The EPA Corporate GHG Goal Evaluation Model

A Model for Benchmarking GHG Reductions and Evaluating Corporate Climate Performance

Update Process Manual

U.S. Environmental Protection Agency
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UPDATE PROCESS MANUAL

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1.0 GENERAL INFORMATION

The purpose of this manual is to provide an overview of the actions taken to update the most recent version of the U.S. Environmental Protection Agency's (EPA's) Corporate GHG Goal Evaluation Model (the model) and to instruct how modelers can make future updates as new model data are made available. The model was initially created under EPA's Climate Leaders program as a tool for projecting business-as-usual greenhouse gas (GHG) intensity improvements in order to assess GHG reduction goals set by companies participating in the program. The model incorporates best available forecast data on energy consumption and economic production output from a variety of publicly available federal sources, and has been updated and enhanced with data from 2013 and 2014. The model was developed using Analytica software from Lumina Decisions Inc.

References to "nodes" and "indexes" are abundant throughout this document. **Nodes** depict variables or modules while an **index** is used to define a dimension of an array. The model utilizes several different classes of nodes and indexes that are connected to each other to create tables or perform calculations.

Three main module nodes, "BLS Economic Data," "Energy Prices," and "Final Result Modeling" required updating based on the availability of data. Section 2, below, describes how to open, edit, and identify the node or index class of each model element. Sections 3-5 describe the necessary data updates in each main module of the model.

1.1 Updating the Model in Analytica

Analytica Professional is required in order to gain access to Analytica's editing tool. While the Analytica Free Player can open and run the model, it contains no editing capabilities. Once the model is opened in Analytica Professional, double click on the "Modeling" node, highlighted in Figure 1, to access the individual nodes and indexes that make up the model.

Figure 1: EPA Climate Leader Goal Evaluation Modeling System Main Screen

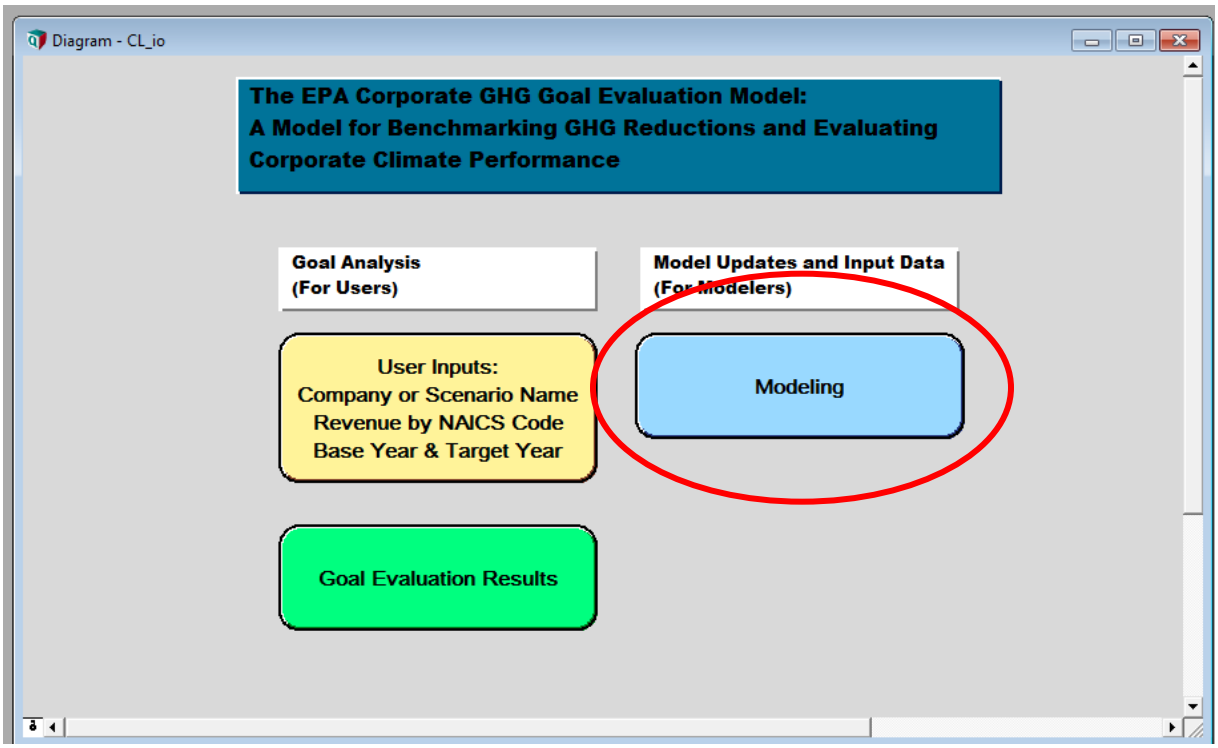
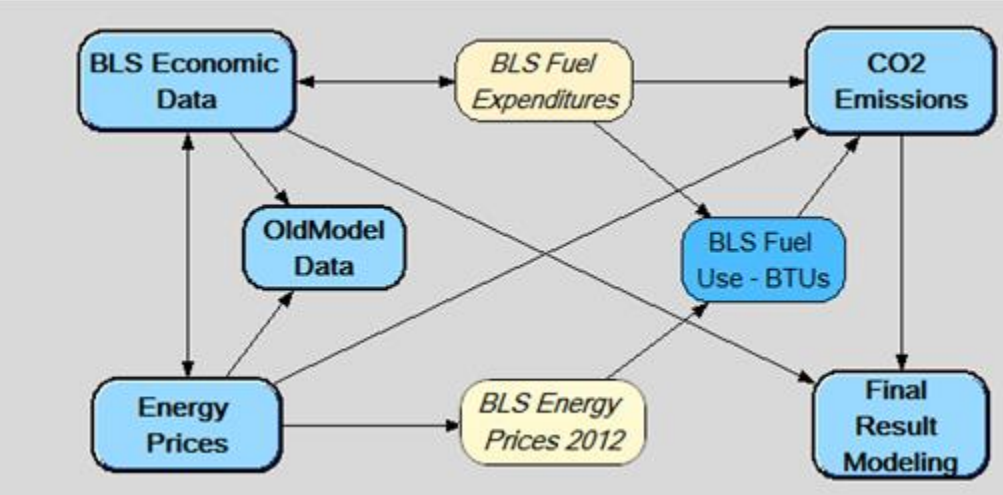


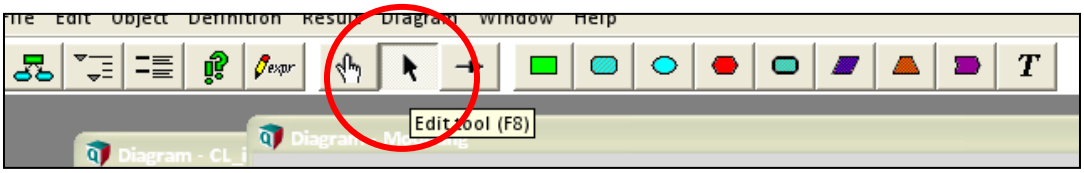
Figure 2 illustrates how the main modeling nodes are connected; double clicking on each node will open it up for editing.

Figure 2: Diagram-Modeling



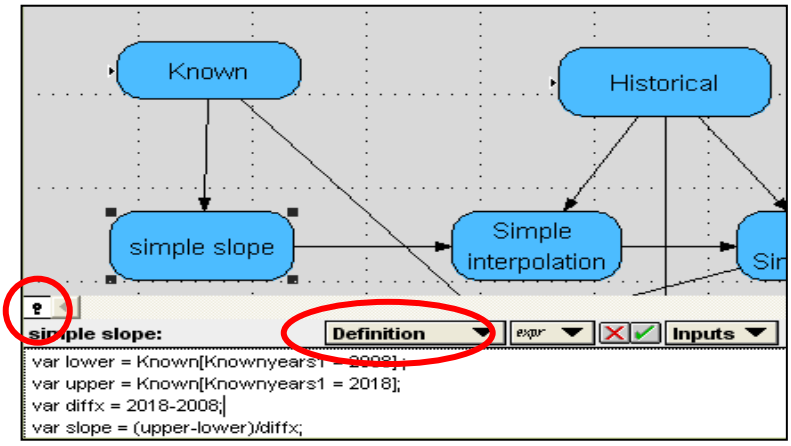
To begin editing, click on the Edit Tool icon (see Figure 3, below) located on the top tool bar.

Figure 3: Edit Tool Location



Analytica provides several tools that are useful when editing nodes and indexes. First, the Key icon located on the bottom left corner of the screen allows the user to open the Attribute Panel. With this panel open, the user can select one of many attributes that provide different types of information about the selected node or index.

Figure 4: Key and Attribute Panel Location



Attributes include:

- **Definition** – a number, text, a probability distribution, or a more complicated expression;
- **Identifier** – the name of a node or an index the system uses;
- **Title** – the name of a node or an index that appears to the user;
- **Class** – the type of node or index;
- **Inputs or outputs** – the nodes or indexes that feed or fed into other nodes or indexes; and
- **Other information**[1]

Both the Key and Attribute Panel features are highlighted in Figure 4. The node or index definition can be edited in the Attribute Panel, or by double clicking on the node or index.

Important Note: All nodes should be checked to ensure correct references to data years and outside nodes. This step is particularly important if renaming a node that acts as an input to or output from an outside node.

Shortcuts

Analytica utilizes several keyboard shortcuts that are useful when editing a model. These include:

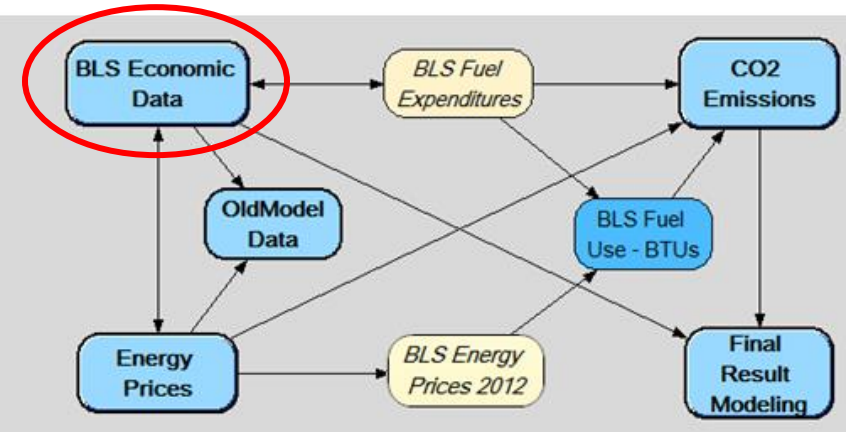
- Ctrl + D – Duplicate node
- Ctrl + Y – Toggle between identifier and title of node
- Ctrl + R – Show the result of the node

[1] The Analytica Users Guide available from the **Help** pull down menu contains abundant information on node and index attributes, as well as a variety of other topics relevant to building a model with this software.

2.0 BLS ECONOMIC DATA MODULE

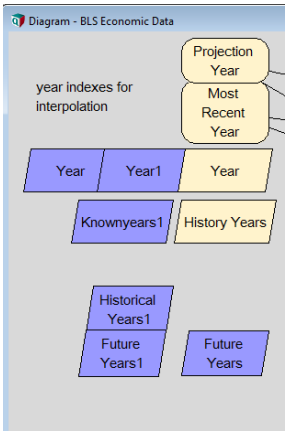
The following is a detailed list of datasets and nodes located in the BLS Economic Data module (Figure 5) that required updating. This module requires data from the U.S. Bureau of Labor Statistics (BLS)[2]:

Figure 5: BLS Economic Data Module Location



2.1 Year Indexes for Interpolation

Figure 6: Year Indexes Location



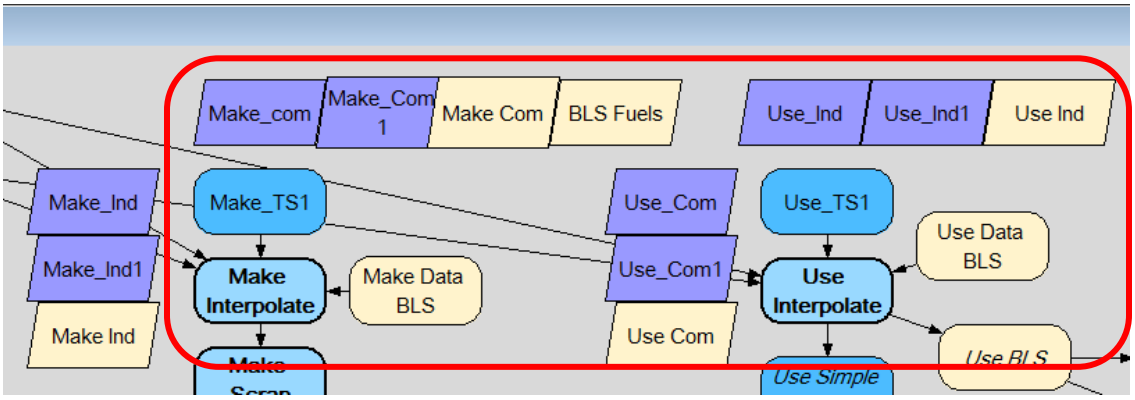
Within the BLS Economic Data node, considerable clean-up and simplification was performed for the indexes for years. The new set of indexes accounts for the new data years for BLS data.

[2] [BLS] Bureau of Labor Statistics. 2010. "Inter-industry relationships (Input/Output matrix)." http://www.bls.gov/emp/ep_data_input_output_matrix.htm.

2.2 Make_ind1, Make_com1, Make_TS1

The updated "Make Data BLS" matrix variable contains commodity production values from the BLS "MAKE" data set (in 2005 U.S. dollars) by various industries for years 1993-2012 and 2022 (See Figure 7). The matrix structure was created by merging the index nodes "Make_ind2," "Make_com2," and "year2." Both "Make_ind2" and "Make_com2"were updated with the new categorization of commodity production and industry sectors (see Appendix 1).

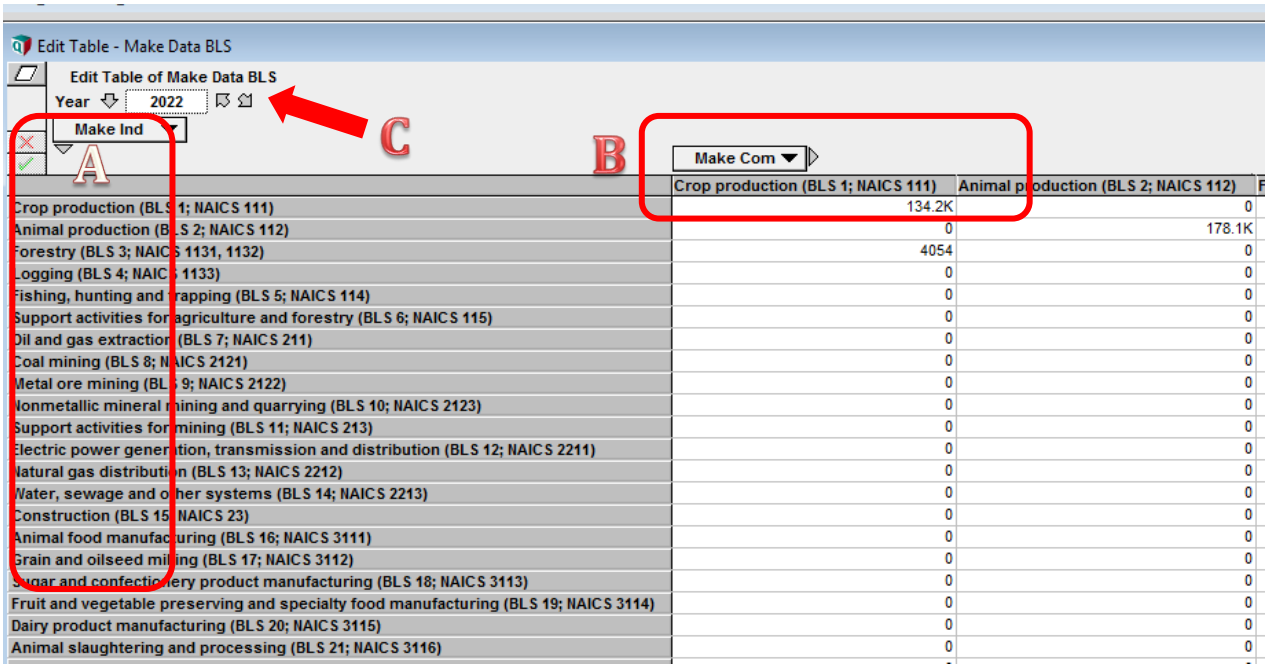
Figure 7: BLS Make and Use Data Nodes



Location

The "Make Data BLS" node contains the BLS input/output matrix data, which are provided for each available year as a .DAT file. This file can be opened in Excel. To update the data in the "Make Data BLS" node, properly align the vertical and horizontal category axes of the node. As illustrated in Figure 8, the vertical axis should be set as "Make_ind1" (a) while the horizontal axis should be set as "Make_com1" (b). These can be toggled by using the drop down list at each axis. The data year can be toggled using the dropdown in the upper left corner (c). BLS data can be copied from the BLS excel file to the "Make_TS1" node for each year available.

Figure 8: "Make Data BLS" layout



	Crop production (BLS 1; NAICS 111)	Animal production (BLS 2; NAICS 112)
Crop production (BLS 1; NAICS 111)	134.2K	0
Animal production (BLS 2; NAICS 112)	0	178.1K
Forestry (BLS 3; NAICS 1131, 1132)	4054	0
Logging (BLS 4; NAICS 1133)	0	0
Fishing, hunting and trapping (BLS 5; NAICS 114)	0	0
Support activities for agriculture and forestry (BLS 6; NAICS 115)	0	0
Oil and gas extraction (BLS 7; NAICS 211)	0	0
Coal mining (BLS 8; NAICS 2121)	0	0
Metal ore mining (BLS 9; NAICS 2122)	0	0
Nonmetallic mineral mining and quarrying (BLS 10; NAICS 2123)	0	0
Support activities for mining (BLS 11; NAICS 213)	0	0
Electric power generation, transmission and distribution (BLS 12; NAICS 2211)	0	0
Natural gas distribution (BLS 13; NAICS 2212)	0	0
Water, sewage and other systems (BLS 14; NAICS 2213)	0	0
Construction (BLS 15; NAICS 23)	0	0
Animal food manufacturing (BLS 16; NAICS 3111)	0	0
Grain and oilseed milling (BLS 17; NAICS 3112)	0	0
Sugar and confectionery product manufacturing (BLS 18; NAICS 3113)	0	0
Fruit and vegetable preserving and specialty food manufacturing (BLS 19; NAICS 3114)	0	0
Dairy product manufacturing (BLS 20; NAICS 3115)	0	0
Animal slaughtering and processing (BLS 21; NAICS 3116)	0	0

The BLS "MAKE" matrix details the production of commodities by industries. Each row sums to industry output and each column sums to commodity output. The data contained in the "Make Data BLS" node was updated with 1993-2012 annual data[3] and projected year data in 2022[4] from the BLS data set. The previous dataset had annual data from 2000-2008 and projected year data in 2018.

Similar updates were undertaken for "Use_TS1," based on the BLS "USE" data set. The BLS "USE" matrix contains the sales of commodities sold to intermediate consumers and final demand. Each column sums to its respective industry output and each row sums to its respective commodity output. The "Use_TS1" node was updated with BLS historical data from 2000 to 2008[5], projected data for 2018[6], and zeros for years 2009 to 2017 where BLS does not have historical data or annual projections available.

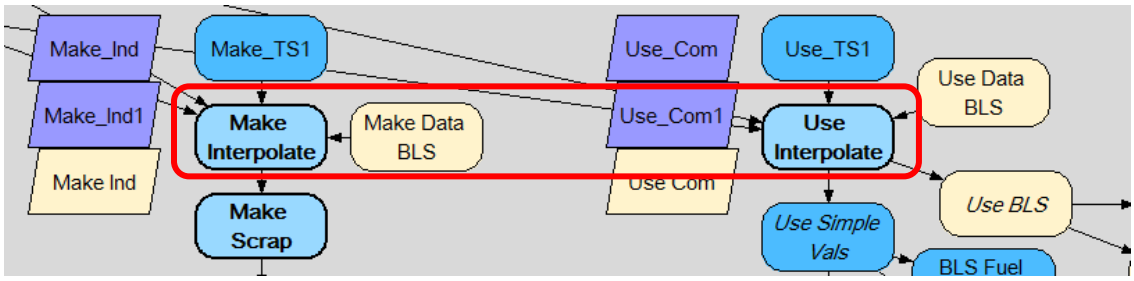
[3] REAL_MAKE_YYYY.DAT found in the zip file "Chain-weighted (2005 dollar based) input-output data for 1993-2012" at http://www.bls.gov/emp/ep_data_input_output_matrix.htm The data files be opened with excel.
[4] PROJECT_MAKE_2012.DAT found in the zip file "Chain-weighted (2005 dollar based) input-output data for 1993-2012" at http://www.bls.gov/emp/ep_data_input_output_matrix.htm The data files be opened with excel.
[5] REAL_USE_YYYY.DAT found in the zip file "Chain-weighted (2005 dollar based) input-output data for 1993-2012" at http://www.bls.gov/emp/ep_data_input_output_matrix.htm The data files be opened with excel.
[6] PROJECT_USE_2012.DAT found in the zip file "Chain-weighted (2005 dollar based) input-output data for 1993-2012" at http://www.bls.gov/emp/ep_data_input_output_matrix.htm The data files be opened with excel.

The "use_ind1," "use_com1," "Make_ind1," and "Make_com1" indexes were updated with the new 202 commodity production categories/industrial sectors shown in Appendix 1.

2.3 Make Interpolate, Use Interpolate

This set of module nodes interpolates production and consumption values (in 2000 U.S. dollars) for years 2009-2017 based on the last year of historical data (2008) and the forecasted data (2022). Each of these module nodes was updated to ensure all references to years and other nodes was correct.

Figure 9: Make Interpolate & Use Node Location

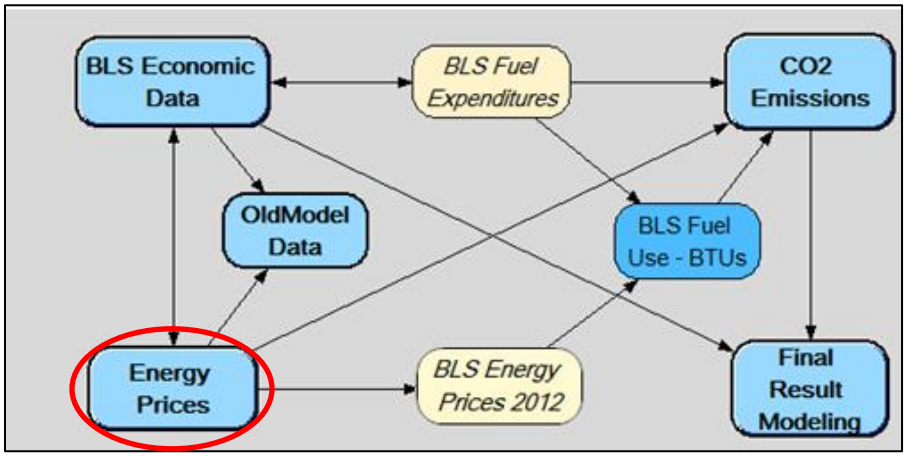


All nodes in the BLS Economic Data module should be checked to ensure correct references to data years and outside nodes.

3.0 ENERGY PRICES

The following is a detailed list of datasets and nodes located in the Energy Prices module (Figure 10) which required updating. Datasets used include the U.S. Energy Information Administration (EIA) Manufacturing Energy Consumption Survey (MECS), the EIA Annual Energy Outlook (AEO), the EIA State Energy Data System (SEDS), and U.S. Bureau of Economic Analysis (BEA) Price Deflators for Gross Domestic Product.

Figure 10: Energy Prices Module Location



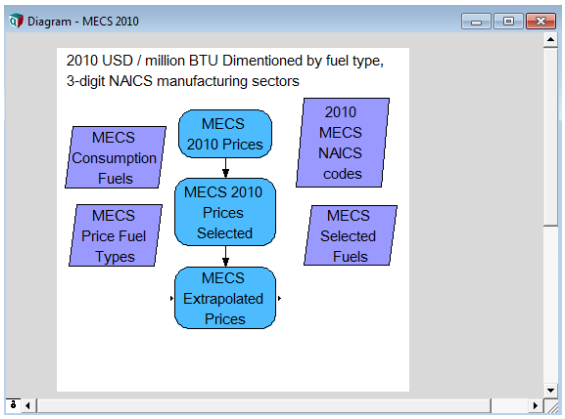
3.1 Updating Indexes - MECS NAICS codes, MECS Prices

The EIA MECS dataset[7] covers energy consumption by energy source and industry type, where each industry type is given a unique NAICS code. The "2006 MECS NAICS codes" index was updated with the list of NAICS codes relevant to the 2010 MECS dataset and renamed to "2010 MECS NAICS codes" (Figure 11). The "MECS 2006 Prices" variable node was copied, updated with 2010 MECS energy price data, and renamed to "MECS 2010 Prices." The updated variables and indexes are all found in a new node called "MECS 2010" while all the 2006 MECS-related variables and indexes were moved to a node called "MECS 2006." All nodes connected to the "MECS 2010 Prices" variable node were remapped to ensure they were linked to new data and not still referencing the original 2006 index.

The 2010 MECS data contains additional NAICS codes that were not found in the previous dataset.

[7] [EIA] U.S. Energy Information Administration. (2013) Manufacturing Energy Consumption Survey 2010 http://www.eia.gov/consumption/manufacturing/data/2010/

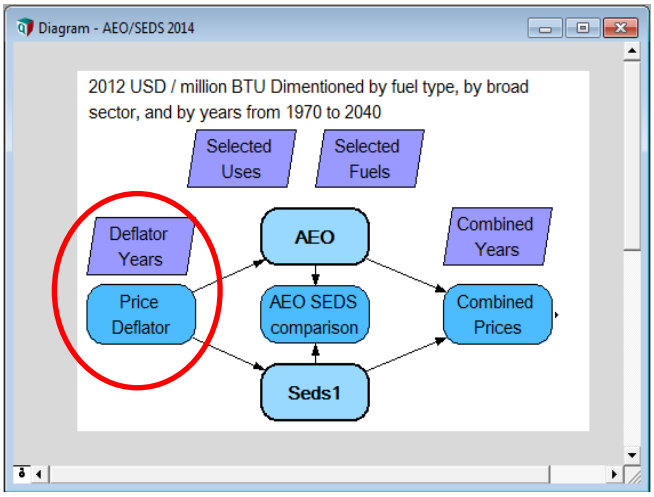
Figure 11: 2010 MECS NAICS codes, MECS 2010 Prices



3.2 Deflator Years, Price Deflator

The "Deflator Years" index node sequence (Figure 12) was updated with the range of years relevant to the most recent economic deflator data from the U.S. BEA (1970-2014)[8]. The "Price Deflator" node was updated with the deflator data from this series. This updated dataset includes a change in its 100 index value (Base Year), from 2005 to 2012. The price deflator data appear within the new node "AEO/SEDS 2014," as shown in Figure 12.

Figure 12: Price Deflator Node Location



[8] [BEA] U.S. Bureau of Economic Analysis. (2014) "Table 1.1.9. Implicit Price Deflators for Gross Domestic Product" http://www.bea.gov/iTable/iTable.cfm?reqid=9&step=3&isuri=1&903=13#reqid=9&step=3&isuri=1&903=13

3.3 AEO

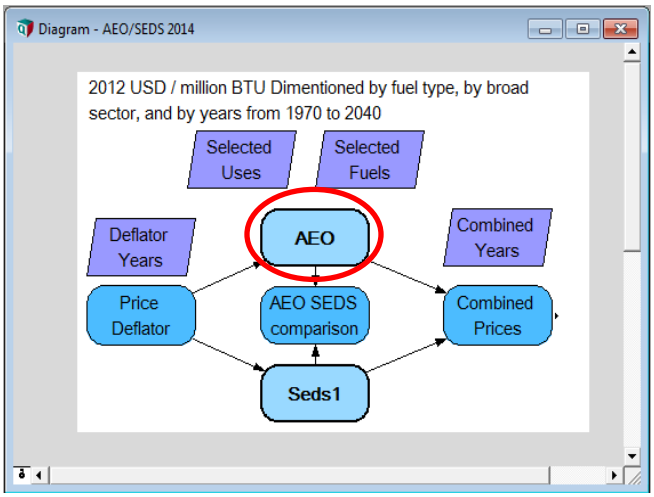
The EIA AEO examines energy market trends and the direction they may take in the future. This model utilizes current year and forecasted price data for a variety of energy sources (petroleum, natural gas, coal, and electricity) and sectors (industrial, transportation, commercial, residential, and electric). The "AEO Years" index node, found in the "AEO" module (Figure 13), was updated to contain years 2011 through 2040, which is the time period the latest AEO examined.

The AEO price data for each sector in the "AEO Electricity," "AEO Coal," and "AEO Natural Gas" variable nodes and the "Petrol Prices" module were updated based on Table 3 in the 2014 EIA AEO, reported in 2012 dollars per million Btu.[9]

The AEO and SEDS price data merge with the MECS database in the "MECS AEO Combined Prices" node, and therefore, the AEO, SEDS, and MECS price data need to all be in the same dollar year. The current Deflator Year ("Var Current") was updated from 2009 to 2012 in the "AEO Price Data Deflated 2002" node. The Base Year ("Var Base"), which is the Dollar Year the final output should be in was updated from 2006 to 2012, so the units would match MECS, which was also converted to 2012 U.S dollars.

All variables and indexes in the original module node "AEO" were duplicated and used to contain updated data matched to updated year indices.

Figure 13: AEO Module Node Location



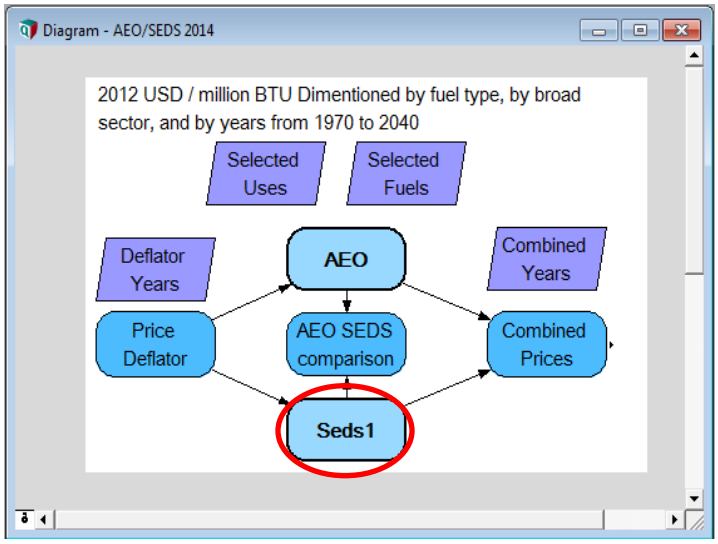
[9] [EIA] U.S. Energy Information Administration (2014) Annual Energy Outlook "Table 3. Energy Prices by Sector and Source- United States" http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=0-AEO2014&table=3-AEO2014&region=1-0&cases=ref2014-d102413a

3.4 SEDS

The EIA SEDS is a collection of state-level energy production, consumption, and price data. The model utilizes national-level price data for the same energy sources and sectors as the AEO data, described above. The "SEDS Years" index was updated to contain the year sequence of 1970 through 2010, thus terminating in the last year prior to the start of the AEO price data time series.

SEDS price data was updated for each sector, by fuel in nominal dollars per million Btu.[10] The Base Year ("Var Base Year") was changed to 2012 as part of the equation that changes nominal dollars to 2012 $U.S. so that the AEO and SEDS price data get linked correctly to the MECS database in the "MECS AEO Combined Prices" node, as described above.

Figure 14: SEDS Module Node Location



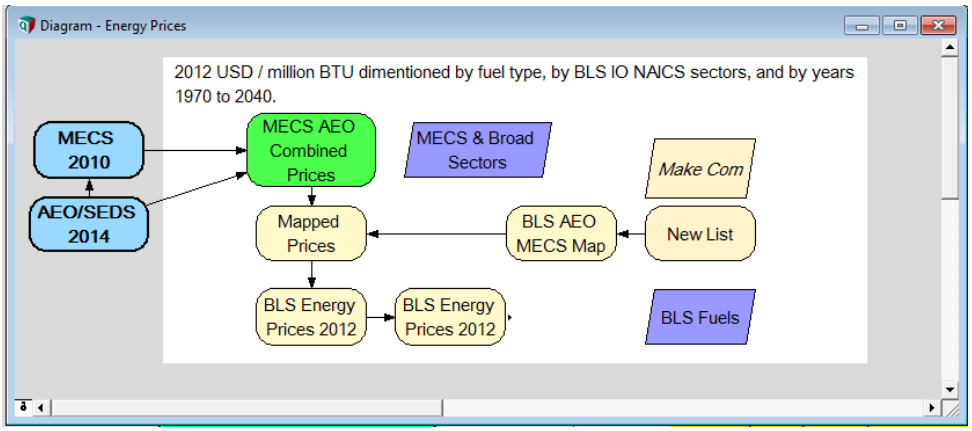
[10] [EIA] U.S. Energy Information Administration (2014) "State Energy Data System (SEDS) Prices, 1970-2012" http://www.eia.gov/state/seds/data.cfm

3.5 Proxy List

The "BLS Common Codes - duplicates" column in the "New List" variable node was updated by copying the list of sector codes found in the "Make Com" index node.[11]

Since the next step in the model merges the "Make Com" index node with the "New List" node, the list of codes found in these two columns must match exactly. Note that any subsector in the "Make Com" node that lists two or more codes should to be repeated in the "proxy list" node, with each unique code listed under the "NAICS 2010 padded" column.

Figure 15: Proxy List Node Location



For example, each sector appears in the "Make Com" node as:

"Sector name (BLS_CODE, NAICS Code)" (see Figure 16)

Figure 16: Sectors in Make Com Node

Crop production (BLS 1; NAICS 111)
Animal production (BLS 2; NAICS 112)
Forestry (BLS 3; NAICS 1131, 1132)
Logging (BLS 4; NAICS 1133)
Fishing, hunting and trapping (BLS 5; NAICS 114)
Support activities for agriculture and forestry (BLS 6; NAICS 115)
Oil and gas extraction (BLS 7; NAICS 211)
Coal mining (BLS 8; NAICS 2121)
Metal ore mining (BLS 9; NAICS 2122)
Nonmetallic mineral mining and quarrying (BLS 10; NAICS 2123)
Support activities for mining (BLS 11; NAICS 213)
Electric power generation, transmission and distribution (BLS 12; NAICS 22...
Natural gas distribution (BLS 13; NAICS 2212)
Water, sewage and other systems (BLS 14; NAICS 2213)
Construction (BLS 15; NAICS 23)

[11] Located in the BLS Economic Data module. See Section 2.

Each entry in this table needs to be entered in the "New List" table as shown below.

Figure 17: Entries in New List

Result - New List

Mid Value of New List

Proxy Rows ☐ Totals

Proxy Columns ☐ Totals

	BLS Common Codes - duplicates	NAICS 2006 padded	Proxy	Relation
1	Crop production (BLS 1; NAICS 111)	011100	industrial	1
2	Animal production (BLS 2; NAICS 112)	011200	industrial	1
3	Forestry (BLS 3; NAICS 1131, 1132)	113100	industrial	1
4	Forestry (BLS 3; NAICS 1131, 1132)	113200	industrial	1
5	Logging (BLS 4; NAICS 1133)	113300	industrial	1
6	Fishing, hunting and trapping (BLS 5; NAICS 114)	114000	industrial	1
7	Support activities for agriculture and forestry (BLS 6; NAICS 115)	115000	industrial	1
8	Oil and gas extraction (BLS 7; NAICS 211)	211000	industrial	1
9	Coal mining (BLS 8; NAICS 2121)	212100	industrial	1
10	Metal ore mining (BLS 9; NAICS 2122)	212200	industrial	1
11	Nonmetallic mineral mining and quarrying (BLS 10; NAICS 2123)	212300	industrial	1
12	Support activities for mining (BLS 11; NAICS 213)	213000	industrial	1
13	Electric power generation, transmission and distribution (BLS 12; NAICS 2211)	221100	electric	1
14	Natural gas distribution (BLS 13; NAICS 2212)	221200	industrial	1
15	Water, sewage and other systems (BLS 14; NAICS 2213)	221300	industrial	1
16	Construction (BLS 15; NAICS 23)	230000	industrial	1
17	Animal food manufacturing (BLS 16; NAICS 3111)	311100	311000	1
18	Grain and oilseed milling (BLS 17; NAICS 3112)	311200	311000	1
19	Sugar and confectionery product manufacturing (BLS 18; NAICS 3113)	311300	311000	1
20	Fruit and vegetable preserving and specialty food manufacturing (BLS 19; NAIC...	311400	311000	1
21	Dairy product manufacturing (BLS 20; NAICS 3115)	311500	311000	1
22	Animal slaughtering and processing (BLS 21; NAICS 3116)	311600	311000	1
23	Seafood product preparation and packaging (BLS 22; NAICS 3117)	311700	311000	1
24	Bakeries and tortilla manufacturing (BLS 23; NAICS 3118)	311800	311000	1
25	Other food manufacturing (BLS 24; NAICS 3119)	311900	311000	1
26	Beverage manufacturing (BLS 25; NAICS 3121)	312100	312100	1
27	Tobacco manufacturing (BLS 26; NAICS 3122)	312200	312200	1
28	Textile mills and textile product mills (BLS 27; NAICS 313314)	313100	313000	1
29	Textile mills and textile product mills (BLS 27; NAICS 313314)	313200	313000	1
30	Textile mills and textile product mills (BLS 27; NAICS 313314)	313300	313000	1
31	Textile mills and textile product mills (BLS 27; NAICS 313314)	314100	314000	1
32	Textile mills and textile product mills (BLS 27; NAICS 313314)	314900	314000	1
33	Apparel manufacturing (BLS 28; NAICS 315)	315100	315000	1
34	Apparel manufacturing (BLS 28; NAICS 315)	315200	315000	1

The "Proxy" column assigns each BLS common code a general sector (as found in the AEO and SEDS energy commodity price data series) or a more specific sector (as found in the MECS energy commodity price data series). This column should be reviewed and updated, as needed.

The "Relation" column defines the relationship between the "BLS common codes" and the "Proxy" columns and should always be populated with a "1."

3.6 BLS Energy Prices 2012

The most recent MECS data contains price data for 2010. These prices were converted to 2012 dollars for consistency with other price and expenditure data in the model. The BLS production and consumption data are for annual expenditures on energy inputs, by each sector, for both historical and future years. The BLS datasets express spending amounts in two forms: "current dollars" (prices in each year's currency) and "real dollars" (expressed in 2005 dollars).

The model was updated to using the real price data, and these prices were then converted to 2012 dollars for consistency with other price and expenditure data in the model.

Thus, the renamed "BLS Energy Prices 2006" variable node was updated to convert price data in the renamed "BLS Energy Prices 2012" variable node from 2006 prices to 2012 prices (Figure 15).

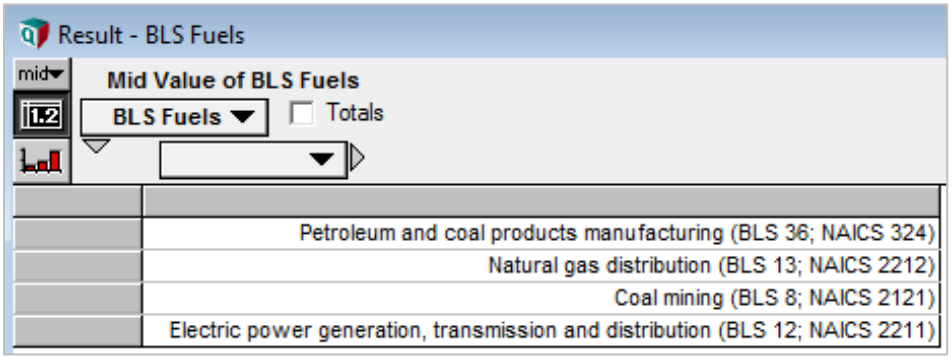
3.7 BLS Fuels

This node lists the energy sources covered in this model (coal, petroleum, natural gas, and electricity) as they appear in the current list of BLS codes (Figure 15). These entries were updated by copying the codes associated with these energy sources found in the "Make Com" index node located in the BLS Economic Data module:

From: Make Com index node		
43	324	Petroleum and coal products manufacturing
13	2212	Natural gas distribution
8	2121	Coal mining
12	2211	Electric power generation, transmission and distribution

These codes need to be copied directly into the BLS Fuels node (see Figure 18).

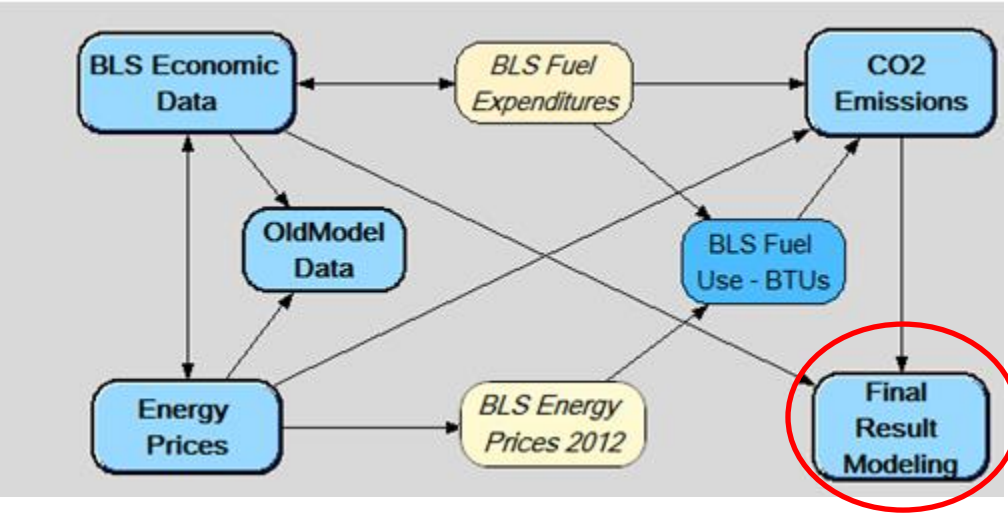
Figure 18: BLS Fuels Node



4.0 FINAL RESULT MODELING

The following is a detailed list of nodes located in the Final Result Modeling module which required updating. This module does not contain any outside datasets; rather, this module refers to other modules and user-entered data. While only a few simple updates in this module are needed, they are necessary for the model to capture data for years 2017 and 2018.

Figure 19: Final Result Modeling Module Location



- ***Output in Selected Years:*** Located in Step 2: Economic Output, this node was updated by changing the reference to the "year1" node to "year2."

- ***All Ann intens by fuel, by subsect:*** Located in Step 4: Composite fuel intensities-contribution from sectors, this node was updated by changing the reference to the "year1" node to "year2."

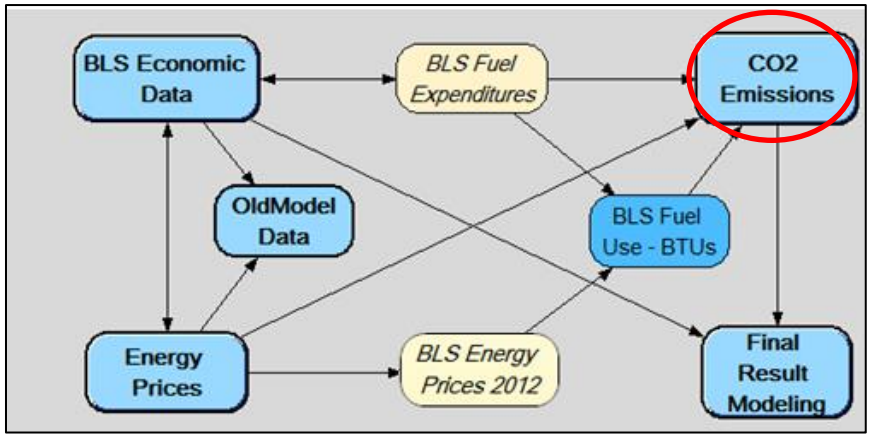
- ***Intens by fuel by subsect Base and Target Years:*** Located in Step 4: Composite fuel intensities - contribution from sectors, this node was updated by changing the reference to the "year1" node to "year2."

- ***Step 5: Composite Sector Intensities-contribution from duel types, all nodes:*** All references to the "year1" node were changed to "year2" in all nodes located in this section.

5.0 EMISSION FACTOR UPDATES

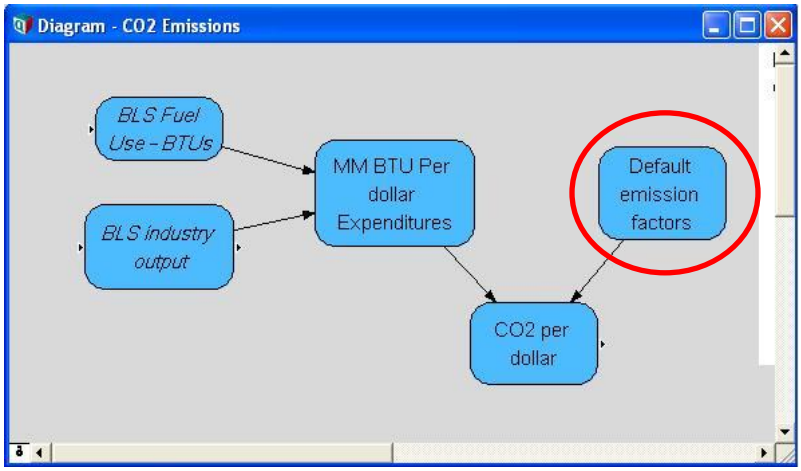
The emission factors used by the model were updated with the data provided in Appendix 2. In order to update these factors, open the "CO_2 Emissions" node shown in Figure 20.

Figure 20: CO_2 Emissions Node Location



Once this node is opened, the factors are located in the "Default Emission Factors" node as shown below in Figure 21.

Figure 21: Default Emission Factors Node Location



6.0 DATA SOURCE REFERENCES

[BEA] U.S. Bureau of Economic Analysis. (2014) "Table 1.1.9. Implicit Price Deflators for Gross Domestic Product"
http://www.bea.gov/iTable/iTable.cfm?reqid=9&step=3&isuri=1&903=13#reqid=9&step=3&isuri=1&903=13

[BLS] Bureau of Labor Statistics. December 2013. "Inter-industry relationships (Input/Output matrix)."
http://www.bls.gov/emp/ep_data_input_output_matrix.htm

[EIA] U.S. Energy Information Administration. (2013) Manufacturing Energy Consumption Survey 2010
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[EIA] U.S. Energy Information Administration (2014) Annual Energy Outlook "Table 3. Energy Prices by Sector and Source- United States"
http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=0-AEO2014&table=3-AEO2014&region=1-0&cases=ref2014-d102413a

[EIA] U.S. Energy Information Administration (2014) "State Energy Data System (SEDS) Prices, 1970-2012" http://www.eia.gov/state/seds/data.cfm

7.0 APPENDIX 1 – UPDATED BLS COMMODITY PRODUCTION CATEGORIES

Crop production (BLS 1; NAICS 111)
Animal production (BLS 2; NAICS 112)
Forestry (BLS 3; NAICS 1131, 1132)
Logging (BLS 4; NAICS 1133)
Fishing, hunting and trapping (BLS 5; NAICS 114)
Support activities for agriculture and forestry (BLS 6; NAICS 115)
Oil and gas extraction (BLS 7; NAICS 211)
Coal mining (BLS 8; NAICS 2121)
Metal ore mining (BLS 9; NAICS 2122)
Nonmetallic mineral mining and quarrying (BLS 10; NAICS 2123)
Support activities for mining (BLS 11; NAICS 213)
Electric power generation, transmission and distribution (BLS 12; NAICS 2211)
Natural gas distribution (BLS 13; NAICS 2212)
Water, sewage and other systems (BLS 14; NAICS 2213)
Construction (BLS 15; NAICS 23)
Animal food manufacturing (BLS 16; NAICS 3111)
Grain and oilseed milling (BLS 17; NAICS 3112)
Sugar and confectionery product manufacturing (BLS 18; NAICS 3113)
Fruit and vegetable preserving and specialty food manufacturing (BLS 19; NAICS 3114)
Dairy product manufacturing (BLS 20; NAICS 3115)
Animal slaughtering and processing (BLS 21; NAICS 3116)
Seafood product preparation and packaging (BLS 22; NAICS 3117)
Bakeries and tortilla manufacturing (BLS 23; NAICS 3118)
Other food manufacturing (BLS 24; NAICS 3119)
Beverage manufacturing (BLS 25; NAICS 3121)
Tobacco manufacturing (BLS 26; NAICS 3122)
Textile mills and textile product mills (BLS 27; NAICS 313314)
Apparel manufacturing (BLS 28; NAICS 315)
Leather and allied product manufacturing, including footwear manufacturing (BLS 29; NAICS 316)
Sawmills and wood preservation (BLS 30; NAICS 3211)
Veneer, plywood, and engineered wood product manufacturing (BLS 31; NAICS 3212)
Other wood product manufacturing (BLS 32; NAICS 3219)
Pulp, paper, and paperboard mills (BLS 33; NAICS 3221)
Converted paper product manufacturing (BLS 34; NAICS 3222)
Printing and related support activities (BLS 35; NAICS 323)
Petroleum and coal products manufacturing (BLS 36; NAICS 324)
Basic chemical manufacturing (BLS 37; NAICS 3251)

Resin, synthetic rubber, and artificial synthetic fibers and filaments manufacturing (BLS 38; NAICS 3252)
Pesticide, fertilizer, and other agricultural chemical manufacturing (BLS 39; NAICS 3253)
Pharmaceutical and medicine manufacturing (BLS 40; NAICS 3254)
Paint, coating, and adhesive manufacturing (BLS 41; NAICS 3255)
Soap, cleaning compound, and toilet preparation manufacturing (BLS 42; NAICS 3256)
Other chemical product and preparation manufacturing (BLS 43; NAICS 3259)
Plastics product manufacturing (BLS 44; NAICS 3261)
Rubber product manufacturing (BLS 45; NAICS 3262)
Clay product and refractory manufacturing (BLS 46; NAICS 3271)
Glass and glass product manufacturing (BLS 47; NAICS 3272)
Cement and concrete product manufacturing (BLS 48; NAICS 3273)
Lime, gypsum and other nonmetallic mineral product manufacturing (BLS 49; NAICS 3274, 3279)
Iron and steel mills and ferroalloy manufacturing (BLS 50; NAICS 3311)
Steel product manufacturing from purchased steel (BLS 51; NAICS 3312)
Alumina and aluminum production and processing (BLS 52; NAICS 3313)
Nonferrous metal (except aluminum) production and processing (BLS 53; NAICS 3314)
Foundries (BLS 54; NAICS 3315)
Forging and stamping (BLS 55; NAICS 3321)
Cutlery and handtool manufacturing (BLS 56; NAICS 3322)
Architectural and structural metals manufacturing (BLS 57; NAICS 3323)
Boiler, tank, and shipping container manufacturing (BLS 58; NAICS 3324)
Hardware manufacturing (BLS 59; NAICS 3325)
Spring and wire product manufacturing (BLS 60; NAICS 3326)
Machine shops; turned product; and screw, nut, and bolt manufacturing (BLS 61; NAICS 3327)
Coating, engraving, heat treating, and allied activities (BLS 62; NAICS 3328)
Other fabricated metal product manufacturing (BLS 63; NAICS 3329)
Agriculture, construction, and mining machinery manufacturing (BLS 64; NAICS 3331)
Industrial machinery manufacturing (BLS 65; NAICS 3332)
Commercial and service industry machinery manufacturing (BLS 66; NAICS 3333)
Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing (BLS 67; NAICS 3334)
Metalworking machinery manufacturing (BLS 68; NAICS 3335)
Engine, turbine, and power transmission equipment manufacturing (BLS 69; NAICS 3336)
Other general purpose machinery manufacturing (BLS 70; NAICS 3339)
Computer and peripheral equipment manufacturing (BLS 71; NAICS 3341)
Communications equipment manufacturing (BLS 72; NAICS 3342)
Audio and video equipment manufacturing (BLS 73; NAICS 3343)
Semiconductor and other electronic component manufacturing (BLS 74; NAICS 3344)
Navigational, measuring, electromedical, and control instruments manufacturing (BLS 75; NAICS 3345)

Manufacturing and reproducing magnetic and optical media (BLS 76; NAICS 3346)
Electric lighting equipment manufacturing (BLS 77; NAICS 3351)
Household appliance manufacturing (BLS 78; NAICS 3352)
Electrical equipment manufacturing (BLS 79; NAICS 3353)
Other electrical equipment and component manufacturing (BLS 80; NAICS 3359)
Motor vehicle manufacturing (BLS 81; NAICS 3361)
Motor vehicle body and trailer manufacturing (BLS 82; NAICS 3362)
Motor vehicle parts manufacturing (BLS 83; NAICS 3363)
Aerospace product and parts manufacturing (BLS 84; NAICS 3364)
Railroad rolling stock manufacturing (BLS 85; NAICS 3365)
Ship and boat building (BLS 86; NAICS 3366)
Other transportation equipment manufacturing (BLS 87; NAICS 3369)
Household and institutional furniture and kitchen cabinet manufacturing (BLS 88; NAICS 3371)
Office furniture (including fixtures) manufacturing (BLS 89; NAICS 3372)
Other furniture related product manufacturing (BLS 90; NAICS 3379)
Medical equipment and supplies manufacturing (BLS 91; NAICS 3391)
Other miscellaneous manufacturing (BLS 92; NAICS 3399)
Wholesale trade (BLS 93; NAICS 42)
Retail trade (BLS 94; NAICS 44, 45)
Air transportation (BLS 95; NAICS 481)
Rail transportation (BLS 96; NAICS 482)
Water transportation (BLS 97; NAICS 483)
Truck transportation (BLS 98; NAICS 484)
Transit and ground passenger transportation (BLS 99; NAICS 485)
Pipeline transportation (BLS 100; NAICS 486)
Scenic and sightseeing transportation and support activities for transportation (BLS 101; NAICS 487, 488)
Couriers and messengers (BLS 102; NAICS 492)
Warehousing and storage (BLS 103; NAICS 493)
Newspaper, periodical, book, and directory publishers (BLS 104; NAICS 5111)
Software publishers (BLS 105; NAICS 5112)
Motion picture, video, and sound recording industries (BLS 106; NAICS 512)
Broadcasting (except internet) (BLS 107; NAICS 515)
Telecommunications (BLS 108; NAICS 517)
Data processing, hosting, related services, and other information services (BLS 109; NAICS 518, 519)
Monetary authorities, credit intermediation, and related activities (BLS 110; NAICS 521, 522)
Securities, commodity contracts, and other financial investments and related activities (BLS 111; NAICS 523)
Insurance carriers (BLS 112; NAICS 5241)
Agencies, brokerages, and other insurance related activities (BLS 113; NAICS 5242)

Funds, trusts, and other financial vehicles (BLS 114; NAICS 525)
Real estate (BLS 115; NAICS 531)
Automotive equipment rental and leasing (BLS 116; NAICS 5321)
Consumer goods rental and general rental centers (BLS 117; NAICS 5322, 5323)
Commercial and industrial machinery and equipment rental and leasing (BLS 118; NAICS 5324)
Lessors of nonfinancial intangible assets (except copyrighted works) (BLS 119; NAICS 533)
Legal services (BLS 120; NAICS 5411)
Accounting, tax preparation, bookkeeping, and payroll services (BLS 121; NAICS 5412)
Architectural, engineering, and related services (BLS 122; NAICS 5413)
Specialized design services (BLS 123; NAICS 5414)
Computer systems design and related services (BLS 124; NAICS 5415)
Management, scientific, and technical consulting services (BLS 125; NAICS 5416)
Scientific research and development services (BLS 126; NAICS 5417)
Advertising and related services (BLS 127; NAICS 5418)
Other professional, scientific, and technical services (BLS 128; NAICS 5419)
Management of companies and enterprises (BLS 129; NAICS 55)
Office administrative services (BLS 130; NAICS 5611)
Facilities support services (BLS 131; NAICS 5612)
Employment services (BLS 132; NAICS 5613)
Business support services (BLS 133; NAICS 5614)
Travel arrangement and reservation services (BLS 134; NAICS 5615)
Investigation and security services (BLS 135; NAICS 5616)
Services to buildings and dwellings (BLS 136; NAICS 5617)
Other support services (BLS 137; NAICS 5619)
Waste management and remediation services (BLS 138; NAICS 562)
Elementary and secondary schools (BLS 139; NAICS 6111)
Junior colleges, colleges, universities, and professional schools (BLS 140; NAICS 6112, 6113)
Other educational services (BLS 141; NAICS 6114-7)
Offices of health practitioners (BLS 142; NAICS 6211, 6212, 6213)
Home health care services (BLS 143; NAICS 6216)
Outpatient, laboratory, and other ambulatory care services (BLS 144; NAICS 6214, 6215, 6219)
Hospitals (BLS 145; NAICS 622)
Nursing and residential care facilities (BLS 146; NAICS 623)
Individual and family services (BLS 147; NAICS 6241)
Community and vocational rehabilitation services (BLS 148; NAICS 6242, 6243)
Child day care services (BLS 149; NAICS 6244)
Performing arts companies (BLS 150; NAICS 7111)
Spectator sports (BLS 151; NAICS 7112)
Promoters of events, and agents and managers (BLS 152; NAICS 7113, 7114)
Independent artists, writers, and performers (BLS 153; NAICS 7115)

Museums, historical sites, and similar institutions (BLS 154; NAICS 712)
Amusement, gambling, and recreation industries (BLS 155; NAICS 713)
Accommodation (BLS 156; NAICS 721)
Food services and drinking places (BLS 157; NAICS 722)
Automotive repair and maintenance (BLS 158; NAICS 8111)
Electronic and precision equipment repair and maintenance (BLS 159; NAICS 8112)
Commercial and industrial machinery and equipment (except automotive and electronic) repair and maintenance (BLS 160; NAICS 8113)
Personal and household goods repair and maintenance (BLS 161; NAICS 8114)
Personal care services (BLS 162; NAICS 8121)
Death care services (BLS 163; NAICS 8122)
Drycleaning and laundry services (BLS 164; NAICS 8123)
Other personal services (BLS 165; NAICS 8129)
Religious organizations (BLS 166; NAICS 8131)
Grantmaking and giving services and social advocacy organizations (BLS 167; NAICS 8132, 8133)
Civic, social, professional, and similar organizations (BLS 168; NAICS 8134, 8139)
Private households (BLS 169; NAICS 814)
Postal Service (BLS 170; NAICS 491)
Federal electric utilities (BLS 171; NAICS NA)
Federal enterprises except the Postal Service and electric utilities (BLS 172; NAICS NA)
General Federal defense government compensation (BLS 173; NAICS NA)
General Federal defense government consumption of fixed capital (BLS 174; NAICS NA)
General Federal defense government except compensation and consumption of fixed capital (BLS 175; NAICS NA)
General Federal non-defense government compensation (BLS 176; NAICS NA)
General Federal non-defense government consumption of fixed capital (BLS 177; NAICS NA)
General Federal non-defense government except compensation and consumption of fixed capital (BLS 178; NAICS NA)
Local government passenger transit (BLS 179; NAICS NA)
Local government enterprises except passenger transit (BLS 180; NAICS NA)
General Local government hospitals compensation (BLS 181; NAICS NA)
General Local government educational services compensation (BLS 182; NAICS NA)
General Local government, other compensation (BLS 183; NAICS NA)
State government enterprises (BLS 184; NAICS NA)
General State government hospitals compensation (BLS 185; NAICS NA)
General State government educational services compensation (BLS 186; NAICS NA)
General State government, other compensation (BLS 187; NAICS NA)
General State and Local government consumption of fixed capital (BLS 188; NAICS NA)
General State and Local government except compensation and consumption of fixed capital (BLS 189; NAICS NA)
Owner-occupied dwellings (BLS 190; NAICS NA)

Noncomparable imports (BLS 191; NAICS NA)
Scrap (BLS 192; NAICS NA)
Used and secondhand goods (BLS 193; NAICS NA)
Rest of the world adjustment (BLS 194; NAICS NA)
Import valuation adjustments (BLS 195; NAICS NA)

8.0 APPENDIX 2 – DEFAULT EMISSION FACTOR UPDATES

	Emission Factor	Units	Source	URL
Petroleum and coal products manufacturing	74.064	Kg CO_2e /MMbtu	Emission Factors for Greenhouse Gas Inventories. Updated April 4, 2014. Average of factors for Distillate Fuel Oil #1 and #2, and Residual Fuel Oil #5 and #6. Factor includes contributions from CO2, CH4 and N2O.	http://www.epa.gov/climateleadership/inventory/ghg-emissions.html
Natural gas distribution	53.11	Kg CO_2e /MMbtu	Emission Factors for Greenhouse Gas Inventories. Updated April 4, 2014. Factor includes contributions from CO2, CH4 and N2O.	http://www.epa.gov/climateleadership/inventory/ghg-emissions.html
Coal	95.42	Kg CO_2e /MMbtu	Emission Factors for Greenhouse Gas Inventories. Updated April 4, 2014. Factor for "Mixed (Industrial Sector)." Factor includes contributions from CO2, CH4 and N2O.	http://www.epa.gov/climateleadership/inventory/ghg-emissions.html
Electric power generation, transmission and distribution	220.07	Kg CO_2e /MMbtu	Emission Factors for Greenhouse Gas Inventories. Updated April 4, 2014. Factor for US Average, Non-Baseload Emissions Factor. Factor includes contributions from CO2, CH4 and N2O.	http://www.epa.gov/climateleadership/inventory/ghg-emissions.html