NETL Life Cycle Inventory Data
Process Documentation File

Process Name: U.S. National Average Electricity Grid Mix 2007

Reference Flow: 1 MWh of Electricity

Brief Description: The average composition of the U.S. electricity grid by generation type in 2007 accounting for imports from Canada

Section I: Meta Data

Geographical Coverage: United States **Region:** N/A

Year Data Best Represents: 2007

Process Type: Energy Conversion (EC)

Process Scope: Gate-to-Gate Process (GG)

Allocation Applied: No

Completeness: All Relevant Flows Captured

Flows Aggregated in Data Set:

☒ Process ☒ Energy Use ☐ Energy P&D ☐ Material P&D

Relevant Output Flows Included in Data Set:

Releases to Air:	☐ Greenhouse Gases	☐ Criteria Air Pollutants	☐ Other
Releases to Water:	☐ Inorganic Emissions	☐ Organic Emissions	☐ Other
Water Usage:	☐ Water Consumption	☐ Water Demand (throughput)	
Releases to Soil:	☐ Inorganic Releases	☐ Organic Releases	☐ Other

Adjustable Process Parameters:

Coal	[MWh] Fraction of U.S. average electricity grid mix produced from coal
Fuel Oil	[MWh] Fraction of U.S. average electricity grid mix produced from fuel oil
Natural_Gas	[MWh] Fraction of U.S. average electricity grid mix produced from natural gas

Nuclear	[MWh] Fraction of U.S. average electricity grid mix produced from nuclear
Hydro	[MWh] Fraction of U.S. average electricity grid mix produced from hydro
Biomass	[MWh] Fraction of U.S. average electricity grid mix produced from biomass
Wind	[MWh] Fraction of U.S. average electricity grid mix produced from wind
Solar	[MWh] Fraction of U.S. average electricity grid mix produced from solar
Geothermal	[MWh] Fraction of U.S. average electricity grid mix produced from geothermal

Tracked Input Flows:

Coal [Electric Power]	Electric power from coal
Fuel Oil [Electric Power]	Electric power from fuel oil
Natural Gas [Electric Power]	Electric power from natural gas
Nuclear [Electric Power]	Electric power from nuclear
Hydro [Electric Power]	Electric power from hydro
Biomass [Electric Power]	Electric power from biomass
Wind [Electric Power]	Electric power from wind
Solar [Electric Power]	Electric power from solar
Geothermal [Electric Power]	Electric power from geothermal

Tracked Output Flows:

Power [Electric Power]	Reference flow

Section II: Process Description

Associated Documentation

This unit process is composed of this document and the data sheet (DS) *DS_Stage3_2007_US_Electricity_Grid_Mix.2012.01.xlsx*, which provides additional details regarding relevant calculations, data quality, and references.

Goal and Scope

This unit process provides a summary of relevant input and output flows associated with the average U.S. electricity grid in 2007 accounting for imports from Canada. The inputs include the various generation types in the U.S. and the output is a MWh of average grid electricity representative of 2007 data. The reference flow of this unit process is: 1 MWh of Electricity.

Boundary and Description

The 2007 U.S. domestic electricity generation mix was obtained via the Emissions and Generation Resource Integrated Database (eGRID) (EPA, 2010). The breakdown of electricity production by generation method is shown in **Table 1**.

Table 1: 2007 U.S. Electricity Generation by Technology

Electricity Generation Technology	Percentage of 2007 U.S. Generation
Coal	48.80%
Fuel Oil	1.59%
Natural Gas	21.84%
Nuclear	19.46%
Hydro	5.81%
Biomass	1.31%
Wind	0.83%
Solar	0.01%
Geothermal	0.35%
Total	100.00%

In 2007, electricity generation in the U.S. totaled to 4,005 billion kWh (EIA, 2010). For the same period, the U.S. imported 50 billion kWh from Canada and exported 20 billion kWh to the same country for a net import of 30 billion kWh. The breakdown of generation sources for electricity imported to the U.S. in 2007 is shown in **Table 2** (Statistics Canada, 2009 & 2011). As shown by this breakdown, the over 75 percent of the electricity imported from Canada was produced via hydropower. It is important to account for this share since hydropower is a non-fossil source with low greenhouse gas emissions compared to conventional technologies.

Table 2: 2007 Canadian Electricity Exports to the U.S. by Generation Technology

Electricity Generation Technology	Percentage of 2007 Canadian Exports to the U.S.
Coal	5.75%
Fuel Oil	1.07%
Natural Gas	4.08%
Nuclear	11.91%
Hydro	76.42%
Biomass	0.33%
Wind	0.44%
Solar	0.00%
Geothermal	0.00%
Total	100.00%

Based on the data in **Table 1** and **Table 2** a new adjusted U.S. electricity mix was calculated. The detailed results are shown in **Table 3**. Exports from the U.S. to Canada were assumed to be representative of the U.S. mix prior to imports. As previously noted, the Canadian electricity exported to the U.S. is dominated by hydropower. **Table 3** illustrates that the U.S. grid contribution of electricity from hydropower increased from 5.81 percent to 6.68 percent after accounting for imports. **Table 4** applies the U.S. grid mix to a functional unit of 1 MWh of electricity.

Table 3: 2007 U.S. Electricity Mix Adjusted for Imports from Canada

Electricity Generation Technology	U.S. Mix Prior to Imports (%)	U.S. Generation (billion kWh)	U.S. Exports to Canada (billion kWh)	Imports from Canada (billion kWh)	U.S. Net (billion kWh)	U.S. Mix Adjusted for Imports (%)
Coal	48.80%	1954.6	9.76	2.87	1947.7	48.27%
Fuel Oil	1.59%	63.6	0.32	0.54	63.8	1.58%
Natural Gas	21.84%	874.5	4.37	2.04	872.2	21.62%
Nuclear	19.46%	779.2	3.89	5.95	781.3	19.36%
Hydro	5.81%	232.5	1.16	38.21	269.5	6.68%
Biomass	1.31%	52.6	0.26	0.16	52.5	1.30%
Wind	0.83%	33.3	0.17	0.22	33.3	0.83%
Solar	0.01%	0.6	0.00	0.00	0.6	0.01%
Geothermal	0.35%	14.1	0.07	0.00	14.1	0.35%
Total	100.0%	4005.0	20.0	50.0	4035.0	100%

Table 4: Unit Process Input and Output Flows

Flow Name	Value	Units (Per Reference Flow)
Inputs		
Coal [Electric Power]	4.83E-01	MWh
Fuel Oil [Electric Power]	1.58E-02	MWh
Natural Gas [Electric Power]	2.16E-01	MWh
Nuclear [Electric Power]	1.94E-01	MWh
Hydro [Electric Power]	6.68E-02	MWh
Biomass [Electric Power]	1.30E-02	MWh
Wind [Electric Power]	8.26E-03	MWh
Solar [Electric Power]	1.46E-04	MWh
Geothermal [Electric Power]	3.49E-03	MWh
Outputs		
Power [Electric Power]	1.00	MWh

* **Bold face** clarifies that the value shown *does not* include upstream environmental flows.

Embedded Unit Processes

None.

References

EIA. (2010). *Electric Power Annual 2009*. (DOE/EIA-0348(2009)). Washington, DC: Energy Information Administration Retrieved June 12, 2012, from http://www.eia.gov/cneaf/electricity/epa/epa_sum.html

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Statistics Canada. (2011). *Energy Statistics Handbook Fourth Quarter 2010*. (57-601-X). Ottawa, Ontario, Canada: Minister of Industry Retrieved June 12, 2012, from http://www.statcan.gc.ca/pub/57-601-x/57-601-x2010004-eng.pdf

Section III: Document Control Information

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Revision History:

Original/no revisions

How to Cite This Document: This document should be cited as:

NETL (2012). NETL Life Cycle Inventory Data – Unit Process: 2007 U.S. Electricity Grid Mix. U.S. Department of Energy, National Energy Technology Laboratory. Last Updated: June 2012 (version 01). www.netl.doe.gov/energy-analyses (http://www.netl.doe.gov/energy-analyses)

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