U.S. Environmental Protection Agency
State Climate and Energy Technical Forum

The Emissions & Generation Resource Integrated Database (eGRID)
Background Document
March 31, 2011

The United States relies on electricity to meet a significant portion of its energy demands- particularly for lighting, electric motors, heating, and air conditioning. Electricity generators consumed 37 percent of total U.S. energy from fossil fuels and emitted 42 percent of total carbon dioxide (CO_2) from fossil fuel combustion in 2008 (EPA 2010a).[1] The U.S. Environmental Protection Agency (EPA) developed the Emissions & Generation Resource Integrated Database (eGRID) to display the environmental attributes of electric power generation in the United States and to highlight the linkages between electricity generation and air emissions. The eGRID Technical Support Document (EPA 2010b) provides background information on eGRID, the various types of emissions and emissions rates in the database, resource mixes used to generate electricity, eGRID-related tools and applications, and state and local government case studies on the application of eGRID factors.

1. eGRID Background

eGRID is a comprehensive inventory of environmental attributes of electric power systems. The preeminent source of air emissions data for the electric power sector, eGRID is based on available plant-specific data for all U.S. electricity generating plants that provide power to the electric grid and report data to the U.S. government. Data are available that provide total emissions[2], emissions rates, and resource mix[3] estimates from each electric generating plant, and are then aggregated by electric generating company (EGC), parent company, state, U.S. total, and the following three types of power grid regions:

- National American Electric Reliability Council (NERC) region plus Alaska and Hawaii;
- eGRID subregion which are subregions of NERC regions (see Figure 1 below); and
- Power control area, also known as balancing authorities, which are generally subsets of eGRID subregions at the level where all power plants are dispatched.

Data in eGRID

For every U.S. power plant and EGC, eGRID provides:

- Detailed emissions profile for nitrogen oxides (NO_X), sulfur dioxide (SO_2), carbon dioxide (CO_2), methane (CH_4) nitrous oxide (N_2O), and mercury (Hg);
  - Total emissions reported in tons (pounds for Hg, CH_4 and N_2O);
  - Output emission rates in lb/MWh (pounds per gigawatt-hour for Hg, CH_4 and N_2O); and
  - Input-based emission rates in pounds per million British thermal units (lb/MMBtu) (pounds per billion Btu for Hg, CH_4 and N_2O);
- Resource mix (generation by fuel type), in megawatt-hours (MWh) and percent; and
- Identification, ownership, corporate affiliation, and location information.

[1] Data from the *U.S. Inventory of Greenhouse Gas Emissions* provide context on electric generator emissions compared to total U.S. emissions. eGRID factors are not used to calculate emissions in the U.S. Inventory.
[2] Emissions data are included for nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and mercury (Hg) for various years.
[3] The renewable and nonrenewable resources used to generate electricity (e.g. coal, oil, gas, nuclear, hydro, geothermal, biomass, solar, etc.)

Data are available for 1996 through 2000, 2004, 2005, and 2007 (the most recent year for which data are available). Additional information on the various levels of aggregation is available in the eGRID Technical Support Document (EPA 2010b).

eGRID emissions data are derived from a variety of data collected by EPA and the Energy Information Administration (EIA). Examples of a few of these sources include:

- EPA, Emissions Data collected under 40 CFR Part 75;
- EIA, EIA-860: Annual Electric Generator Report; and
- EIA, EIA-923: Power Plant Operations Report.

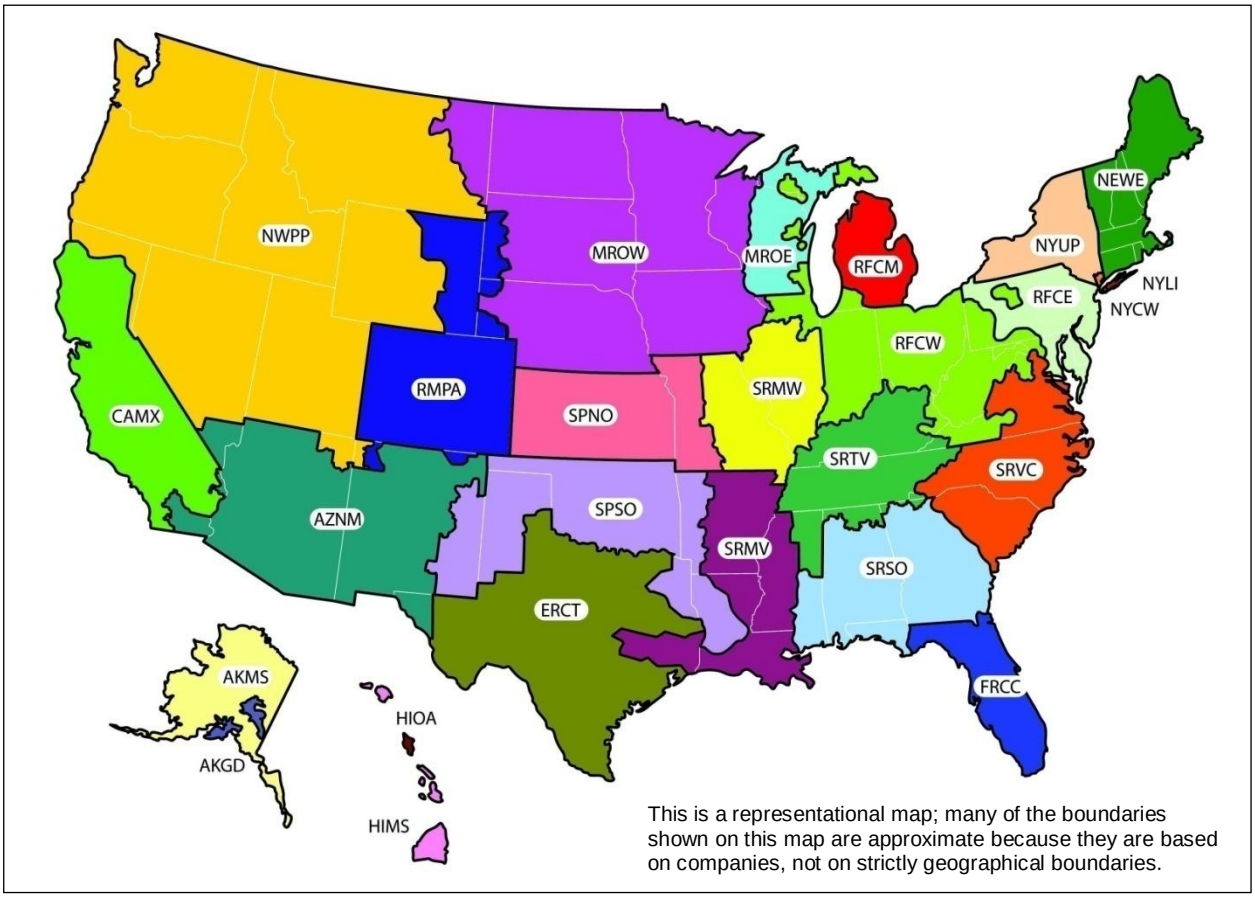

Figure 1. eGRID subregion representational map (eGRID 2010 Version 1.0)

2. Emissions and Emissions Rates

Plant level emissions in eGRID are developed by summing component parts, such as unit level boilers and/or turbines, or an aggregation of like generating units (EPA 2010b). eGRID plant level emissions reflect monitored data, estimated data, or a combination of both. Emissions and emission rates in eGRID represent emissions and rates at the point(s) of generation, and account for losses within the generating plants (net generation). However, they do not take into account any power purchases, imports or exports of electricity into a specific state or any other grouping of plants. In addition, they do not account for any transmission and distribution losses that occur between the points of generation and the points of consumption.

eGRID displays the emissions associated with electricity generation with two adjustments made to emissions estimates. The first adjustment is for combined heat and power plants, which generate both electricity and useful thermal output (e.g. steam) for industrial, commercial, heating, or cooling applications. eGRID separates the emissions associated with electricity production from useful thermal output and shows only the portion associated with electricity production. The second adjustment is for emissions from biomass. See the eGRID Technical Support Document (EPA 2010b) for details about biomass adjustments.

Unadjusted emissions are shown at the boiler level for all years and at the plant level for data years 2004, 2005, and 2007. Unadjusted emissions are not provided at the other levels of aggregation. The emissions rates in eGRID are based on the adjusted emissions.

eGRID also contains output and input emissions rates. Output emissions rates are the emissions per net generation, and input emissions rates are the emissions per heat input (i.e. a measure of fuel combustion).

2.1. Total vs. Non-baseload Output Emission Rates

eGRID provides several output emissions rates: total, combustion, and fossil-fuel category (fossil fuel, coal, oil, gas), and non-baseload. Two commonly used types are total output emission rates and non-baseload output emission rates.[4] The total output emission rate (see Table 1) is a measure of emissions associated with electric generation output. These rates can be used as default factors for estimating GHG emissions for a carbon footprint or emission inventory. EPA uses these rates in its Power Profiler Tool, Personal Emissions Calculator, and the State GHG Inventory Tool. A variety of programs use these rates to estimate scope 2 indirect emissions[5] including the Climate Registry, The California Climate Action Registry, California's Mandatory GHG emissions reporting program (AB 32), and EPA Climate Leaders.

Non-baseload emission rates cover a subset of the total system mix, with a greater weight given to plants that operate concurrently with peak demand for electricity. The non-baseload emissions rates can be used to estimate the emissions reduction benefits from energy efficiency and renewable energy projects. These rates can also be used to estimate GHG emissions reductions from reductions in electricity use. However, they are not well-suited to develop a greenhouse gas inventory or carbon footprint. An example of these rates for each eGRID subregion can be found in Table 1. Non-baseload rates are used in EPA's Green Power Equivalency Calculator to calculate potential avoided CO_2 emissions, , and in both the Green Power Equivalency Calculator and EPA's Greenhouse Gas Equivalencies Calculator to translate purchased electricity into more understandable terms such as an equivalent number of passenger vehicles, homes, or coal plants.

[4] Additional information on how to use total and non-baseload rates is available in the conference paper "The Value of eGRID and eGRIDweb to GHG Inventories" in the reference section of this document.

[5] Scope 2 emissions are indirect GHG emissions resulting from the purchase of electricity, heating and cooling, or steam generated off site, and the transmissions and distribution (T&D) losses associated with some purchases.

2.2. *Resource Mix*

eGRID also displays the resource mix, that is generation by fuel type, for renewable and nonrenewable resources. eGRID classifies biomass, hydro, geothermal, wind, and solar energy as renewable resources. Nonrenewable resources include coal, oil, gas, other fossil, and nuclear. Resource mix is provided at the plant level and all other aggregation levels (i.e. state, U.S. total, company, parent company, and the three power grid levels) and is useful in determining the resources used to generate electricity in a particular state or region. Within eGRID, resource mix is represented both in net generation (in MWh) and in percent of total net generation. Resource mixes at the state-level aggregation level are available in Table 2.

Figure 2 shows the resource mix for the NWPP and the RMPA eGRID subregions. Although these eGRID subregions are adjacent to each other geographically (see Figure 1), they rely on a different combination of renewable and nonrenewable resources to generate electricity. The NWPP region relies heavily on hydro for almost half (48%) of its electricity generation, whereas the RMPA region relies heavily on coal (71%).

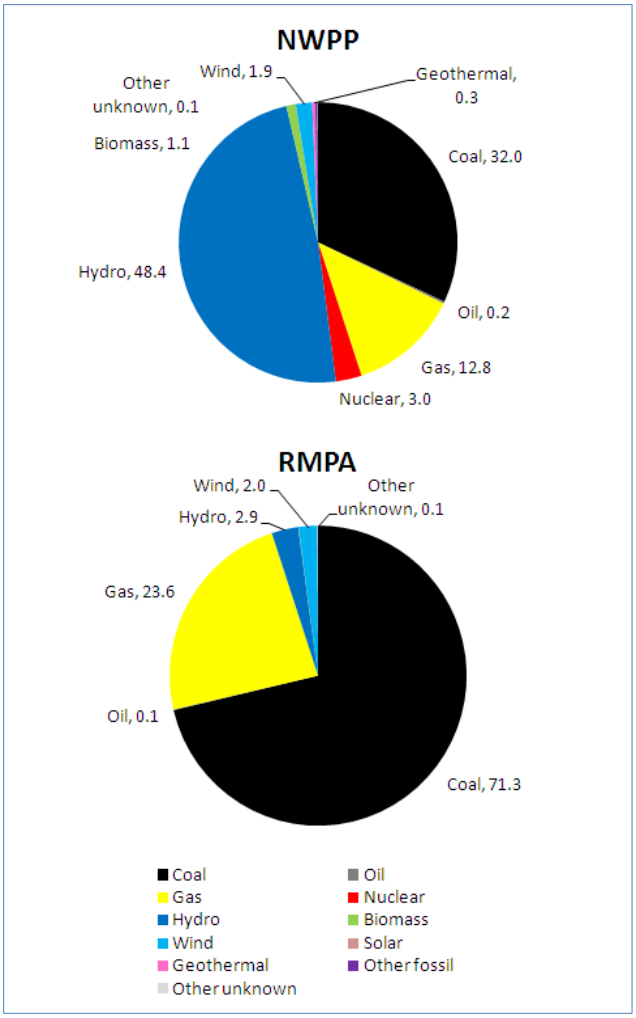

Figure 2. Comparison of Resource Mix for two eGRID subregions (NWPP and RMPA)

3. eGRID Applications: eGRIDweb, Power Profiler

The online application of eGRID, called eGRIDweb, displays eGRID data in a user friendly format, and allows users to export selected data. Currently the eGRIDweb application contains years 2004 and 2005 data and has not yet been updated with the most recent year 2007 data. Users can also download related documents, reports, and files, and receive information about eGRID-related updates. The application provides total and non-baseload emission rates by data year and aggregation level (U.S. total, state, NERC Region, eGRID subregion, power control area (PCA), power plants, and companies). The eGRIDweb application is available online at: http://cfpub.epa.gov/egridweb/.

EPA developed the Power Profiler online application, which provides eGRID subregion total output emissions rate and resource mix data and compares them to the U.S. Totals. The application guides the user to a particular eGRID subregion through a user entered ZIP code and a user selected electric utility. Also, a user can enter electricity usage to determine the air emissions impacts of electricity use in a home or business. The Power Profiler application is available online at: http://www.epa.gov/powerprofiler.

4. Potential Uses

4.1. Estimating Emissions from Generation

eGRID total output emission rates are given in units of mass per quantity of net generation at different levels of aggregation (e.g. plant, state, company, U.S. total, and three types of power grid regions). These values are developed by taking the total emissions of all plants in the specified area and dividing by the total net generation. Table 3 below provides an example of state-level data. An appropriate use of the total output emission rates in this table would be to estimate the emissions from generation that takes place within certain states (for example, for direct emissions in a state-level GHG inventory). This table does not account for electricity that is imported and exported between states to satisfy the demand for electricity within a certain state. The state-level data in Table 3 are not recommended for use in determining indirect emissions from electricity consumption, which is discussed below. Some states are net exporters of electricity, while other states import a significant amount of electricity from other states. eGRID provides information about state net imports and exports of electricity (in the file "eGRID2010V1_0_STIE_USGC.xls" on the eGRID website).

4.2. Estimating Emissions from Consumption at Point of Use

While eGRID factors are an estimate of emissions and output from electric *generation*, the factors can also be used to estimate emissions from electricity *consumption* at the point of use. EPA recommends using eGRID subregion total emission rates (see Table 1) to make consumption based calculations. An example of this type of calculation is estimating GHG emissions from electricity consumption in EPA's State Inventory Tool Electricity Consumption Module, the Climate Registry's Local Government Operations Protocol (LGOP), and in many local government GHG inventories. In order to use eGRID factors to estimate electricity consumption, eGRID total output emission rates must be adjusted to account for transmission and distribution losses that occur between the points of generation and the points of consumption. Because of these transmission and distribution losses, one kWh of electricity consumption requires more than one kWh of electricity generation. Grid loss factors are available in eGRID (see Table 4) if a consumption based estimate which includes transmission and distribution losses is desired. The grid loss factors can be applied using the following equation:

> Emissions (lbs CO_2E) = {(Total Consumption (kWh)) ÷ ((100- Transmission Loss Factor (%))/100)} × eGRID Emission Factor (lbs CO_2E/MWh) × 0.001MWh/kWh

4.3. Calculating GHG Emission Reductions from Energy Efficiency and Renewable Energy Programs

Many state and local governments are interested in calculating indirect emissions from electricity consumption and for calculating emission reductions from energy efficiency and renewable energy projects. EPA recommends using eGRID subregion level emission rates (see Table 1) to make these calculations. Electric generating companies (EGCs) and state level rates are also available; however these rates are not recommended for this purpose because an EGC may purchase power and/or export its power to other EGCs and state electricity generation may not serve all of the consumption within the state. ECG and state level output emission rates are only appropriate when examining the generation (not consumption) that takes place within particular ECGs or states. Further, the total output emission rates should be used for indirect emissions estimates and the non-baseload output emission rates should be used for emissions reductions estimates.

5. State and Local Case Studies

5.1. State Example: Maryland

The Maryland Department of the Environment (MDE) determined eligibility for participation in the Voluntary Renewable Set-Aside Account (VERSA) using eGRID factors. The original VERSA language specified that the number of CO_2 allowances to be retired by the Department should equal the number of megawatt hours of renewable energy represented by the renewable energy credits (RECs) submitted to the Department, multiplied by the CO_2 total output emissions rate in their specific eGRID region (MDE 2010). The eGRID factors played a critical role in determining the number of CO_2 allowances that should be retired by MDE and the amount of CO_2 displaced from conventional fossil fuel generation by one MWh of renewable energy generation as depicted through the creation and subsequent retirement of a voluntary REC.

5.2. State Example: New Mexico

New Mexico has an Energy Efficiency Resource Standard (EERS) that requires 10% energy savings from 2005 sales must be achieved by Investor Owned Utilities by 2020. eGRID non-baseload emission rates were used to estimate the impact of this energy efficiency policy on greenhouse gas and criteria pollutant emissions. First, 2005 electricity sales were obtained for the three investor-owned utilities (IOU's) in the state from the Energy Information Administration (EIA 2010). Next, 10% of the electricity sales for the three IOU's were calculated, totaling 1,290,810 MWh. The AZNM eGRID subregion non-baseload emission rate was then multiplied by the energy efficiency savings, to estimate the total EERS reductions for New Mexico shown in Table 5.

Table 5. Emission Reductions from New Mexico's EERS

Greenhouse Gas Reductions (metric tons)			**Criteria Pollutant Reductions (tons)**	
CO_2	**CH_4**	**N_2O**	**NO_x**	**SO_2**
745,829	12.65	5.72	705.9	277

5.3. Local Example: Delaware Valley Regional Planning Commission (DVRPC)

In 2009, the Delaware Valley Regional Planning Commission (DVRPC)--a nine county region in Pennsylvania and New Jersey--completed a 2005 GHG Inventory in support of regional efforts to quantify and reduce emissions associated with climate change. The DVRPC determined that their entire region fell within the RFC East (RFCE) eGRID subregion, with a year 2005 CO_2 total output emission rate of 1,139 lbs CO_2/MWh. Combining this factor with the RFC East eGRID subregion total output emissions rates for CH_4 and N_2O and a transmission and distribution loss factor of 6.4%, DVRPC staff calculated the total regional GHG emissions from electricity consumption as 30.1 million metric tons CO_2E (DVRPC 2010).

DVRPC is currently working with counties and municipalities in their region on a project to switch out 10,000 incandescent traffic signals for LED lamps. The projected electricity savings from this effort is 3,000 MWh annually. DVRPC used the RFC East non-baseload CO_2 emissions factor to calculate the expected CO_2 savings associated with this effort as 2,274 metric tons.

eGRID Resources

The eGRID main website:
http://www.epa.gov/egrid

eGRID Technical Support Document:
http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2007TechnicalSupportDocument.pdf

eGRIDweb application:
http://cfpub.epa.gov/egridweb/

eGRID FAQs:
http://www.epa.gov/cleanenergy/energy-resources/egrid/faq.html

eGRID Summary tables:
http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2007V1_1_year05_SummaryTables.pdf

Conference paper: "The Value of eGRID and eGRIDweb to GHG Inventories":
http://www.epa.gov/cleanenergy/documents/egridzips/The_Value_of_eGRID_Dec_2009.pdf

Conference Paper: "Total, Non-baseload, eGRID Subregion, State? Guidance on the Use of eGRID Output Emission Rates":
http://www.epa.gov/ttn/chief/conference/ei18/session5/rothschild.pdf

References

DVRPC (2010). *Regional Greenhouse Gas Emissions Inventory.* Delaware Valley Regional Planning Commission, December 2010. Available online at: http://www.dvrpc.org/reports/09038A.pdf

EIA (2010). *State Electricity Sales, Revenue and Price Tables*. U.S. Department of Energy, Energy Information Administration, June 2005. Available online at: http://www.eia.doe.gov/cneaf/electricity/esr/backissues.html.

EPA (2010a). *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008*, U.S. Environmental Protection Agency, April 2010. Available online at: http://www.epa.gov/climatechange/emissions/downloads10/508_Complete_GHG_1990_2008.pdf.

EPA (2010b). eGRID Technical Support Document:
http://www.epa.gov/cleanenergy/documents/egridzips/eGRID2007TechnicalSupportDocument.pdf

EPA (2011). The Emissions & Generation Resource Integrated Database for 2010 (eGRID2010) Version 1.0, eGRID subregion year 2007 data file, February 2011. Available online at: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html.

MDE (2010). *Technical Support Document for Amendments to COMAR 26.09 MD CO_2 Budget Training Program*. Maryland Department of the Environment, October 2010. Available online at: http://www.mde.state.md.us/aboutmde/AboutMDEHome/Documents/RGGI-VERSA_TSD.PDF.

Table 1. eGRID greenhouse gas Annual total output emission rates and non-baseload output emission rates
(year 2007 data from eGRID2010 Version 1.0)

eGRID subregion acronym	eGRID subregion name	Annual total output emission rates			Annual non-baseload output emission rates		
		Carbon dioxide (CO_2) (lb/MWh)	Methane (CH_4) (lb/GWh)	Nitrous oxide (N_2O) (lb/GWh)	Carbon dioxide (CO_2) (lb/MWh)	Methane (CH_4) (lb/GWh)	Nitrous oxide (N_2O) (lb/GWh)
AKGD	ASCC Alaska Grid	1,284.72	27.11	7.44	1,363.19	34.99	6.95
AKMS	ASCC Miscellaneous	535.73	22.65	4.48	1,462.30	61.68	12.18
AZNM	WECC Southwest	1,252.61	18.80	16.57	1,211.84	20.56	9.31
CAMX	WECC California	681.01	28.29	6.23	1,045.30	39.42	4.74
ERCT	ERCOT All	1,252.57	17.76	13.99	1,096.19	19.69	5.63
FRCC	FRCC All	1,220.11	41.19	15.25	1,286.41	43.40	11.50
HIMS	HICC Miscellaneous	1,343.82	135.15	21.71	1,645.57	122.94	21.33
HIOA	HICC Oahu	1,620.76	91.05	20.89	1,630.89	106.18	18.52
MROE	MRO East	1,692.32	28.79	29.05	1,905.18	35.25	29.98
MROW	MRO West	1,771.52	29.50	29.99	1,988.69	53.59	32.98
NEWE	NPCC New England	827.95	76.98	15.20	1,204.91	60.69	13.41
NWPP	WECC Northwest	858.79	16.34	13.64	1,279.58	43.31	15.75
NYCW	NPCC NYC/Westchester	704.80	26.22	3.35	1,234.06	37.65	4.88
NYLI	NPCC Long Island	1,418.74	90.50	13.10	1,397.80	44.08	6.99
NYUP	NPCC Upstate NY	680.49	17.41	9.90	1,378.53	31.55	16.19
RFCE	RFC East	1,059.32	27.40	17.03	1,671.96	33.29	22.19
RFCM	RFC Michigan	1,651.11	32.55	27.79	1,803.64	32.09	27.33
RFCW	RFC West	1,551.52	18.37	25.93	1,982.05	24.30	31.48
RMPA	WECC Rockies	2,187.41	26.69	33.47	1,554.38	23.17	16.45
SPNO	SPP North	1,798.71	21.22	29.20	1,958.22	25.40	27.75
SPSO	SPP South	1,624.03	24.52	22.42	1,435.24	25.03	13.14
SRMV	SERC Mississippi Valley	1,004.10	21.80	11.15	1,171.05	28.25	6.91
SRMW	SERC Midwest	1,779.27	20.57	29.60	1,945.66	24.02	29.69
SRSO	SERC South	1,495.47	23.64	24.57	1,551.05	28.50	21.69
SRTV	SERC Tennessee Valley	1,540.85	19.87	25.48	1,917.25	25.98	30.05
SRVC	SERC Virginia/Carolina	1,118.41	22.26	19.08	1,661.11	38.01	24.51

Table 2. State resource mix (year 2007 data from eGRID2010 Version 1.0)

State	Nameplate capacity (MW)	Net generation (MWh)	Generation resource mix (percent)										
			Coal	Oil	Gas	Other fossil	Biomass	Hydro	Nuclear	Wind	Solar	Geothermal	Other fuel
AK	2,173.3	6,821,391.6	9.4029	14.8062	56.6972	0.0000	0.1498	18.9290	0.0000	0.0148	0.0000	0.0000	0.0000
AL	33,900.3	143,826,270.8	54.2278	0.1091	16.1527	0.1265	2.6425	2.8758	23.8657	0.0000	0.0000	0.0000	0.0000
AR	16,461.7	54,596,235.6	47.1538	0.1725	15.3202	0.0320	2.9741	5.9828	28.3648	0.0000	0.0000	0.0000	0.0000
AZ	28,724.3	113,340,970.3	36.4170	0.0435	33.9411	0.0000	0.0291	5.9317	23.6299	0.0000	0.0076	0.0000	0.0000
CA	68,274.3	211,159,504.1	1.0884	1.1053	54.9409	0.9652	2.6989	13.0885	16.9505	2.6449	0.2638	6.1521	0.1016
CO	13,732.4	53,907,492.1	66.6619	0.0528	27.8548	0.0000	0.0577	2.8966	0.0000	2.3958	0.0041	0.0000	0.0764
CT	8,770.9	33,164,459.2	11.2733	3.9526	29.9470	2.2736	2.0748	1.0299	49.4087	0.0000	0.0000	0.0000	0.0402
DC	868.0	75,251.0	0.0000	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
DE	3,524.5	8,534,163.3	65.8743	2.8255	22.2867	8.4496	0.5638	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FL	63,473.2	231,143,712.5	29.3792	8.7404	45.8741	0.6017	1.8211	0.0668	12.6715	0.0000	0.0000	0.0000	0.8453
GA	39,725.1	145,000,880.2	62.2738	0.5395	11.0865	0.0541	2.2811	1.3204	22.4447	0.0000	0.0000	0.0000	0.0000
HI	2,673.9	11,533,349.6	13.6901	77.2907	0.0000	1.7732	2.3869	0.8007	0.0000	2.0652	0.0000	1.9932	0.0000
IA	13,589.1	49,790,355.0	76.2910	0.6265	6.2078	0.0254	0.3017	1.9328	9.0758	5.5389	0.0000	0.0000	0.0002
ID	3,698.4	11,484,090.6	0.7277	0.0012	14.4309	0.0000	4.1848	78.5582	0.0000	1.5000	0.0000	0.0000	0.5973
IL	48,543.2	200,257,304.4	47.5759	0.0594	3.7659	0.0775	0.3098	0.0768	47.8029	0.3318	0.0000	0.0000	0.0000
IN	30,085.4	130,690,574.2	93.9646	0.1301	3.1099	1.9953	0.1761	0.3443	0.0000	0.0000	0.0000	0.0000	0.2797
KS	12,062.3	50,122,195.7	72.3238	0.4133	4.2548	0.0000	0.0000	0.0210	20.6877	2.2995	0.0000	0.0000	0.0000
KY	23,415.5	97,225,319.4	93.0653	2.8710	1.8525	0.0161	0.4789	1.7162	0.0000	0.0000	0.0000	0.0000	0.0000
LA	29,685.1	92,578,328.7	24.8991	2.4311	47.4355	2.0682	3.2188	0.8929	18.4466	0.0000	0.0000	0.0000	0.6078
MA	15,571.6	47,048,509.5	25.5394	6.4763	52.8870	1.7080	2.5151	0.0000	10.8743	0.0000	0.0000	0.0000	0.0000
MD	13,437.0	50,197,923.8	59.1642	1.9619	4.4642	1.3658	1.1593	3.2914	28.5932	0.0000	0.0000	0.0000	0.0000
ME	4,469.5	16,128,567.4	2.3286	5.0741	41.3837	2.0283	25.3937	23.1773	0.0000	0.6143	0.0000	0.0000	0.0000
MI	32,908.9	117,893,865.2	60.0630	0.5925	9.9453	0.5076	2.0366	0.1194	26.7333	0.0023	0.0000	0.0000	0.0000
MN	14,273.8	54,535,354.5	59.0266	0.7418	7.1539	0.5870	2.3354	1.1989	24.0266	4.8366	0.0000	0.0000	0.0932
MO	21,647.3	91,133,917.6	82.3952	0.0663	5.4401	0.0403	0.0322	1.7423	10.2837	0.0000	0.0000	0.0000	0.0000
MS	17,082.2	49,854,974.3	34.9159	0.8011	42.7999	0.0735	2.6376	0.0000	18.7720	0.0000	0.0000	0.0000	0.0000
MT	5,612.0	28,931,493.0	63.4491	1.6545	0.3663	0.0657	0.3835	32.3673	0.0000	1.7136	0.0000	0.0000	0.0000
NC	29,674.2	130,131,040.8	61.4635	0.3807	3.4371	0.0738	1.2842	2.3985	30.7726	0.0000	0.0000	0.0000	0.1897
ND	5,342.3	31,224,105.0	93.4008	0.1628	0.0531	0.1713	0.0433	4.1807	0.0000	1.9881	0.0000	0.0000	0.0000
NE	7,418.6	32,915,871.1	59.6366	0.1085	3.3686	0.0000	0.1861	2.4969	33.5447	0.6585	0.0000	0.0000	0.0000
NH	4,477.9	23,254,988.6	16.8885	1.6499	24.6525	0.2707	4.8114	5.4407	46.2863	0.0000	0.0000	0.0000	0.0000
NJ	20,233.6	62,671,245.0	16.2282	0.7196	29.8038	1.0906	1.2500	0.0000	50.8753	0.0324	0.0000	0.0000	0.0000
NM	7,875.2	35,974,609.4	76.7309	0.1236	18.4833	0.0000	0.0445	0.7449	0.0000	3.8728	0.0000	0.0000	0.0000
NV	12,377.9	32,813,865.8	21.6095	0.0349	68.2864	0.0130	0.0000	6.1047	0.0000	0.0000	0.1340	3.8176	0.0000
NY	43,276.7	144,552,312.9	14.8082	5.6835	30.6372	0.6834	1.2997	16.9379	29.3685	0.5766	0.0000	0.0000	0.0050
OH	36,457.6	154,647,007.0	85.9478	0.7401	2.5667	0.1871	0.0899	0.2654	10.1936	0.0095	0.0000	0.0000	0.0000
OK	22,240.0	74,813,820.9	46.0315	0.2145	46.9681	0.0342	0.3738	3.8763	0.0000	2.4717	0.0000	0.0000	0.0299
OR	13,894.9	55,077,793.9	7.9009	0.0259	26.9758	0.0751	1.7764	60.9818	0.0000	2.2641	0.0000	0.0000	0.0000
PA	49,436.0	225,840,098.3	54.3003	0.5936	8.5003	0.5766	0.8895	0.6700	34.2615	0.2081	0.0000	0.0000	0.0000
RI	2,021.3	7,049,844.0	0.0000	0.4816	97.2613	0.0000	2.1952	0.0619	0.0000	0.0000	0.0000	0.0000	0.0000
SC	25,044.1	103,402,141.7	40.2145	0.2101	5.7683	0.0953	1.9283	0.3339	51.4495	0.0000	0.0000	0.0000	0.0000
SD	3,219.0	5,662,168.5	46.8961	1.1109	6.1998	0.0005	0.0000	43.1433	0.0000	2.6495	0.0000	0.0000	0.0000
TN	22,736.5	95,113,408.7	63.3321	0.2440	0.7589	0.0152	0.9679	4.4528	30.1749	0.0525	0.0000	0.0000	0.0016
TX	108,838.6	405,502,827.8	36.3201	0.3228	49.2085	0.8881	0.3160	0.4055	10.0998	2.2210	0.0000	0.0000	0.2182
UT	7,515.2	45,372,574.7	81.9235	0.0863	16.3628	0.0111	0.0676	1.1875	0.0000	0.0000	0.0000	0.3613	0.0000
VA	25,610.6	78,360,507.1	44.9887	2.6634	13.8492	0.6492	3.2140	0.0000	34.6343	0.0000	0.0000	0.0000	0.0011
VT	1,093.0	5,823,581.5	0.0000	0.1341	0.0324	0.0000	7.7794	11.1032	80.7704	0.1805	0.0000	0.0000	0.0000
WA	28,699.3	106,990,230.7	7.9978	0.0343	6.8116	0.3746	1.2039	73.7205	7.5788	2.2785	0.0000	0.0000	0.0000
WI	18,227.1	63,364,875.5	63.1710	1.5993	10.2403	0.1103	1.8835	2.3926	20.3746	0.1725	0.0000	0.0000	0.0559
WV	17,076.0	93,933,109.1	97.7997	0.2128	0.4139	0.0597	0.0000	1.3354	0.0000	0.1784	0.0000	0.0000	0.0001
WY	7,036.4	45,633,486.4	94.5069	0.1035	1.3017	0.6839	0.0000	1.5984	0.0000	1.6542	0.0000	0.0000	0.1513

Table 3. State-level eGRID emissions, and emission rates (2007 data from eGRID 2010 Version 1.0)

State	Carbon Dioxide (CO_2)		Methane (CH_4)		Nitrous Oxide (N_2O)	
	Emissions (tons)	Annual output emission rate (lb/MWh)	Emissions (tons)	Annual output emission rate (lb/MWh)	Emissions (tons)	Annual output emission rate (lb/MWh)
AK	3,870,171.3	1,134.72	178,811.0	26.21	46,691.4	6.84
AL	95,175,079.1	1,323.47	3,252,679.8	22.62	3,104,833.2	21.59
AR	32,758,019.7	1,200.01	1,384,538.5	25.36	1,136,388.6	20.81
AZ	66,806,501.0	1,178.86	1,796,874.6	15.85	1,763,432.8	15.56
CA	59,745,976.8	565.88	6,278,405.6	29.73	894,536.1	4.24
CO	48,707,188.2	1,807.07	1,232,425.3	22.86	1,434,672.2	26.61
CT	11,455,975.3	690.86	1,977,435.0	59.63	386,072.6	11.64
DC	104,664.7	2,781.75	8,996.1	119.55	1,804.4	23.98
DE	7,696,592.6	1,803.71	209,763.8	24.58	219,894.5	25.77
FL	145,312,945.9	1,257.34	9,490,446.0	41.06	3,737,078.8	16.17
GA	101,695,384.7	1,402.69	2,883,526.7	19.89	3,347,770.4	23.09
HI	8,903,185.2	1,543.90	1,191,239.4	103.29	243,537.4	21.12
IA	44,340,716.1	1,781.10	1,045,355.6	21.00	1,467,402.4	29.47
ID	801,889.2	139.65	154,896.2	13.49	28,590.2	2.49
IL	110,803,587.4	1,106.61	2,585,640.7	12.91	3,650,092.1	18.23
IN	134,051,476.0	2,051.43	3,106,741.6	23.77	4,453,239.4	34.07
KS	43,128,004.9	1,720.91	1,005,625.8	20.06	1,420,936.3	28.35
KY	101,862,091.3	2,095.38	2,379,341.1	24.47	3,440,496.2	35.39
LA	50,112,665.1	1,082.60	2,142,626.2	23.14	1,081,046.5	11.68
MA	28,206,643.0	1,199.05	3,050,805.8	64.84	771,221.8	16.39
MD	33,573,366.7	1,337.64	1,655,057.2	32.97	1,162,330.2	23.15
ME	4,257,425.0	527.94	3,157,344.4	195.76	453,933.7	28.14
MI	83,515,634.0	1,416.79	3,346,732.8	28.39	2,841,901.1	24.11
MN	41,499,640.8	1,521.94	2,328,846.5	42.70	1,503,548.4	27.57
MO	81,238,841.2	1,782.85	1,886,681.5	20.70	2,687,573.2	29.49
MS	30,770,982.0	1,234.42	1,094,496.9	21.95	786,552.9	15.78
MT	23,350,584.5	1,614.20	582,111.7	20.12	797,239.5	27.56
NC	80,353,778.6	1,234.97	2,457,234.1	18.88	2,737,822.7	21.04
ND	34,823,011.7	2,230.52	753,614.9	24.14	1,119,340.9	35.85
NE	23,500,501.1	1,427.91	545,547.1	16.57	779,286.7	23.68
NH	7,708,904.4	662.99	1,447,021.2	62.22	331,090.7	14.24
NJ	21,937,504.2	700.08	1,496,956.8	23.89	542,313.8	8.65
NM	32,184,310.5	1,789.28	791,381.1	22.00	985,417.4	27.39
NV	19,065,644.6	1,162.05	609,908.9	18.59	328,629.0	10.01
NY	54,316,450.8	751.51	3,865,533.8	26.74	1,227,195.8	8.49
OH	139,768,179.9	1,807.58	3,352,858.9	21.68	4,702,938.4	30.41
OK	55,557,232.3	1,485.21	1,616,040.9	21.60	1,362,662.7	18.21
OR	11,312,850.0	410.80	952,774.7	17.30	277,299.3	5.03
PA	136,409,270.4	1,208.02	5,393,096.1	23.88	4,516,751.4	20.00
RI	3,201,967.8	908.38	127,055.5	18.02	12,896.2	1.83
SC	46,911,223.2	907.36	1,657,101.3	16.03	1,597,679.3	15.45
SD	3,473,323.0	1,226.85	83,830.9	14.81	108,538.9	19.17
TN	64,538,994.0	1,357.10	1,689,981.0	17.77	2,217,302.5	23.31
TX	265,054,368.6	1,307.29	7,711,487.2	19.02	6,017,653.6	14.84
UT	43,912,103.2	1,935.62	1,061,986.0	23.41	1,391,766.3	30.67
VA	44,590,344.3	1,138.08	2,812,928.0	35.90	1,522,490.8	19.43
VT	10,931.7	3.75	438,607.4	75.32	58,492.0	10.04
WA	13,865,412.3	259.19	1,053,604.3	9.85	464,079.1	4.34
WI	50,429,615.4	1,591.72	1,706,888.4	26.94	1,686,016.3	26.61
WV	92,380,022.6	1,966.93	2,103,479.5	22.39	3,133,278.8	33.36
WY	64,690,352.5	2,835.21	1,462,674.7	32.05	2,169,671.5	47.55

Table 4. State-level eGRID grid loss factors (2007 data from eGRID 2010 Version 1.0)

State	Grid loss factor (%)
AK	6.47
AL	1.24
AR	4.84
AZ	6.47
CA	4.84
CO	4.84
CT	6.47
DC	6.47
DE	6.47
FL	6.47
GA	6.47
HI	3.20
IA	4.84
ID	6.47
IL	6.47
IN	6.47
KS	6.47
KY	6.47
LA	6.47
MA	6.47
MD	6.47
ME	6.47
MI	6.47
MN	6.47
MO	6.47
MS	6.47
MT	4.84
NC	6.47
ND	4.84
NE	6.47
NH	6.47
NJ	4.84
NM	6.47
NV	6.47
NY	6.47
OH	6.47
OK	6.47
OR	4.84
PA	6.47
RI	6.47
SC	6.47
SD	6.47
TN	6.47
TX	6.42
UT	4.84
VA	6.47
VT	6.47
WA	4.84
WI	6.47
WV	6.47
WY	4.84