-05	0.000613	0.001644	2.061E-08
West Virginia	2.114	2.437E-05	3.546E-05	0.012024	0.003866	6.416E-08
Wisconsin	1.885	4.032E-05	2.857E-05	0.005351	0.002572	2.421E-08
Wyoming	2.161	2.581E-05	3.455E-05	0.002513	0.003430	3.900E-08
US Average	1.607	3.406E-05	1.946E-05	0.005356	0.002066	2.569E-08

Note: EGRID2010, year 2007; except Hg year 2005 because 2007 data is not available

Table 2-5: eGRID Subregion-level Non-baseload Fossil Generation Electricity Emission Factors

These emission factors are for the calculation of emission reduction benefits from energy efficiency and renewable energy (Annual non-baseload fossil generation emission rates, including 5.7% transmission and distribution loss)[12, 13]

Subregion Acronym	Subregion Name	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
AKGD	ASCC Alaska Grid	1.441	3.699E-05	7.346E-06	0.001434	0.002855	0.000E+00
AKMS	ASCC Miscellaneous	1.546	6.520E-05	1.287E-05	0.001806	0.021994	N/A
ERCT	ERCOT All	1.159	2.081E-05	5.956E-06	0.000709	0.000555	4.439E-09
FRCC	FRCC All	1.360	4.588E-05	1.216E-05	0.002766	0.001740	4.122E-09
HIMS	HICC Miscellaneous	1.739	1.300E-04	2.254E-05	0.002580	0.008939	N/A
HIOA	HICC Oahu	1.724	1.122E-04	1.957E-05	0.005863	0.003665	1.871E-08
MROE	MRO East	2.014	3.726E-05	3.169E-05	0.007387	0.003514	1.924E-08
MROW	MRO West	2.102	5.664E-05	3.486E-05	0.006574	0.003957	4.503E-08
NYLI	NPCC Long Island	1.477	4.659E-05	7.393E-06	0.002257	0.001506	5.285E-10
NEWE	NPCC New England	1.274	6.415E-05	1.417E-05	0.002597	0.000853	6.871E-09
NYCW	NPCC NYC/Westchester	1.304	3.980E-05	5.161E-06	0.000756	0.000963	5.179E-09
NYUP	NPCC Upstate NY	1.463	3.335E-05	1.711E-05	0.005655	0.001510	2.315E-08
RFCE	RFC East	1.767	3.519E-05	2.346E-05	0.010332	0.002318	4.482E-08
RFCM	RFC Michigan	1.906	3.391E-05	2.889E-05	0.007030	0.002313	3.795E-08
RFCW	RFC West	2.095	2.569E-05	3.327E-05	0.012298	0.003385	6.395E-08
SRMW	SERC Midwest	2.057	2.539E-05	3.138E-05	0.007314	0.002593	4.482E-08
SRMV	SERC Mississippi Valley	1.238	2.986E-05	7.307E-06	0.001185	0.001588	7.188E-09
SRSO	SERC South	1.639	3.013E-05	2.293E-05	0.008942	0.002307	3.129E-08
SRTV	SERC Tennessee Valley	2.027	2.746E-05	3.176E-05	0.007694	0.003113	4.186E-08
SRVC	SERC Virginia/Carolina	1.756	4.018E-05	2.591E-05	0.008421	0.002188	3.319E-08
SPNO	SPP North	2.070	2.685E-05	2.933E-05	0.005932	0.003451	3.700E-08
SPSO	SPP South	1.517	2.646E-05	1.389E-05	0.002103	0.002109	1.247E-08
CAMX	WECC California	1.105	4.167E-05	5.009E-06	0.000180	0.000368	3.277E-09
NWPP	WECC Northwest	1.353	4.578E-05	1.665E-05	0.000799	0.001975	1.353E-08
RMPA	WECC Rockies	1.643	2.449E-05	1.739E-05	0.001733	0.001935	1.258E-08
AZNM	WECC Southwest	1.281	2.173E-05	9.836E-06	0.000476	0.001100	9.513E-09
US Average		1.607	3.406E-05	1.946E-05	0.005356	0.002066	2.569E-08

Note: EGRID2010, year 2007; except Hg year 2005 because 2007 data is not available

[12] U.S. EPA eGRID2010 Version 1.1 Subregion Location (Operator)-based File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[13] U.S. EPA eGRID2010 Version 1.1 United States File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

Table 2-6: NERC Region-level Non-baseload Fossil Generation Electricity Emission Factors
These emission factors are for the calculation of emission reduction benefits from energy efficiency and renewable energy (Annual non-baseload fossil Generation emission rates, including 5.7% transmission and distribution loss)[14, 15]

NERC Region Acronym	NERC Region Name	CO_2 lbs/kWh	CH_4 lbs/kWh	N_2O lbs/kWh	SO_2 lbs/kWh	NO_x lbs/kWh	Hg lbs/kWh
ASCC	Alaska Systems Coordinating Council	1.460	4.225E-05	8.377E-06	0.001503	0.006425	0.000E+00
FRCC	Florida Reliability Coordinating Council	1.360	4.588E-05	1.216E-05	0.002766	0.001740	4.122E-09
HICC	Hawaiian Islands Coordinating Council	1.729	1.178E-04	2.051E-05	0.004826	0.005330	1.311E-08
MRO	Midwest Reliability Organization	2.085	5.282E-05	3.423E-05	0.006734	0.003869	3.985E-08
NPCC	Northeast Power Coordinating Council	1.342	5.098E-05	1.245E-05	0.002892	0.001084	9.830E-09
RFC	Reliability First Corporation	1.971	2.969E-05	2.972E-05	0.010963	0.002915	5.433E-08
SERC	SERC Reliability Corporation	1.717	3.116E-05	2.336E-05	0.006785	0.002364	3.012E-08
SPP	Southwest Power Pool	1.645	2.655E-05	1.745E-05	0.002986	0.002418	1.807E-08
TRE	Texas Regional Entity	1.159	2.081E-05	5.956E-06	0.000709	0.000555	4.439E-09
WECC	Western Electricity Coordinating Council	1.267	3.346E-05	1.012E-05	0.000551	0.001084	7.928E-09
US Average		1.607	3.406E-05	1.946E-05	0.005356	0.002066	2.569E-08

Note: EGRID2010, year 2007; except Hg year 2005 because 2007 data is not available

[14] U.S. EPA eGRID2010 Version 1.1 NERC Region Location (Operator)-based File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

[15] U.S. EPA eGRID2010 Version 1.1 United States File (Year 2007 Data), Released May 20, 2011. http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html

SECTION 3: BUILDING FUELS EMISSION FACTORS

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 CO_2 and SO_2 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, CO, and VOC emission factors used for natural gas in this reporting guide provide a good 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 AP-42 Project. Reporters may be able to find emission factors for their specific project equipment through the AP-42 website (http://www.epa.gov/ttn/chief/ap42/). 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.

Tables 3-1 through 3-4 below present emission factors for a variety of emissions for fuels commonly used in buildings.

Table 3-1: Emission Factors for Natural Gas[16]

Emission Type	Emission Factor		
	lbs per million Btu	lbs per 1000 ft^3	lbs per Therm
CO_2	117.6	120	11.76
CH_4	0.0225	0.023	0.0023
N_2O	0.0022	0.0022	0.0002
SO_2	0.0006	0.0006	0.00006
NO_x (residential furnace)[17]	0.0922	0.094	0.0092
NO_x (small boiler)	0.0980	0.1	0.0098
CO (residential furnace)[18]	0.0392	0.04	0.0039
CO (small boiler)[9]	0.0824	0.084	0.0082
PM_{10}	0.00186	0.0019	0.000186
VOC	0.0054	0.0055	0.00054
Hg	2.5E-07	2.6E-07	2.5E-08

Conversion: 1.02 MMBtu/1000 ft^3

[16] U.S. EPA Office of Air Quality Planning & Standards, AP 42 Chapter 1.4, Updated July 1998. Website: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s04.pdf

[17] Residential furnace factors for NO_x and CO are for home furnaces without NO_x controls.

[18] Small boiler factors for NO_x and CO are for boilers with less than 100 MMBtu/hour heat input without NO_x controls.

Table 3-2: Emission Factors for Propane[19]

Emission Type	lbs/gallon	lbs/million Btu
CO_2	12.5	136.6
CH_4	0.0002	0.0022
N_2O	0.0009	0.0098
NO_x	0.013	0.14
SO_2*	0.00010S	0.0011S
PM-filterable	0.0002	0.0022
PM-condensable	0.0005	0.0055
VOC(TOC)	0.0010	0.011
CO	0.0075	0.082
Hg	0/negligible	0/negligible

Conversion: 0.0915 MMBtu/gallon

Table 3-3: Emission Factors for Butane[19]

Emission Type	lbs/gallon	lbs/million Btu
CO_2	14.3	140.2
CH_4	0.0002	.0020
N_2O	0.0009	0.0088
NO_x	0.015	0.147
SO_2*	0.00009S	0.00088S
PM-filterable	0.0002	0.0020
PM-condensable	0.0006	.0059
VOC(TOC)	0.0011	0.0108
CO	0.0084	0.0824
Hg	0/negligible	0/negligible

Conversion: 0.102 MMBtu/gallon

* 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.

[19] U.S. EPA Office of Air Quality Planning & Standards, AP 42 Chapter 1.5, Updated July 2008, Website http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s05.pdf

Table 3-4: Emission Factors for Residual & Distillate Fuels[20]

Emission Type	No. 6 oil		No. 4 oil		Residential	
	lbs/gal	lbs/MMBtu	lbs/gal	lbs/MMBtu	lbs/gal	lbs/MMBtu
CO_2	25	167	25	167	21.5	154
CH_4	0.000475	0.00317	0.000216	0.00144	0.00178	0.0127
N_2O	0.00053	0.00353	0.00011	0.00073	0.00005	0.0004
NO_x	0.055	0.37	0.02	0.13	0.018	0.13
SO_2*	0.157S	1.05S	0.15S	1.0S	0.142S	1.01S
PM-filterable**	0.01	0.07	0.007	0.05	0.0004	0.003
VOC(NMTOC)	0.00113	0.00753	0.00034	0.0023	0.000713	0.00509
CO	0.005	0.03	0.005	0.03	0.005	0.04
Hg	1.13E-07	7.53E-07	1.13E-07	7.53E-07	3E-06	2E-05

Conversion: 0.15 MMBtu/gallon for Nos. 4 & 6; 0.14 MMBtu/gallon for residential.

*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.

**Assume 1% Sulfur for No. 6 oil

In Table 3-4 above, the NO_x, SO_2, PM, VOC, & CO factors assume use in boilers generating less than 100 million Btu per hour. The CH_4 and NMTOC factors assume use in commercial, institutional, or residential combustors. Utility and industrial boilers and boilers with outputs greater than 100 million Btu/hr should reference AP-42 Tables 1.3-1 and 1.3-3 for appropriate factors.

[20] U.S. EPA Office of Air Quality Planning & Standards, AP 42 Chapter 1.3, Updated May 2010, Website: http://www.epa.gov/ttn/chief/ap42/ch01/final/c01s03.pdf

SECTION 4: ENERGY PRICES

The following tables (4-1 – 4-4) show the average energy prices for January through May of 2011 for electricity and all of 2010 for natural gas for residential, commercial, and industrial consumers.

Table 4-1: Average Price of Electricity to End Customers, by Sector and State, January – May 2011[21]

State	Residential (cents/kWh)	Commercial (cents/kWh)	Industrial (cents/kWh)
Alabama	10.91	10.36	5.85
Alaska	17.10	15.04	15.26
Arizona	10.55	9.1	6.26
Arkansas	8.34	7.13	5.17
California	14.93	12.69	10.02
Colorado	10.73	8.92	6.73
Connecticut	18.04	15.74	13.46
Delaware	13.57	10.94	9.39
District of Columbia	13.8	13.29	7.87
Florida	11.65	10.04	8.93
Georgia	10.53	9.83	6.19
Hawaii	32.05	29.70	25.67
Idaho	7.86	6.54	4.74
Illinois	11.46	8.50	6.24
Indiana	9.88	8.76	6.20
Iowa	10.01	7.52	5.02
Kansas	10.06	8.46	6.46
Kentucky	8.98	8.38	5.18
Louisiana	8.58	8.37	5.42
Maine	15.56	12.47	9.20
Maryland	13.74	11.57	9.13
Massachusetts	14.73	14.10	13.20
Michigan	12.55	10.12	7.28
Minnesota	10.65	8.41	6.31
Mississippi	10.27	9.66	6.38
Missouri	8.92	7.42	5.48
Montana	9.38	9.02	5.21
Nebraska	8.33	7.63	5.95
Nevada	11.92	9.27	5.67
New Hampshire	16.49	14.23	12.59
New Jersey	16.34	13.30	11.55
New Mexico	10.19	8.51	5.88
New York	17.64	15.09	9.54
North Carolina	10.05	7.96	5.79

[21] US DOE/EIA Electric Power Monthly August 2011 with data for January-May 2011. Table 5.6.B: Average Retail Price of Electricity to Ultimate Customers by End-Use Sector, by State, Year-to-Date Through May 2011 and 2010, Released May 20, 2011. http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html

State	Residential (cents/kWh)	Commercial (cents/kWh)	Industrial (cents/kWh)
North Dakota	7.64	7.04	5.94
Ohio	10.77	9.74	5.86
Oklahoma	8.96	7.08	5.14
Oregon	9.34	8.22	5.43
Pennsylvania	13.01	9.86	7.82
Rhode Island	15.69	12.76	11.33
South Carolina	11.07	9.21	5.73
South Dakota	8.61	7.48	6.08
Tennessee	9.72	10.11	6.65
Texas	11.24	8.97	6.10
Utah	8.43	6.97	4.72
Vermont	16.10	13.93	9.82
Virginia	10.12	7.66	6.52
Washington	8.09	7.47	5.05
West Virginia	9.09	8.00	6.04
Wisconsin	12.78	10.18	7.10
Wyoming	8.67	7.60	5.25
U.S. Total	11.74	10.07	6.67

Table 4-2: Average Price of Natural Gas Sold to Residential Customers by State, 2010[22] ($ in bold are for 2009)

State	$ per MCF	$ per MMBtu	$ per therm
Alabama	15.92	16.24	1.624
Alaska	8.89	9.07	0.907
Arizona	15.86	16.18	1.618
Arkansas	11.52	11.75	1.175
California	**9.43**	9.62	0.962
Colorado	8.14	8.30	0.830
Connecticut	14.93	15.23	1.523
Delaware	**17.79**	18.15	1.815
District of Columbia	**13.92**	14.20	1.420
Florida	18.14	18.50	1.850
Georgia	15.56	15.87	1.587
Hawaii	44.62	45.51	4.551
Idaho	9.08	9.26	0.926
Illinois	9.39	9.58	0.958
Indiana	8.52	8.69	0.869
Iowa	9.59	9.78	0.978
Kansas	10.64	10.85	1.085
Kentucky	10	10.20	1.020
Louisiana	11.79	12.03	1.203
Maine	14.14	14.42	1.442
Maryland	**13.73**	14.00	1.400
Massachusetts	**14.85**	15.15	1.515
Michigan	11.25	11.48	1.148
Minnesota	8.7	8.87	0.887
Mississippi	10.01	10.21	1.021
Missouri	**12.61**	12.86	1.286
Montana	8.67	8.84	0.884
Nebraska	8.96	9.14	0.914
Nevada	12.25	12.50	1.250
New Hampshire	**15.33**	15.64	1.564
New Jersey	**14.54**	14.83	1.483
New Mexico	9.61	9.80	0.980
New York	14.04	14.32	1.432
North Carolina	**14.25**	14.54	1.454

[22] U.S. EIA Natural Gas Natural Gas Monthly, August 30, 2011.
www.eia.gov/natural_gas/data_publications/natural_gas_monthly/ngm.html

State	$ per MCF	$ per MMBtu	$ per therm
North Dakota	8.08	8.24	0.824
Ohio	11.02	11.24	1.124
Oklahoma	**11.39**	11.62	1.162
Oregon	12.81	13.07	1.307
Pennsylvania	12.94	13.20	1.320
Rhode Island	**17.06**	17.40	1.740
South Carolina	**14.91**	15.21	1.521
South Dakota	8.77	8.95	0.895
Tennessee	10.21	10.41	1.041
Texas	10.76	10.98	1.098
Utah	8.21	8.37	0.837
Vermont	16.14	16.46	1.646
Virginia	**13.83**	14.11	1.411
Washington	12.26	12.51	1.251
West Virginia	11.35	11.58	1.158
Wisconsin	10.34	10.55	1.055
Wyoming	8.47	8.64	0.864
U.S. Total	11.21	11.43	1.143

Table 4-3: Average Price of Natural Gas Sold to Commercial Customers by State, 2010[23] ($ in bold are for 2009)

State	$ per MCF	$ per MMBtu	$ per therm
Alabama	13.39	16.28	1.628
Alaska	8.69	16.28	1.628
Arizona	10.71	7.63	0.763
Arkansas	8.88	13.29	1.329
California	**7.75**	11.87	1.187
Colorado	**7.56**	12.11	1.211
Connecticut	9.55	9.40	0.940
Delaware	**15.87**	14.49	1.449
District of Columbia	**12.99**	14.83	1.483
Florida	10.59	13.95	1.395
Georgia	10.82	14.71	1.471
Hawaii	36.74	14.89	1.489
Idaho	8.31	37.87	3.787
Illinois	8.74	10.49	1.049
Indiana	7.44	13.18	1.318
Iowa	**7.88**	12.00	1.200
Kansas	9.81	11.20	1.120
Kentucky	8.42	14.35	1.435
Louisiana	9.93	13.76	1.376
Maine	**13.94**	13.60	1.360
Maryland	9.93	15.88	1.588
Massachusetts	**12.85**	13.62	1.362
Michigan	8.79	15.44	1.544
Minnesota	7.56	11.27	1.127
Mississippi	**9.48**	11.41	1.141
Missouri	10.24	12.68	1.268
Montana	8.56	13.08	1.308
Nebraska	7.04	12.14	1.214
Nevada	9.74	10.41	1.041
New Hampshire	**14.37**	11.75	1.175
New Jersey	10.11	15.62	1.562
New Mexico	7.55	14.15	1.415
New York	10.03	11.43	1.143

[23] U.S. EIA Natural Gas Natural Gas Monthly, August 30, 2011. www.eia.gov/natural_gas/data_publications/natural_gas_monthly/ngm.html

State	$ per MCF	$ per MMBtu	$ per therm
North Carolina	**11.63**	13.02	1.302
North Dakota	7.03	14.63	1.463
Ohio	9.23	10.46	1.046
Oklahoma	**10.6**	13.38	1.338
Oregon	10.3	13.53	1.353
Pennsylvania	10.53	11.82	1.182
Rhode Island	**15.14**	14.87	1.487
South Carolina	10.33	16.34	1.634
South Dakota	7.16	14.82	1.482
Tennessee	8.96	10.30	1.030
Texas	8.03	14.20	1.420
Utah	6.82	11.81	1.181
Vermont	11.82	7.79	0.779
Virginia	**10.31**	14.43	1.443
Washington	10.51	13.44	1.344
West Virginia	10.31	11.67	1.167
Wisconsin	8.54	14.26	1.426
Wyoming	6.91	11.89	1.189
U.S. Total	9.15	8.96	0.896

Table 4-4: Average Price of Natural Gas Delivered to Industrial Customers by State, 2010[24] ($ in bold are for 2009)

State	$ per MCF	$ per MMBtu	$ per therm
Alabama	6.36	6.49	0.649
Alaska	4.23	4.31	0.431
Arizona	7.56	7.71	0.771
Arkansas	7.25	7.40	0.740
California	7.01	7.15	0.715
Colorado	5.84	5.96	0.596
Connecticut	9.6	9.79	0.979
Delaware	**13.99**	14.27	1.427
District of Columbia	**9.41**	9.60	0.960
Florida	6.69	6.82	0.682
Georgia	24.24	24.72	2.472
Hawaii	6.4	6.53	0.653
Idaho	7.25	7.40	0.740
Illinois	5.53	5.64	0.564
Indiana	6.05	6.17	0.617
Iowa	5.3	5.41	0.541
Kansas	5.3	5.41	0.541
Kentucky	4.63	4.72	0.472
Louisiana	**9.12**	9.30	0.930
Maine	8.64	8.81	0.881
Maryland	**12.07**	12.31	1.231
Massachusetts	9.18	9.36	0.936
Michigan	5.71	5.82	0.582
Minnesota	5.93	6.05	0.605
Mississippi	**10.3**	10.51	1.051
Missouri	8.63	8.80	0.880
Montana	**9.06**	9.24	0.924
Nebraska	5.71	5.82	0.582
Nevada	10.5	10.71	1.071
New Hampshire	12.05	12.29	1.229
New Jersey	9.67	9.86	0.986
New Mexico	5.97	6.09	0.609

[24] U.S. EIA Natural Gas Natural Gas Monthly, August 30, 2011.
www.eia.gov/natural_gas/data_publications/natural_gas_monthly/ngm.html

State	$ per MCF	$ per MMBtu	$ per therm
New York	**9.52**	9.71	0.971
North Carolina	8.12	8.28	0.828
North Dakota	5.22	5.32	0.532
Ohio	**8.93**	9.11	0.911
Oklahoma	**12.55**	12.80	1.280
Oregon	7.31	7.46	0.746
Pennsylvania	10.18	10.38	1.038
Rhode Island	**12.58**	12.83	1.283
South Carolina	**6.06**	6.18	0.618
South Dakota	5.93	6.05	0.605
Tennessee	6.22	6.34	0.634
Texas	4.61	4.70	0.470
Utah	5.54	5.65	0.565
Vermont	6.59	6.72	0.672
Virginia	**7.14**	7.28	0.728
Washington	9.43	9.62	0.962
West Virginia	5.39	5.50	0.550
Wisconsin	7.61	7.76	0.776
Wyoming	5.41	5.52	0.552
U.S. Total	5.4	5.51	0.551

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