The EPA Corporate GHG Goal Evaluation Model

A Model for Benchmarking GHG Reductions and Evaluating Corporate Climate Performance

User's Manual

U.S. Environmental Protection Agency
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1.0 GENERAL INFORMATION

1.0 GENERAL INFORMATION

This document provides the user with important information on the U.S. Environmental Protection Agency's (EPA) Corporate GHG Goal Evaluation Model (the model), the software and data needed in order to use the model, and general guidance on how to analyze the outputs from the model.

1.1 Organization of the Manual

- ***Section 1 - General Information:*** This section provides the user with program and model overviews, details on the three main pieces of information needed to use the model, points of contact, and a list of acronyms/abbreviations.

- ***Section 2 - How to Enter Data:*** This section provides a step-by-step walkthrough to familiarize the user with how to enter the data into the model and the basic structure of the model.

- ***Section 3 - Analyzing Model Results:*** This section helps the user understand the summary data output produced by the model and provides suggestions on how to further analyze the data provided by the model.

- ***Section 4 - Other Manuals and Guides:*** This section includes information on where to find other related EPA program and model information.

1.2 Acronyms and Abbreviations

- Annual Energy Outlook (AEO)
- Calendar Year (CY)
- EPA Corporate GHG Goal Evaluation Model (the model)
- Greenhouse Gas (GHG)
- Manufacturers Energy Consumption Survey (MECS)
- North American Industry Classification System (NAICS)
- Non-Governmental Organization (NGO)
- Office of Management and Budget (OMB)
- Standard Classification (SIC)
- State Energy Data System (SEDS)
- U.S. Environmental Protection Agency (EPA)
- U.S. Energy Information Administration (EIA)

1.3 Greenhouse Gas Goals and EPA Climate Leaders

From 2002 to 2011, Climate Leaders was an EPA industry-government partnership that worked with companies to develop comprehensive climate change strategies. Partner companies committed to reducing their impact on the global environment by completing a corporate-wide inventory of their greenhouse gas (GHG) emissions, setting long-term reduction goals, and annually reporting their progress to EPA.

EPA worked closely with Climate Leaders partners to help them in setting aggressive, long-term, individualized GHG emissions reduction goals. These goals were individualized because every company has a unique set of GHG emissions sources and reduction opportunities. Despite these nuances, however, each company's goal had to be:

- Corporate-wide (including at least all U.S. operations);
- Based on the most recent Base Year for which data were available;
- Achieved over four to six years. Longer goal periods may have been acceptable based on a partners' capital planning cycle;
- Expressed as an absolute GHG reduction;[1] and
- Aggressive compared with the projected GHG performance for the partner's sector.

What EPA considered an aggressive goal varied for different sectors and for different companies depending on several factors:

- *Sector Issues:* GHG intensity tends to decrease over time in most sectors as equipment is replaced with newer, more efficient technology. This trend can be rapid in sectors in which capital stock turns over quickly, but much slower in traditional manufacturing sectors. The rate of intensity improvement can also be affected by the growth rate of the sector.

- *Company Issues:* Partners within the same sector can have different GHG emissions sources and a wide range of reduction opportunities. For example, partners in the same sector may use different technologies with varying levels of energy consumption, or have control over the type of energy combusted onsite instead of consuming electricity from a utility with more limited control over energy sources. In addition, some partners had undertaken considerable GHG reduction activities prior to joining Climate Leaders. These actions were taken into consideration when evaluating a partner's proposed goal.

To address this variability, Climate Leaders conducted an iterative goal evaluation and

[1] Aggressive intensity (or normalized) goals were acceptable throughout most of the program's tenure. In early 2010, EPA modified its approach to goal setting to require absolute goals only.

approval process based on a performance benchmarking methodology to ensure that all Climate Leaders goals were aggressive enough to receive EPA approval and recognition. To do this, EPA created a model that would help determine whether proposed reduction targets met the designation of aggressive when compared with business-as-usual forecasts. An additional purpose of the model was to enable EPA to evaluate goals submitted by a diverse set of companies from a variety of sectors across the economy, using a consistent method. Once the decision was made to shutter the Climate Leaders program, EPA decided to make a version of this model available for public use in order to help users evaluate individual corporate GHG reduction goals on their own. Detailed information on how to use this model is provided in Sections 2 and 3 of this manual.

1.4 Information Needed to Use the Model

EPA's Corporate GHG Goal Evaluation Model was built using Lumina Decision Systems' Analytica software. In order to use the model, users must first download the Free Analytica Player from Lumina's website—which allows viewing and running of existing models—and then download the actual model from EPA's website.

http://www.lumina.com/products/analytica-editions/#users.

In order to successfully use the model, users will need to know two pieces of basic information about the organization whose goal is being analyzed: its North American Industry Classification System (NAICS) code(s) and the appropriate Base Year and Target Year for the goal.

1.4.1 NAICS Codes

NAICS codes are the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. Business Economy. NAICS was developed under the purview of the Office of Management and Budget (OMB) to replace the Standard Industrial Classification (SIC) system to allow for a high level of comparability in business statistics among North American countries. The NAICS numbering system employs a six-digit code at the most detailed industry level. The first two digits designate the largest business sector, the third digit designates the subsector, the fourth designates the industry group, the fifth digit designates particular industries, and the sixth digit designates a particular North American country: United States, Canada, or Mexico.

In order to use the model, a user must know the organization's four-digit NAICS code. An organization may be a company, a division of a company, or another corporate association. Many companies have multiple NAICS codes indicating they are involved in several subsectors of industry; in this case a user must know the organization's percentage of

revenue by NAICS code, as illustrated in examples below.

Single NAICS Code Example
Acme Paint, NAICS Code 2211
22 = Utilities
2211 = Electric Power Generation Transmission and Distribution

Relevant NAICS Codes	Revenue (million U.S. dollars)	Percent Revenue
2211	10.5	100%

Multiple NAICS Code Example
Diverse Company, NAICS Code 1133, 115, 2122, 2211
1133 = Logging
115 = Support activities for agriculture and forestry
2122 = Metal ore mining
2211 = Electric power generation, transmission and distribution

Relevant NAICS Codes	Revenue (million U.S. dollars)	Percent Revenue
1133	2.5	25%
115	2.5	25%
2122	2.5	25%
2211	2.5	25%
Total	10.0	100%

A user, who does not know the organization's NAICS code, can use the search feature at www.census.gov/naics. In the "2007 NAICS Search" box on the left side of the page, enter a keyword that describes the entity. A list of primary business activities containing that keyword and the corresponding NAICS codes will appear. Choose the one that most closely corresponds to the entity's primary business activity, or refine the search to obtain other choices.

If the percentage of revenue by NAICS code is unknown, some places to look include:

- A Company's Form 10-K
- Annual Reports
- Financial Statements
- Entity's Financial Officer

1.4.2 Base Year and Target Year

The model will also require that the user select a Base Year and a Target Year. The Base Year is the year that future reductions are measured against. The Target Year is the year in which the entity expects to achieve the reduction goal. The time period from the Base Year to the

Target Year is referred to as the organization's Goal Period. Please keep in mind that the best Base Year for an organization is typically the most recent year for which data are available and which represents standard business–as-usual GHG emissions levels. However, other Base Years could be used, and the model allows for multiple scenarios to be analyzed. For example, a company may want to measure the impacts of installing a solar array two years prior against the "business-as-usual" scenario for the company's sector. Target Years currently cannot extend beyond 2022 due to limitations on data contained in the model. If using Target Years beyond 2022, please refer to section 3.3 Next Steps of Analysis.

2.0 HOW TO ENTER DATA

2.0 HOW TO ENTER DATA

This section provides step-by-step guidance on how to use the model. Screenshots are used to help illustrate the instructions.

2.1 Download Software

2.1.1 Analytica Player

As described in Section 1.4, in order to use the model users must first download the Free Analytica Player from Lumina's website which allows viewing and running of existing models. If the user chooses to download the free player from Analytica's "Downloads" page, be sure to download the *Analytica 32-bit* (AnaSetup.exe) version.

2.1.2 Model

Once the Analytica Player has been downloaded and installed, users should download the model which is available on the Goal Setting page of EPA's Center for Corporate Climate Leadership website and save it to a local folder. To open the model, first launch the Analytica Player and then open the model from the folder to which it was saved.

2.2 Welcome Screen

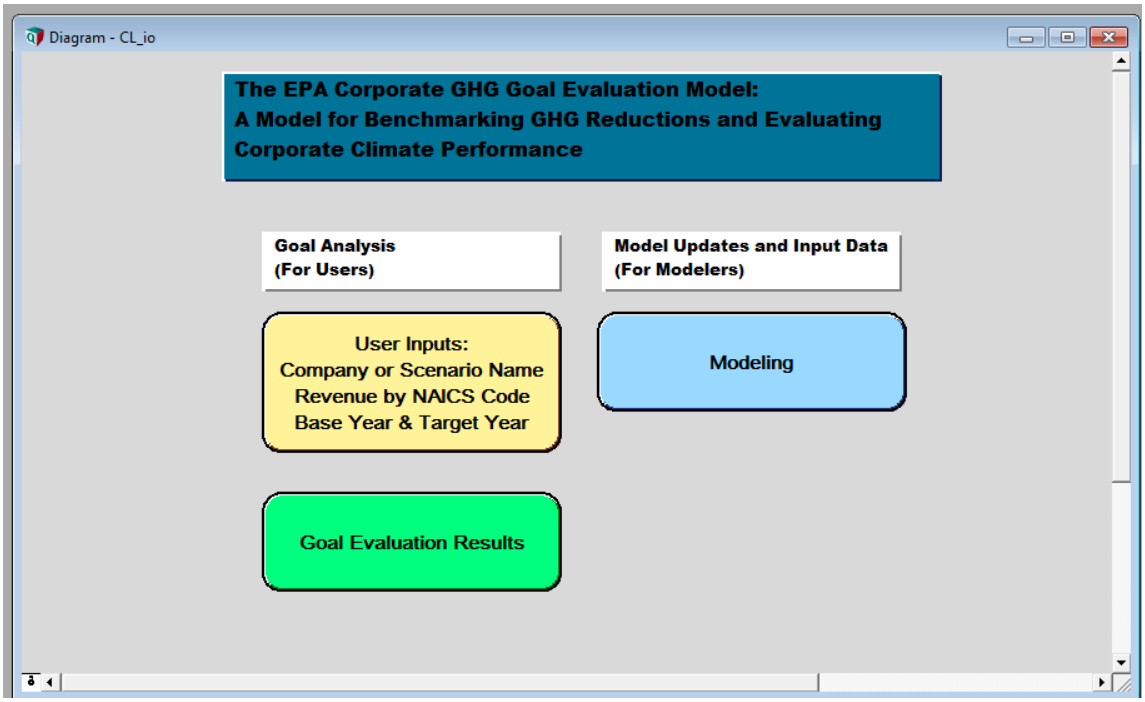
Figure 2-1 illustrates the model's Welcome screen. From this screen, users can access three separate areas of the model by double-clicking on each one:

- ***User Inputs*** - For users, this yellow object collects user-entered data required by the model to calculate a company's performance benchmark.
- ***Goal Evaluation Results*** - For users, this green object contains the model's performance benchmark results.
- ***Modeling*** - For modelers, this blue object contains the background data and calculations the model utilizes to compute the performance benchmarks.

Each modeling screen will contain different elements that the user can interact with. Figure 2-1 contains labels and nodes. Square boxes are labels (such as the title and white boxes on the Welcome screen) and do not have any functionality. Rounded rectangular boxes in a modeling screen are nodes and are functional when double-clicked. A single click will

highlight a node but not open it. Examples of nodes include the yellow User Inputs, blue Modeling, and green Goal Evaluation Results nodes shown in the Welcome screen below. Buttons, as shown in Figure 2-2, require only a single click on the mouse to activate.

Figure 2-1 Goal Evaluation Model – Welcome Screen

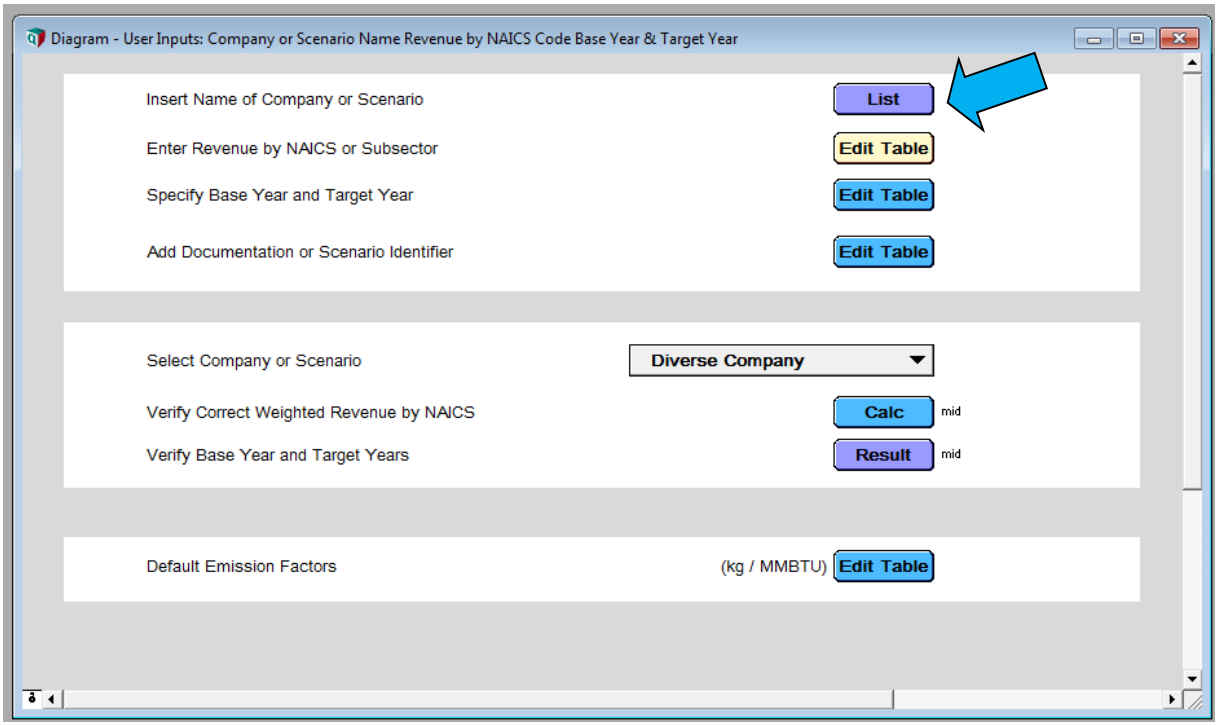


2.3 Goal Analysis (For Users)

2.3.1 User Inputs: Company or Scenario Name, Revenue by NAICS Code, Base Year, and Target Year

Double-clicking the yellow "User Inputs" button under the label "Goal Analysis (For Users)" on the Welcome Page (displayed in Figure 2-1) brings the user to this diagram.

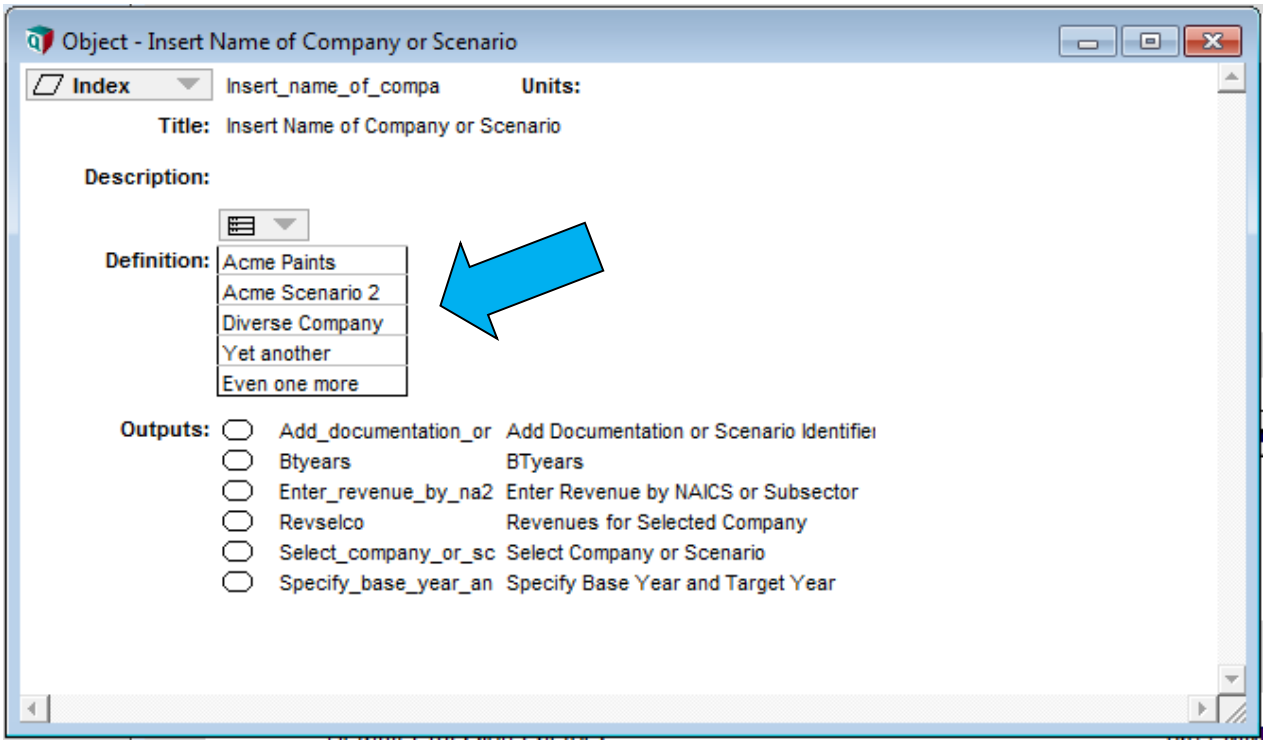
Figure 2-2 Goal Evaluation Model – User Inputs Screen



Step 1 - Insert Name of Company or Scenario:

In order to enter the company's name, first click the purple button labeled "List," as indicated by the blue arrow in Figure 2-2.

Figure 2-3 Goal Evaluation Model – First Data Input Screen

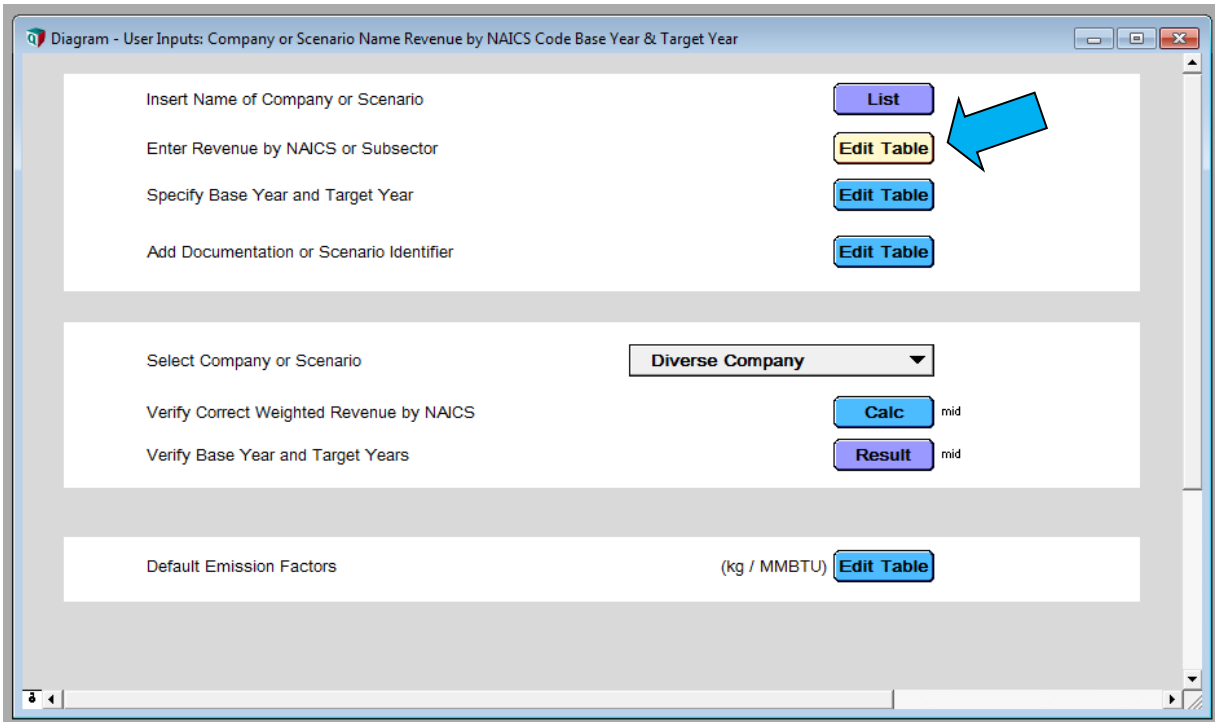


Once on the next screen, click in the cell next to "Definition," as indicated in Figure 2-3 with the blue arrow, and type in the company's name. Up to five company names or scenario identifiers can be entered into the model at one time. The "Outputs" area lists all the objects within the model that pull the information listed in the "Definition". The user does **not** need to enter any data in this area or open any of the listed output objects. Once complete, the user may close this screen by clicking the "X" in the upper right corner.

Step 2 - Enter Revenue by NAICS or Subsector:

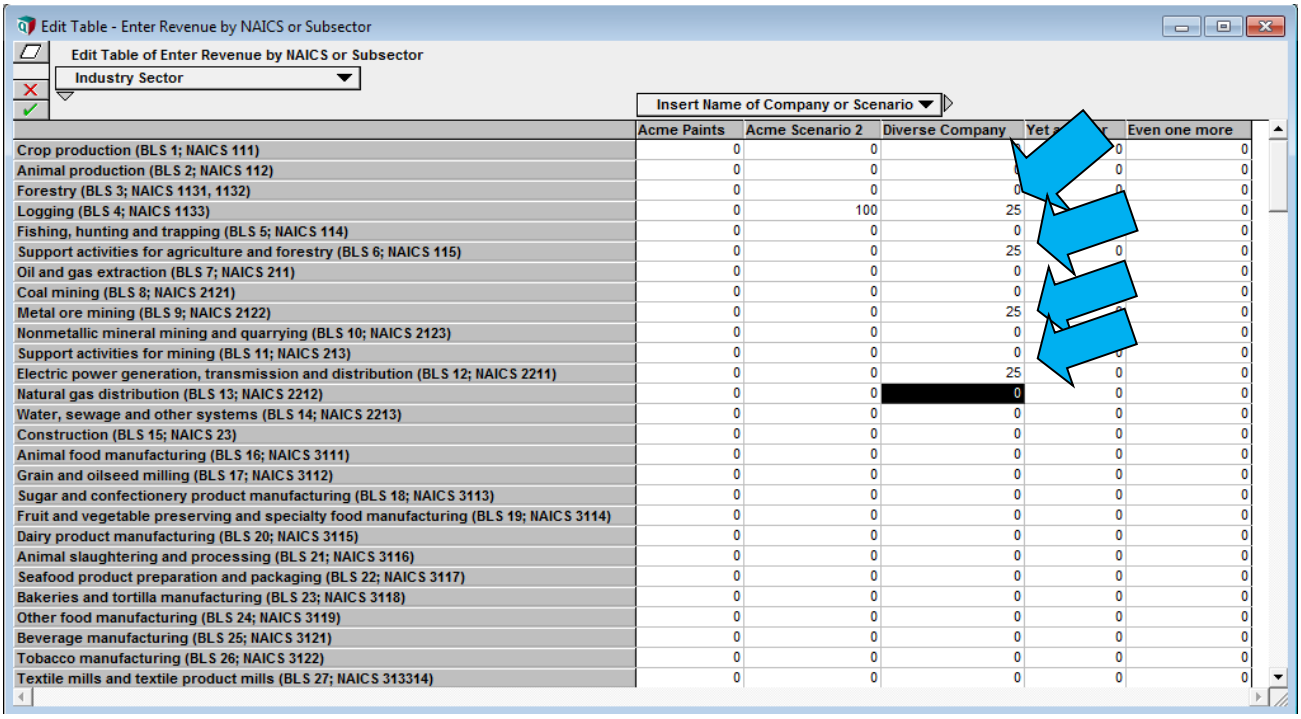
Next, the user must enter the percentage of company revenues received in each sector or subsector. See Section 1.4.1 for more information on NAICS codes and Subsector Revenue Weighting. To enter weighted revenue by NAICS, click the "Edit Table" button in the main User Inputs screen as shown in Figure 2-4.

Figure 2-4 Goal Evaluation Model – NAICS User Input Screen



As illustrated in Figure 2-5, "Diverse Company" receives revenues from four sectors of equal weight. Users will use the company NAICS codes to determine the row in which percentage of revenue belongs. Once complete, close this screen by clicking the "X" in the upper right corner.

Figure 2-5 Goal Evaluation Model – User Input of Revenue by NAICS or Subsector

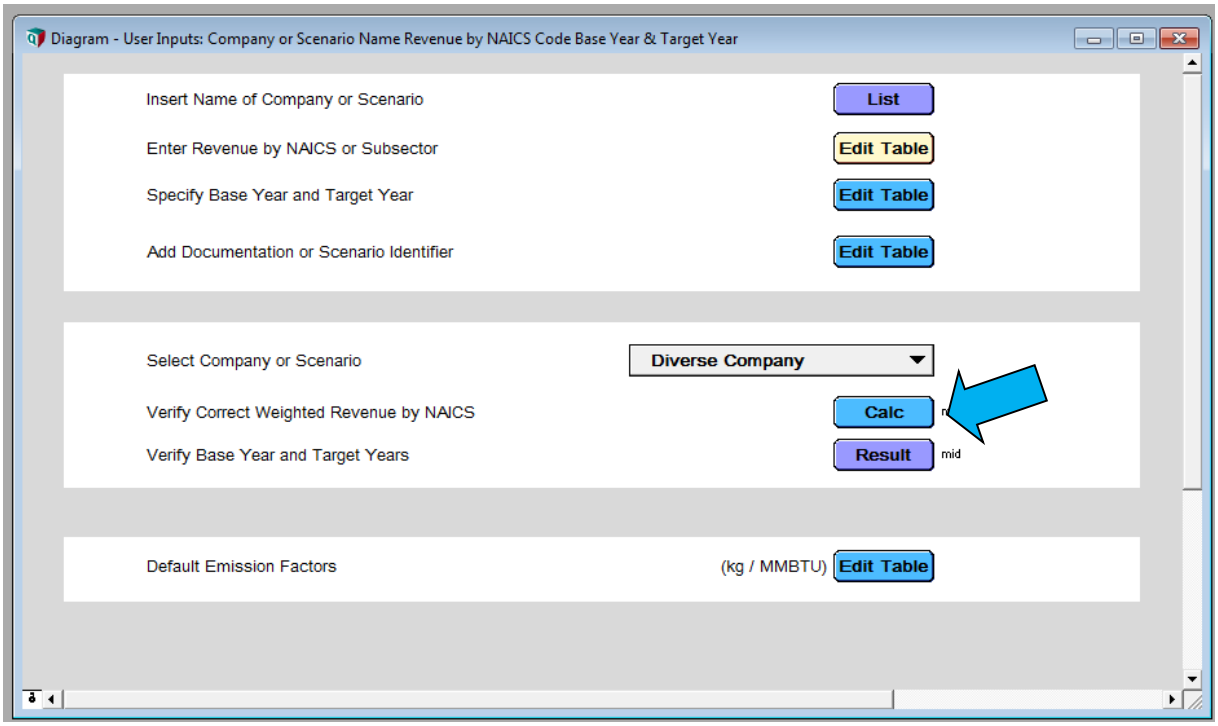


	Acme Paints	Acme Scenario 2	Diverse Company	Yet a…r	Even one more
Crop production (BLS 1; NAICS 111)	0	0	0	0	0
Animal production (BLS 2; NAICS 112)	0	0	0	0	0
Forestry (BLS 3; NAICS 1131, 1132)	0	0	0	0	0
Logging (BLS 4; NAICS 1133)	0	100	25	0	0
Fishing, hunting and trapping (BLS 5; NAICS 114)	0	0	0	0	0
Support activities for agriculture and forestry (BLS 6; NAICS 115)	0	0	25	0	0
Oil and gas extraction (BLS 7; NAICS 211)	0	0	0	0	0
Coal mining (BLS 8; NAICS 2121)	0	0	0	0	0
Metal ore mining (BLS 9; NAICS 2122)	0	0	25	0	0
Nonmetallic mineral mining and quarrying (BLS 10; NAICS 2123)	0	0	0	0	0
Support activities for mining (BLS 11; NAICS 213)	0	0	0	0	0
Electric power generation, transmission and distribution (BLS 12; NAICS 2211)	0	0	25	0	0
Natural gas distribution (BLS 13; NAICS 2212)	0	0	0	0	0
Water, sewage and other systems (BLS 14; NAICS 2213)	0	0	0	0	0
Construction (BLS 15; NAICS 23)	0	0	0	0	0
Animal food manufacturing (BLS 16; NAICS 3111)	0	0	0	0	0
Grain and oilseed milling (BLS 17; NAICS 3112)	0	0	0	0	0
Sugar and confectionery product manufacturing (BLS 18; NAICS 3113)	0	0	0	0	0
Fruit and vegetable preserving and specialty food manufacturing (BLS 19; NAICS 3114)	0	0	0	0	0
Dairy product manufacturing (BLS 20; NAICS 3115)	0	0	0	0	0
Animal slaughtering and processing (BLS 21; NAICS 3116)	0	0	0	0	0
Seafood product preparation and packaging (BLS 22; NAICS 3117)	0	0	0	0	0
Bakeries and tortilla manufacturing (BLS 23; NAICS 3118)	0	0	0	0	0
Other food manufacturing (BLS 24; NAICS 3119)	0	0	0	0	0
Beverage manufacturing (BLS 25; NAICS 3121)	0	0	0	0	0
Tobacco manufacturing (BLS 26; NAICS 3122)	0	0	0	0	0
Textile mills and textile product mills (BLS 27; NAICS 313314)	0	0	0	0	0

Data can be entered in multiple ways using the screen shown in Figure 2-5. For example, entering a value of 1 for each of the four NAICS codes would have the same effect as entering the value of 25 into each of the four boxes. The model interprets these data in comparison to the other entries for the same company or scenario, not out of a base value of 100. So if you enter a value of 2 for one NAICS code and a value of 1 for another NAICS code, the model will weigh the NAICS code with the 2 value twice as much as the NAICS code with the 1 value, or 66.6666 percent vs. 33.3333 percent. The drop-down in the top-left corner of this screen toggles the table structure, listing the BLS sectors either on the vertical (as shown in Figure 2-5) or horizontal axis with the listing of company names or scenarios as defined in Figure 2-1 of the previous step on the vertical axis.

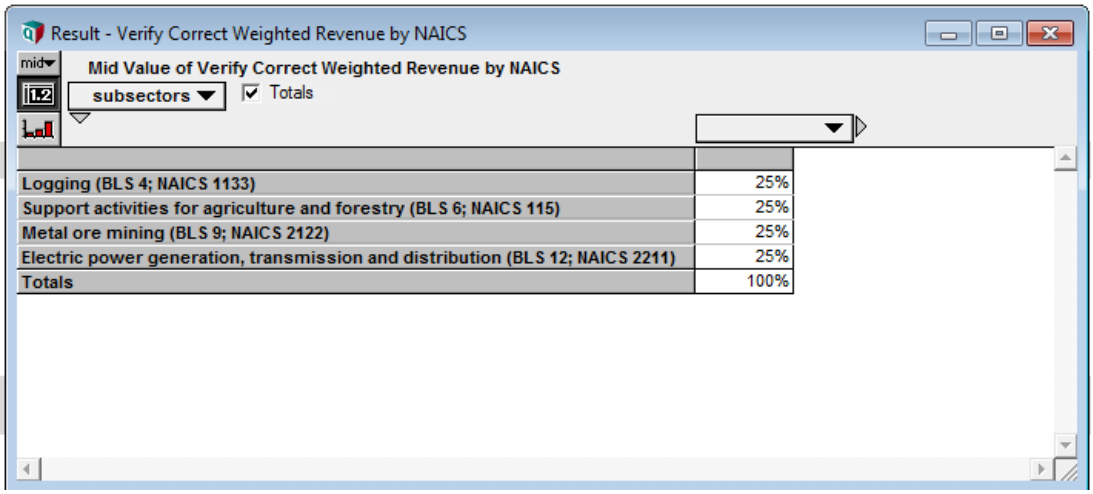
Users can check to ensure they have entered their NAICS code weights correctly by clicking the "Calc" button across from the label "Verify Correct Weighted Revenue by NAICS" as seen in Figure 2-6.

Figure 2-6 Goal Evaluation model – Calc User Input Screen



The verification results will appear as displayed in Figure 2-7. If any changes need to be made to these weighted revenues they must be completed in the "Enter Revenue by NAICS or Subsector" tab (Figure 2-5); they cannot be changed in the screen shown in Figure 2-7. Any changes made should be verified by repeating Step 2 to ensure the desired result was achieved. If you entered multiple scenarios, you may verify each scenario's weighted revenues by selecting the desired scenario from the drop-down listed beside the "Select Company or Scenario" label. In all Results screens there is an option to show the total by checking the box labeled "Totals" in the top of the screen. The default setting has the total displayed; un-checking the box will cause the total row at the bottom to disappear (see example in Figure 2-7).

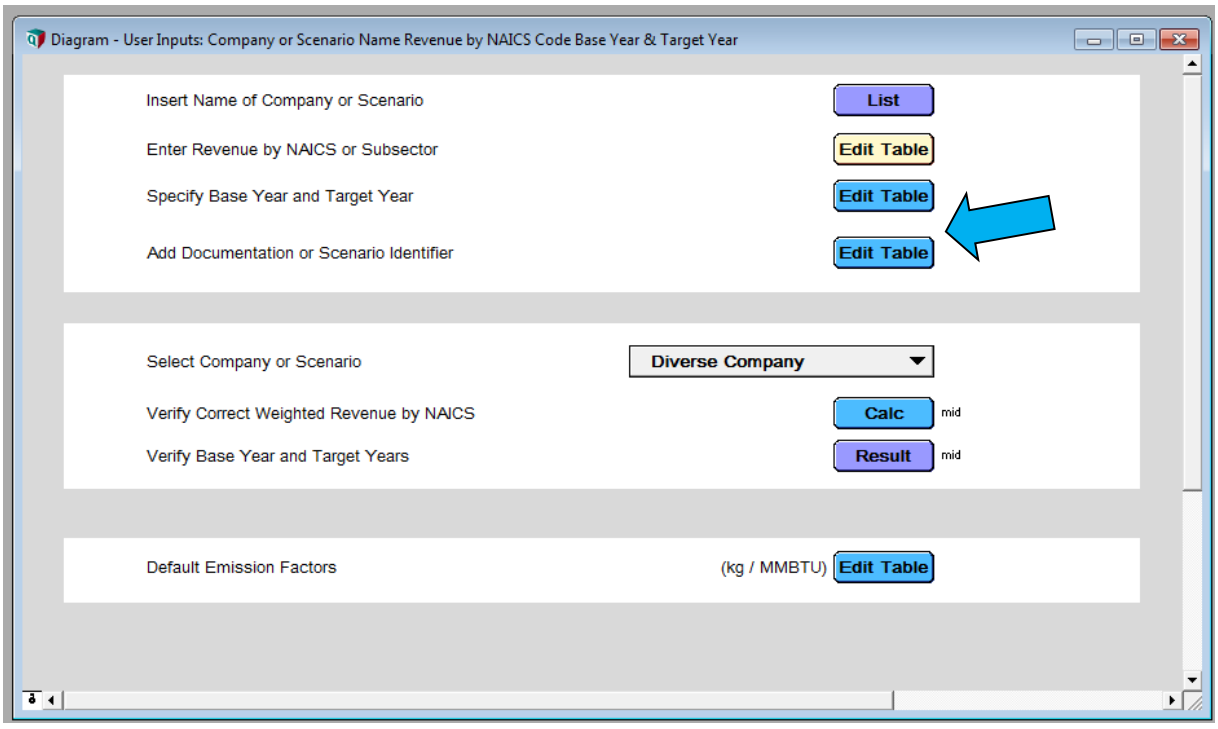
Figure 2-7 Goal Evaluation Model – NAICS Weight Verification Screen



Step 3 - Specify Base Year and Target Year:

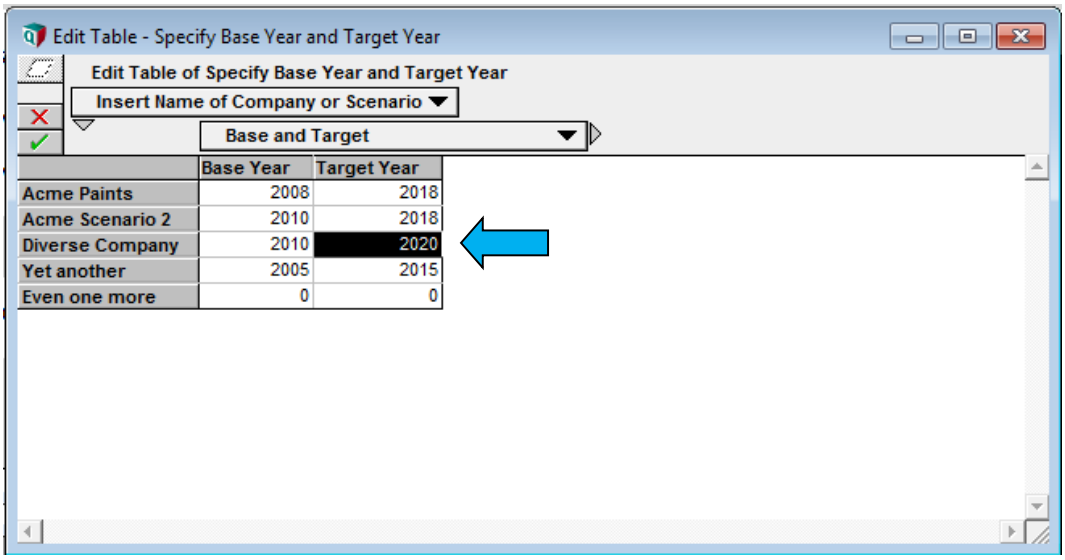
Next, the user must specify the Base Year and Target Year. See Section 1.4.2 for more information on selecting a Base Year and Target Year. To enter these data, click the "Edit Table" button across from the label "Specify Base Year and Target Year" in the main User Inputs Screen as shown in Figure 2-8.

Figure 2-8 Goal Evaluation Model – User Input Base Year and Target Year Screen



The screen shown in Figure 2-9 will appear and the user must enter their Base and Target Years as shown. Occasionally the Analytica software will show you the object box as an interim step between the screen in Figure 2-8 and the one shown in Figure 2-9. If you click on the "edit table" option in this object box, it will take you to the edit table screen shown in Figure 2-9, where you can enter your Base Year and Target Year.

Figure 2-9 Goal Evaluation Model – Specify Base Year and Target Year Screen



Once complete, you may close this screen by clicking the "X" in the upper right corner. The "Result" button next to "Verify Base Year and Target Year" on the main User Inputs screen, as shown in Figure 2-10, will lead you to the Verification screen for the Base and Target Years. The Base Year and Target Year should match what was entered in the "Specify Base Year and Target Year" tab described above. If you entered multiple scenarios, you may verify each scenario's Base and Target Years by selecting the desired scenario from the drop-down listed beside the "Select Company or Scenario" label. If any changes need to be made to either the Base Year or Target Year they must be done in the "Specify Base Year and Target Year" tab in the main "User Inputs" window. Once complete, you may close the "Verify Base Year and Target Year" screen by clicking the "X" in the upper right corner.

Figure 2-10 Goal Evaluation Model – Verify Base Year and Target Years User Input Screen

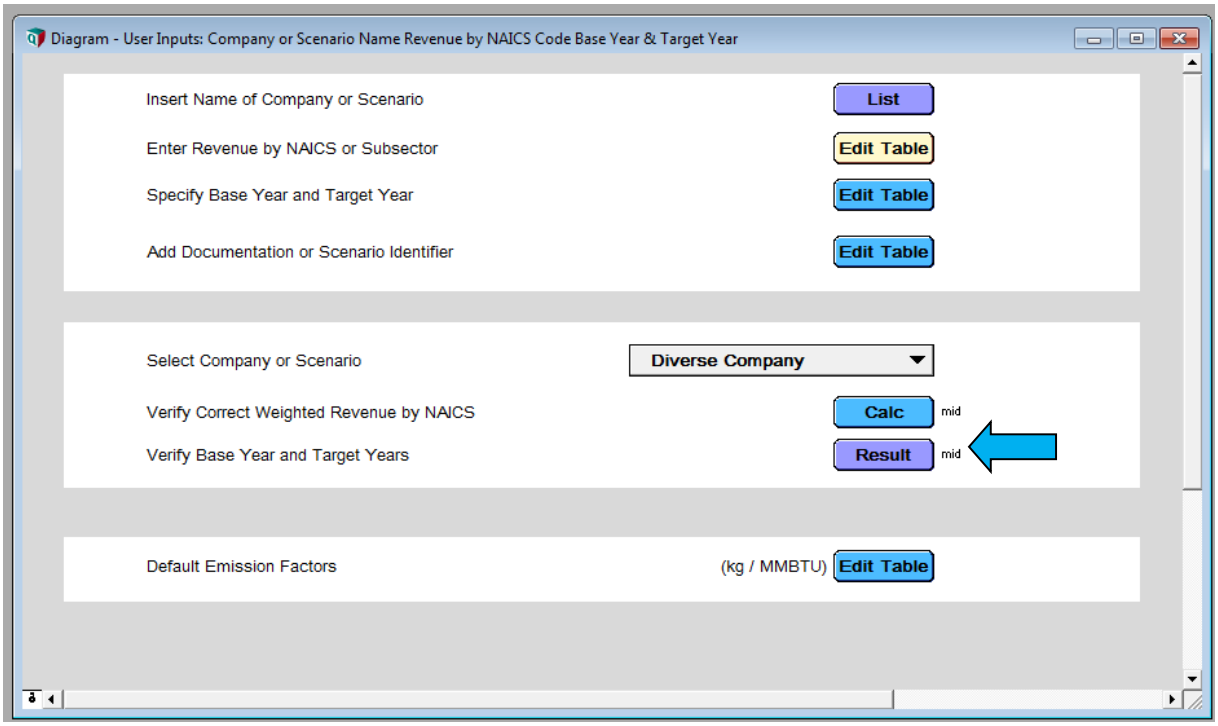
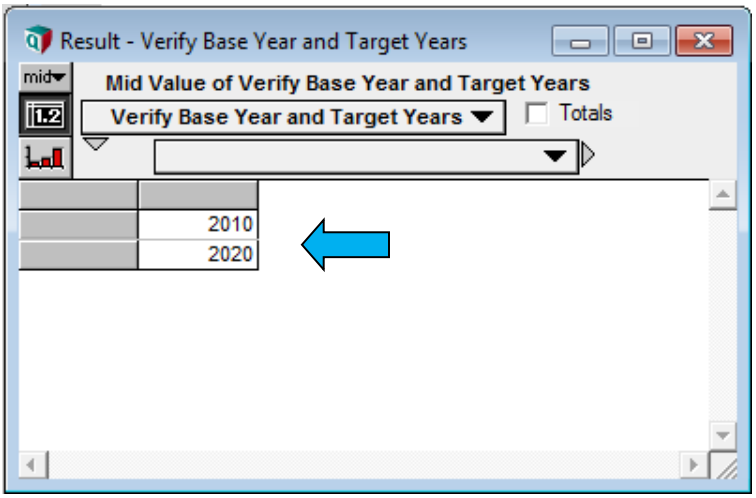
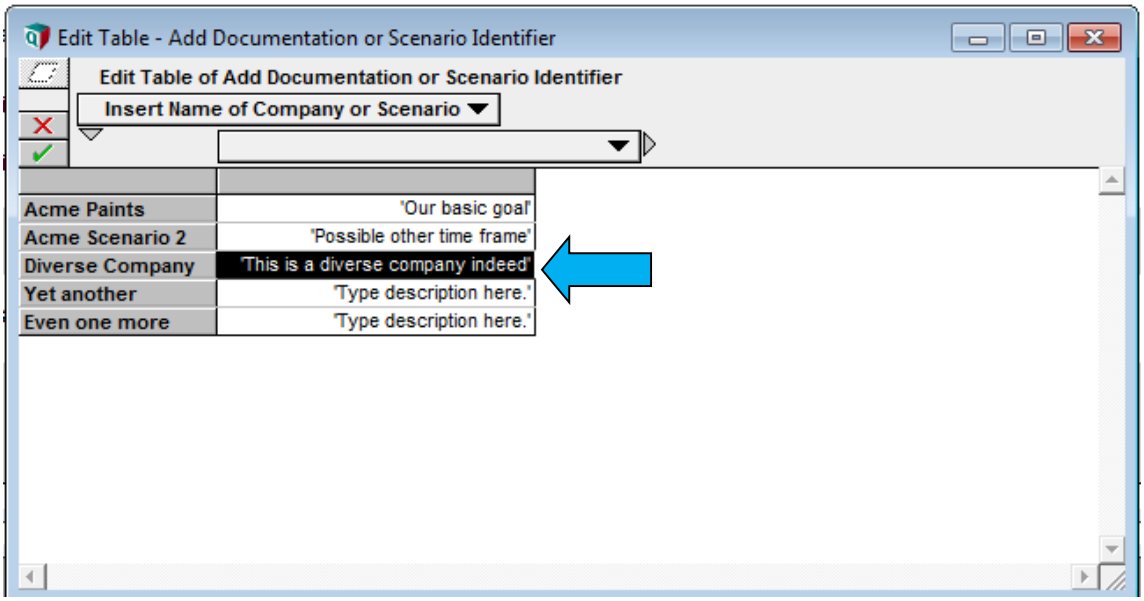


Figure 2-11 Goal Evaluation Model – Verify Base Year and Target Years Result Screen



Step 4 - Add Documentation or Scenario Identifier (Optional):

Figure 2-12 Goal Evaluation Model – Add Documentation or Scenario Identifier Table



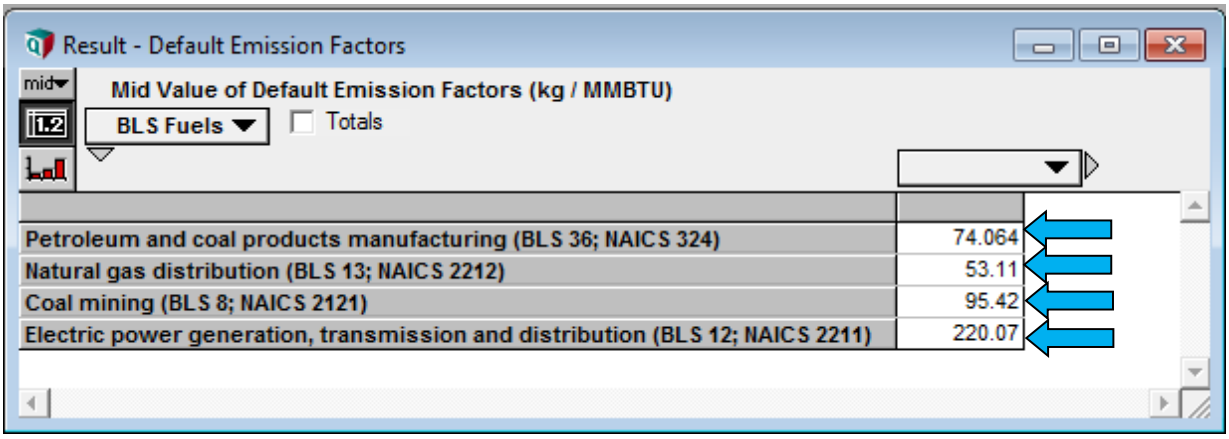
This tab on the main "User Inputs" window is not required in order to run the model; however, it does allow the user an opportunity to provide additional information. Because the information entered in this table (shown in Figure 2-12) is not used in any other object or result in the model, the user should use this table as a centralized area to store documentation concerning the company's reduction goal. Examples include, but are not limited to, specific information about the company such as revenue, number of employees, total owned square footage, specific assumptions about any one scenario, and background information on reduction goals. Please note the cells in this table do not have text

wrapping; therefore, to enter a large amount of additional information, the user must hard-enter to get to the next line by hitting Alt-Enter. Once complete, close this screen by clicking the "X" in the upper right corner.

Important: If using Analytica's free player to view the model and a license has not been purchased, any information entered in the "Add Documentation or Scenario Identifier" table will be lost once the model is closed. If working with multiple goals, this page can still be helpful during a single session to keep different scenarios or goals organized, however, documentation of each goal or scenario should be kept elsewhere by the user for future reference.

Step 5 - Check and modify default emissions factors:

Figure 2-13 Goal Evaluation Model – Check Default Emission Factors Table



The "Results" button next to "Default emission factors" on the "User Inputs" screen will lead you to the Default Emissions Factor screen, shown in Figure 2-13, which is based on previous inputs. Emission factors are in units of kg CO_2e per MMbtu.

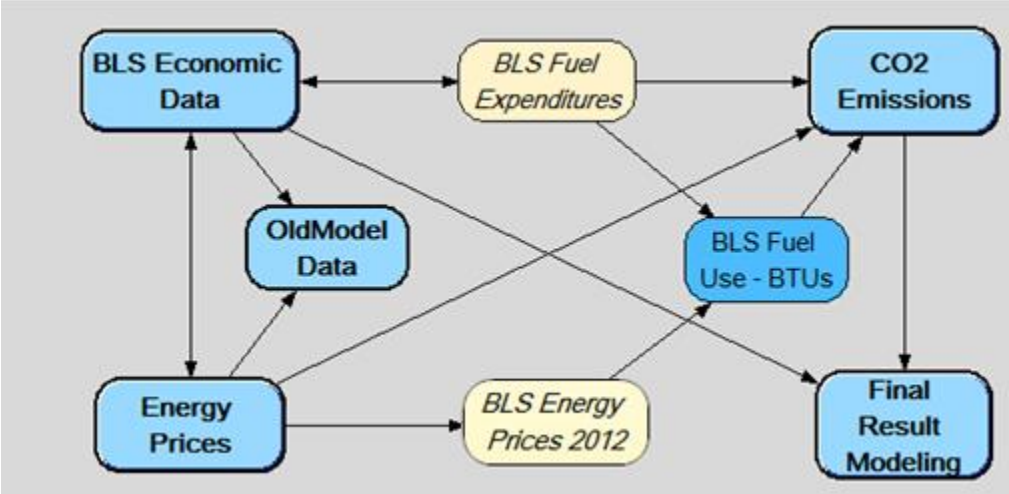
Emission Factors Used by the Goal Evaluation Modeling System

	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

2.4 Model Updates and Input Data (For Modelers)

The "Modeling" button under "Model Updates and Input Data (For Modelers)" on the Welcome screen brings the user to the diagram shown in Figure 2-14.

Figure 2-14 Goal Evaluation Model – Modeling Diagram



2.4.1 Understanding the Diagram

To better understand the five main modules of the model, see the descriptions of each below:

- ***BLS Economic Data***: The expenditure data for each sector come from the Bureau of Labor Statistics (BLS), and are located in this module. These BLS data include historical and projected input/output for 202 sectors and show the flow of commodities from production through purchases by final users.

- ***Energy Prices:*** The price data are available in three datasets from the U.S. Energy Information Administration (EIA). The datasets are the Annual Energy Outlook (AEO), The State Energy Data System (SEDS), and the Manufacturers Energy Consumption Survey (MECS). These three datasets are combined in this module to create a data series containing historical and forecasted energy price data for a variety of sectors.

- ***Old Model Data:*** This module compares the results from this model to those of a previous model. A summary text field describes differences between the models that may cause users to receive different results.

- ***CO_2 Emissions:*** This module translates the fuel consumption for each sector into carbon dioxide emissions normalized by revenue output.

- ***Final Result Modeling:*** This module pulls information from the user-inputs and the modules described above to calculate the company's benchmarks. These results are shown as outputs in the model's "Goal Evaluation Results."

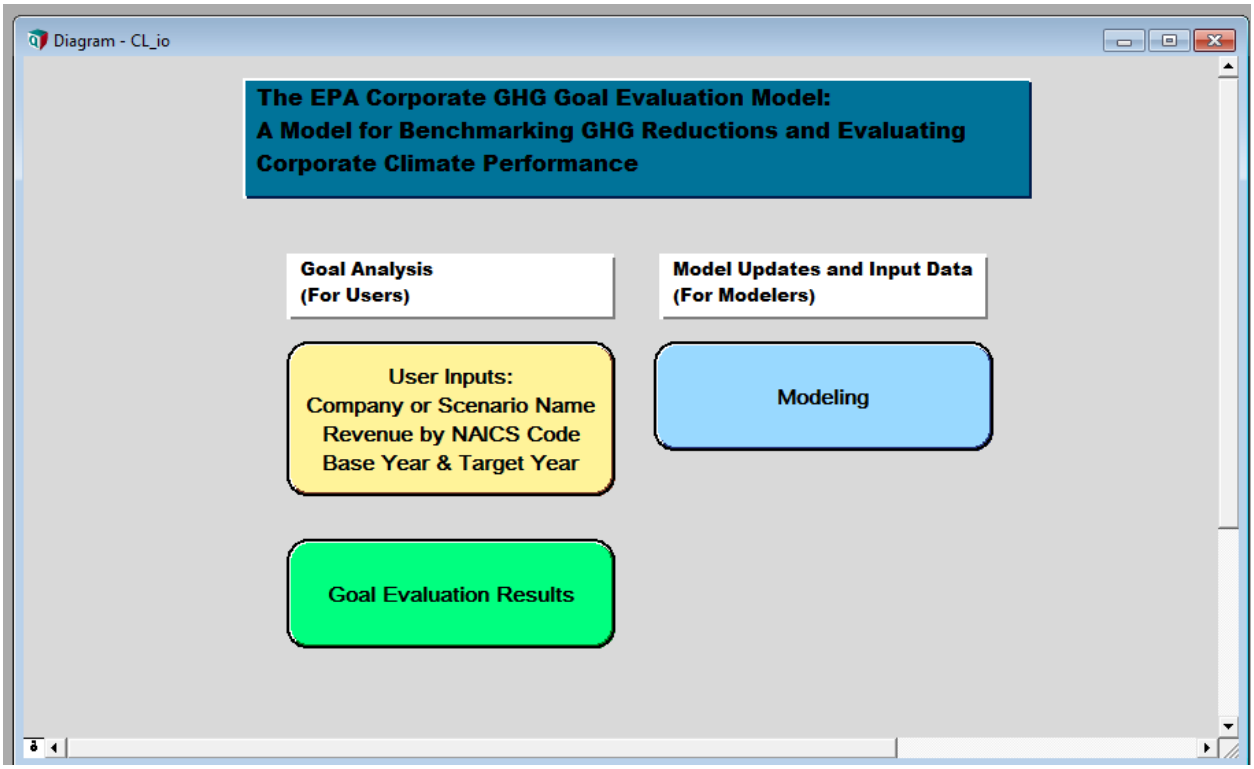
For more information on the data series the model utilizes and how the model calculates the performance benchmarks, please refer to the document *Overview of the EPA Corporate GHG Goal Evaluation Model*, located on the Goal Setting page of EPA's Center for Corporate Climate Leadership website.

3.0 ANALYZING MODEL RESULTS

3.0 ANALYZING MODEL RESULTS

This section provides the user information on how to best analyze the results calculated by the model based on the information entered. From the Welcome screen, double-click on the green "Goal Evaluation Results" object, which will take you to the Results screen, as shown in Figure 3-1.

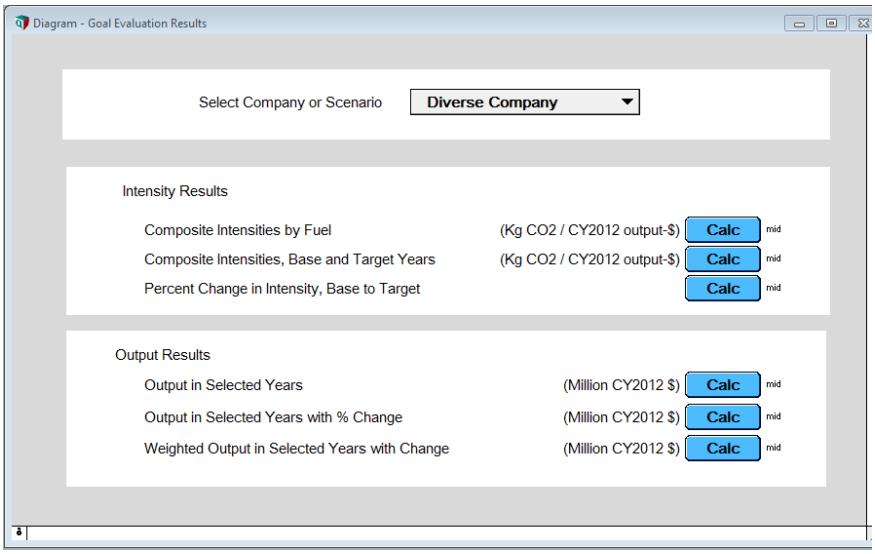
Figure 3-1 Goal Evaluation Model – Welcome Screen



3.1 Goal Evaluation Results

The screen shown in Figure 3-2 illustrates the goal evaluation results available to the user. To obtain each result, click the "Calc" button next to each result identifier. Please note that once the user selects a "Calc" tab, the name of the tab will change from "Calc" to "Result."

Figure 3-2 Goal Evaluation Model – Goal Evaluation Results



3.1.1 Intensity Results

Figure 3-3 Goal Evaluation Model - Composite Intensities by Fuel

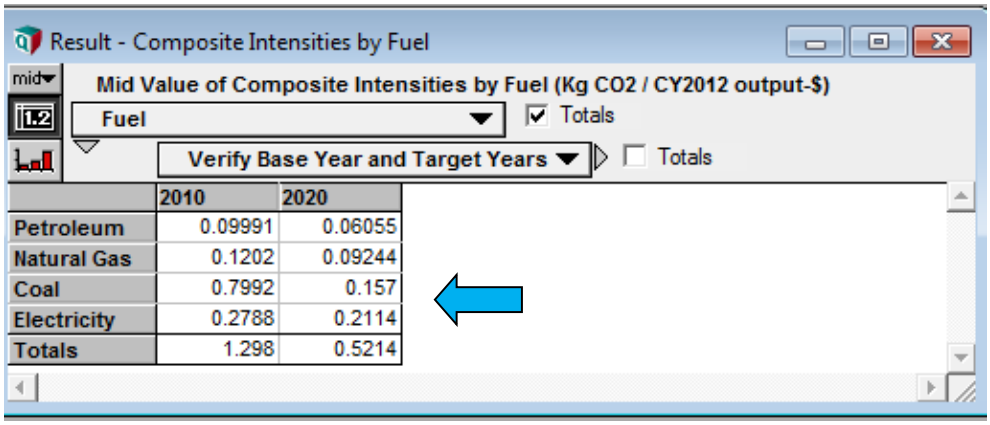


Figure 3-3 shows a calculation of the fuel-specific annual intensities for the composite sector. It reflects the estimated fuel-specific emission intensity (kg CO_2 per $ output in 2012 U.S. dollars) for a composite NAICS sector that is a revenue-weighted average of the company's sub-sectors:

Annual Composite Intensity (ACI) = Σ Subsector Annual Intensity × Subsector Revenue Weighting

Figure 3-4 Goal Evaluation Model - Composite Intensities, Base and Target Years

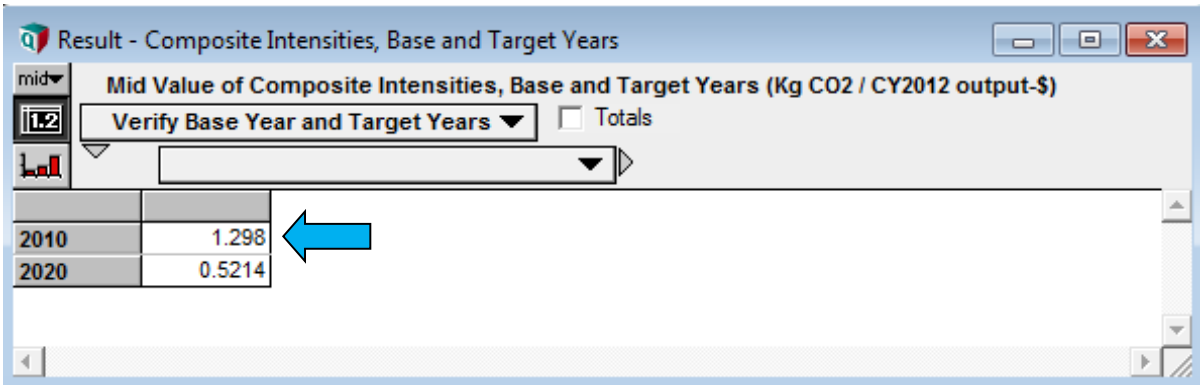


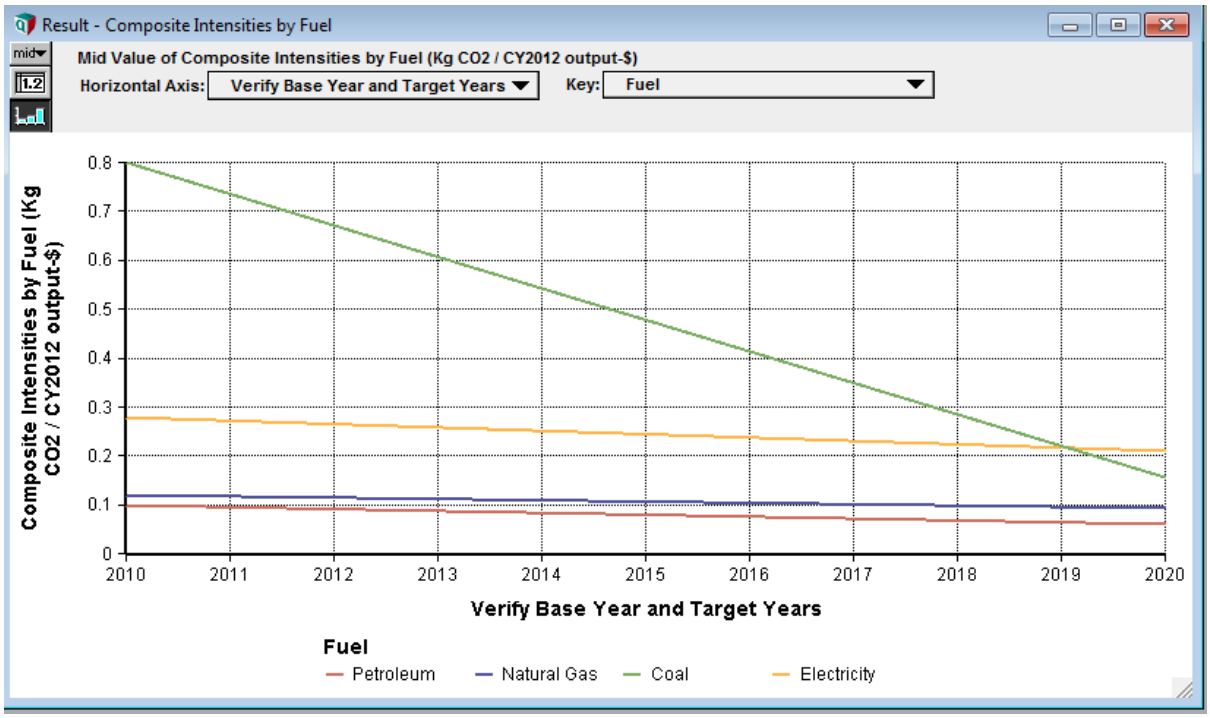
Figure 3-4 shows a calculation of the annual intensities for the composite sector for the Base Year and Target Year. It reflects the estimated Base Year and Target Year emission intensity (kg CO_2 per $ output in 2012 U.S. dollars).

Figure 3-5 Goal Evaluation Model - Percent Change in Intensity, Base to Target

Figure 3-5 shows the percentage change in emissions intensity, by fuel and total, for the composite sector, from the Base to Target Years of the proposed goal. This result, summed over fuels, is used as the performance benchmark and represents the "business as usual" (BAU) case for a typical company in that sector. In order for a goal to be considered aggressive, the first test is whether or not the company goal significantly exceeds this benchmark.

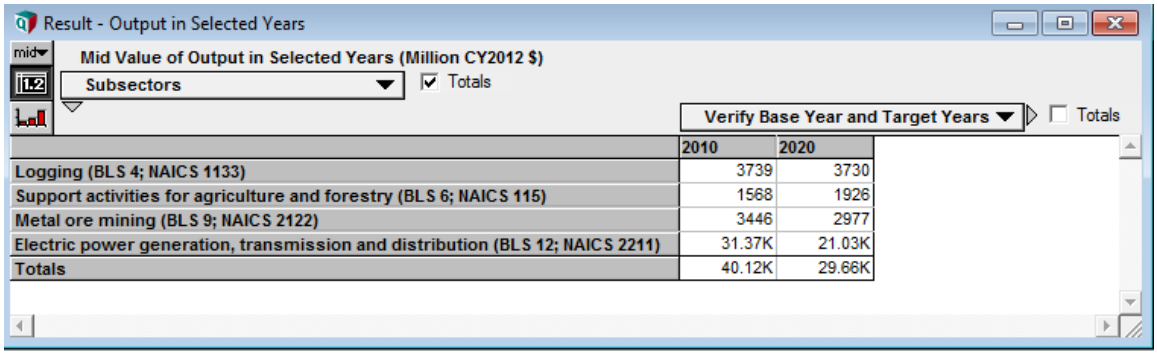
All results have the option of showing the data graphically in a chart rather than as numbers in table. By pressing the button with a picture of a bar chart (as highlighted with the blue arrow in Figure 3-6), you can select to view the data as a chart. Selecting the button above it will return the user to the tabular view.

Figure 3-6 Goal Evaluation Model – Graphic View of Results



3.1.2 Output Results

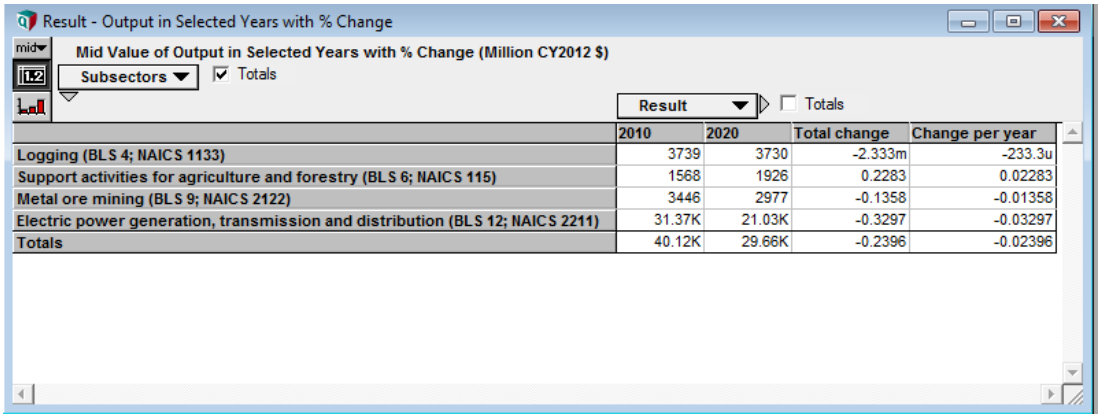
Figure 3-7 Goal Evaluation Model - Output in Selected Years



	2010	2020
Logging (BLS 4; NAICS 1133)	3739	3730
Support activities for agriculture and forestry (BLS 6; NAICS 115)	1568	1926
Metal ore mining (BLS 9; NAICS 2122)	3446	2977
Electric power generation, transmission and distribution (BLS 12; NAICS 2211)	31.37K	21.03K
Totals	40.12K	29.66K

In the calculation result shown in Figure 3-7, estimates of total industry output—in millions of calendar year (CY) 2012 U.S. dollars—depict the industry-wide growth or contraction between the Base Year and the Target Year. This metric is used to estimate market growth and expected company expansion or change in revenue, over the goal period.

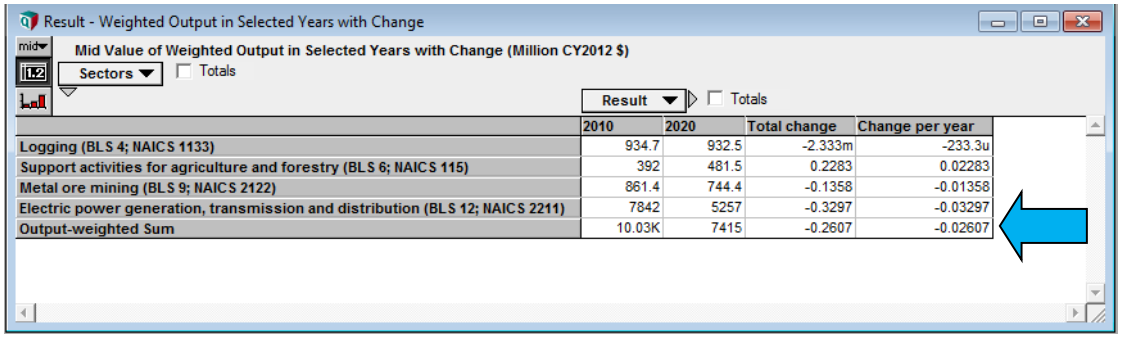
Figure 3-8 Goal Evaluation Model - Output in Selected Years with Percentage Change



	2010	2020	Total change	Change per year
Logging (BLS 4; NAICS 1133)	3739	3730	-2.333m	-233.3u
Support activities for agriculture and forestry (BLS 6; NAICS 115)	1568	1926	0.2283	0.02283
Metal ore mining (BLS 9; NAICS 2122)	3446	2977	-0.1358	-0.01358
Electric power generation, transmission and distribution (BLS 12; NAICS 2211)	31.37K	21.03K	-0.3297	-0.03297
Totals	40.12K	29.66K	-0.2396	-0.02396

In the result shown in Figure 3-8, 'Output' refers to industry-wide production quantified in millions of CY 2012 U.S. dollars. This result also includes the percent change or "Total Change" in output from the Base Year to the Target Year (23.96 percent in Figure 3-8) and the "change per year" (U.S. dollars2.396 percent in Figure 3-8).

Figure 3-9 Goal Evaluation Model - Weighted output in selected years with change



	2010	2020	Total change	Change per year
Logging (BLS 4; NAICS 1133)	934.7	932.5	-2.333m	-233.3u
Support activities for agriculture and forestry (BLS 6; NAICS 115)	392	481.5	0.2283	0.02283
Metal ore mining (BLS 9; NAICS 2122)	861.4	744.4	-0.1358	-0.01358
Electric power generation, transmission and distribution (BLS 12; NAICS 2211)	7842	5257	-0.3297	-0.03297
Output-weighted Sum	10.03K	7415	-0.2607	-0.02607

For companies that are involved in several subsectors of industry, the result shown in Figure 3-9 provides output that is weighted based on the company's percentage of revenue by sector. Therefore, the forecasted growth or decline of any sector will be captured proportionally to its contribution to the company's revenue. The last column of the results table contains the sum of the weighted output across all sectors for the Base Year, Target Year, percent of total change from Base Year to Target Year and the change per year (shown with a blue arrow in Figure 3-9).

These values are important indicators of how and where goal targets should be achieved. If

a company's reduction goal is based primarily in a business sector that is expected to decline and the reductions are coming from reduced production rather than from actual process improvements, then the goal would not be considered aggressive or sufficient by climate leadership standards.

These output values are also useful in converting between absolute reduction goals, benchmarks, and intensity- based goals, allowing companies with different types of goals to use the model results. Companies whose intensity-based goals are related to a metric other than revenue (which was recommended by EPA's Climate Leaders program) will need to complete additional analysis to convert production- employee- or workspace-based metrics into revenue so that a valid comparison can be made. Examples of these types of analyses are provided in Section 3.2 Next Steps of Analysis.

3.2 Next Steps of Analysis

The resulting intensity and economic output data provided by the model can be used in several ways to help a company establish or evaluate a GHG reduction goal.

Important Note: Process emissions are not addressed fully by the model. For companies with significant GHG emissions from industrial processes it is very important to take these into consideration when using the model to establish or evaluate a company's GHG target.

3.2.1 Reduction Goal Analysis

There are different levels of goal analysis that can be performed using the model's output. If you have not yet established a GHG reduction goal, the resulting percent change in CO_2 intensity may be used as a starting benchmark. As mentioned in Section 3.1, the model provides the percent change in intensity and revenue in the "Goal Evaluation Results." For example, the model returned the results shown in Figure 3-10 for "Acme Paint", which is defined as having output in one BLS sector: "Paint, coating, and adhesive manufacturing", which is BLS sector 41, and corresponds to NAICS 3255.

Figure 3-10 Model Results for Acme Paint

Acme Paint Results			
	2010	**2020**	**% change (total)**
Intensity (kg CO_2/ $US)	0.3872	0.3425	-11.53%
Output (million $US) for sector	25,750	30,660	19.08%

The results above show that the "typical" company within Acme Paint's sector will see a 11.53 percent decrease in CO_2 intensity between 2010 and 2020. If Acme Paint would like to establish an aggressive GHG reduction goal compared to its competitors, it should work towards reducing their CO_2 intensity by a percentage significantly greater than 11.5 percent over the same time period.

To take this a step further, the model results can be used in combination with a company's GHG inventory and revenue for the Base Year to obtain the company's revenue, intensity and CO_2 emissions for the Target Year. Because the model's output is based on a BAU forecast for the sector, the analysis shown in Figure 3-11 can be considered a BAU scenario for the company. For example, Acme Paint would like to estimate their expected emissions, assuming the sector's BAU growth rate. To do this, Acme Paint calculates its Base Year intensity by dividing its Base Year GHG emissions by its revenue for the same year, as shown in Figure 3-11.

Figure 3-11 Acme Paint Base Year Intensity Calculation

Acme Paint Data	2010
GHG emissions (kg CO_2)	4,100,000
Revenue ($US)	10,000,000
CO_2 intensity (metric tons CO_2/million $US) =	*$\frac{CO_2 \text{ emissions (kg)}}{\text{Revenue (\$US)}}$*
CO_2 intensity (kg CO_2/ $US)	0.41

As described above, the model's results estimate that CO_2 intensity within Acme Paint's sector will decrease by 11.5 percent. In other words, if Acme Paint does not undertake any special GHG related reduction measures, Acme Paint can still expect its CO_2 intensity to decrease by 11.5 percent. Anticipated trends that affect a sector's expected emissions over time could include: shifting fuel consumption to more natural gas in the place of coal; equipment upgrades or additions to meet growing business demand; process changes or technology improvements in the sector that lead to efficiency improvements; and changes in the fuel mix of electricity consumed off the grid. By applying the sector's forecasted intensity growth or decline to a company's baseline intensity, the company can obtain a BAU intensity that is specific to its own operations.

Figure 3-12 Acme Paint Target Year Intensity Calculation

Acme Paint Target Year Intensity- BAU	CO_2 intensity (kg CO_2/ $US)
2010	0.41
Base Year Intensity x (1.0 - 11.5%) = BAU Target Year Intensity	
2020	0.363

The results shown in Figure 3-12 estimate Acme Paint's BAU intensity as 0.41 kg CO2 per US dollar. The same calculation can be applied to calculate Acme Paint's BAU revenue growth over the goal period. Using this concept, Acme Paint's revenue in 2020 is estimated to increase 19 percent to 11.9 million dollars under this BAU scenario. By multiplying these two results, Acme Paint can estimate its BAU CO_2 emissions in the Target Year. As shown in Figure 3-13, Acme Paint can expect an increase of 5.3 percent in their absolute CO_2 emissions between 2010 and 2020 if the company follows its sector's forecasted trends.

Figure 3-13 Acme Paint Target Year BAU Emissions Calculation

Acme Paint Target Year CO_2 emissions (kg)	2020
CO_2 intensity (kg CO_2/ $US)	0.363
Revenue ($US)	11,900,000
CO_2 emissions (metric tons) = CO_2 intensity (kg CO_2/ $US) × Revenue ($US)	
CO_2 emissions (kg)	4,317,915

	CO_2 emissions (kg)
2010	4,100,000
2020	4,317,915
% Difference	5.3%

Many companies forecast revenue for internal purposes or to include in annual reports or other publications. These data can be used instead of the model's revenue output to obtain a more accurate BAU forecast for your company.

From here, Acme Paint can evaluate its forecasted BAU CO_2 emissions and intensity, along with other company information, to establish an absolute or normalized CO_2 reduction goal that is aggressive compared to its sector, yet attainable.

Absolute emission reduction goals are preferable to intensity-based reduction goals, as they target actual emission reductions regardless of other Acme Paint activities. In the case of an intensity-based emission reduction goal, a company may increase its absolute GHG emissions while achieving a reduction in its intensity measurement. For example, a company may realize increased revenues in one year due to inflation or other price changes, causing its measure of emission intensity to decline (measured in emissions per unit revenue, the number will become smaller as the denominator, revenue, increases) regardless of whether it reduced GHG emissions.

3.2.2 Forecasting past 2022

Due to constraints in background data, the model can only forecast performance benchmark results out to 2022.[2] However, it is possible to use the model's outputs in 2022 to calculate results for years 2023 onward by making certain assumptions. The most typical of these is assuming a constant growth rate for both CO_2 intensity and revenue. For example, Acme Paint may want to evaluate a potential reduction goal from 2010 to 2025 instead of from 2010 to 2020. To do so, Acme Paint must calculate the annual percent change in CO_2 intensity and revenue based on the model output by dividing the total

[2] As certain data inputs to the model are revised and made publically available, EPA will continue to update the goal model so that forecasts can go beyond 2022.

percent change by the number of years between the Base Year (2010) and 2020 (10 years, see calculation in Figure 3-14):

Figure 3-14 Acme Paint Calculation of Annual Percentage Change in Intensity and Revenue

% change (annual) = [% change total] ÷ 10

	Acme Paint Results		% change (total)	% change (annual)
	2010	**2020**		
Intensity (kg CO_2/ $US)	0.41	0.363	-11.53%	-1.15%
Output (million $US) for sector	25,750	30,660	19.08%	1.91%

By assuming constant growth between 2020 and 2025 for both factors, Acme Paint can apply these annual percent changes to the 2020 data and obtain results for 2025, as shown in Figure 3-15.

Figure 3-15 Acme Paint Calculation of Intensity and Output in Year 2025

2025 Result = 2020 Result × [1 + (5× % change, annual)]

	Acme Paint Results		
	2010	2025	% change (total)
Intensity (kg CO_2/ $US)	0.41	0.335	-18.3%
Output (million $US) for sector	25,750	33,588	30.4%

Once these factors are calculated for your Target Year, you may proceed with your company's goal analysis as described in Section 3.2.1.

Additionally, you may use assumptions regarding factors such as your company's expected production efficiency (emissions per unit production), expected capital expansion (emissions per square foot), or expected headcount (emissions per employee), among others, to estimate GHG emissions over the course of the goal period. These estimates may be held constant over the goal period, or they may be shifted to reflect expected changes such as efficiency of machinery, number and size of buildings owned by the company, or number of people employed by the company. An assumption of constant change is valid only in the near term; medium or long term estimates not covered by the model should take other factors into account.

3.2.2 Intensity-Based Goal Analysis

While the model provides performance benchmark results based on output (revenue), several other normalizing factors may be more useful for your company. These factors include per unit of production, number of employees, or square foot of owned or operational space. There are advantages and disadvantages of using normalized goals. Advantages include:

- Ability to reflect GHG performance improvements independent of organic growth or decline;

- Ability to target Base Year calculations for structural changes are usually not required; and

- Possibility of increasing the comparability of GHG performance among companies.

Disadvantages of establishing a normalized goal include:

- No guarantee that GHG emissions to the atmosphere will be reduced—absolute emissions may rise even if intensity declines and output increases;

- Companies with diverse operations may find it difficult to define a single common business metric; and

- If a monetary variable is used for the business metric, such as dollar of revenue or sales, it must be recalculated for changes in product prices and product mix, as well as inflation, adding complexity to the tracking process.

It is possible to analyze a normalized CO_2 reduction goal using the model output, but additional data are required. If adopting a normalized CO_2 reduction goal, you should have an understanding of how that normalized metric is expected to change over the goal period. Projections of the normalizing factor can be used to estimate its relationship with your company's or the model's revenue projections. By understanding how these two factors interact over the goal period for your company, the mass of CO_2 per normalizing factor can be converted to its equivalent mass of CO_2 per dollar output.

For example, let's now assume that Acme Paint decided to implement a short term goal of reducing CO_2 emissions by 20 percent per ton of production between 2010 and 2016. As described above, the model estimates that Acme Paint's BAU change in emissions intensity (kg CO_2/ U.S. dollars) to be a reduction of 11.53 percent from 2010 to 2020; the estimated reduction in intensity from the model for the period 2010 to 2016 turns out to be just 2.8 percent. To compare this BAU metric to its proposed goal, Acme Paint needs to obtain projected production data over the entire goal period (ideal) or part of the goal period. The result from the following calculations will tell you "If Acme Paint reduces CO_2 per ton of production by 20 percent, the equivalent of X percent in metric tons CO_2 per million dollar of revenue will be achieved." This CO_2 intensity equivalent factor can then be compared to the BAU intensity factor estimated by the model. If projected data are available for only part of the goal period, the average annual percent change over the available years can be used to forecast through the end of the goal period.

Step 1

Calculate annual revenue for the goal period based on the growth rate provided by the model or company results (shown in Figure 3-16).

Figure 3-16 Calculation of Annual Revenue for Goal Period

	2010	2011	2012	2013	2014	2015	2016	% Change
Revenue (million $US)	3,200	3254.0	3308.8	3364.6	3421.3	3479.0	3523.7	10.12%

Note: values colored in red are assumed to be provided by the company

Step 2

Forecast production data for any missing years by calculating the average annual change with available data. For example, Acme Paint had a projection of production data for years 2010 through 2013. The average annual percent change was applied to years 2014 through 2016 (shown in Figure 3-17).

Figure 3-17 Forecast of Production Data for Goal Period

	2010	2011	2012	2013	2014	2015	2016	% Change
Production (ton)	2,800	2,890	2,930	2,990	3,057.6	3,126.8	3,197.5	14.2%

Step 3

Calculate the annual revenue-production factor (revenue per ton of product) by dividing revenue by production for each year in the goal period (shown in Figure 3-18), results shown in the gray row in Figure 3-18.

Figure 3-18 Calculation of Annual Revenue-Production Factor

	2010	2011	2012	2013	2014	2015	2016	% Change
Revenue (million $US)	3,200	3254.0	3308.8	3364.6	3421.3	3479.0	3523.7	10.12%
Production (ton)	2,800	2,890	2,930	2,990	3,057.6	3,126.8	3,197.5	14.2%
Revenue per ton production	1.14	1.13	1.13	1.13	1.12	1.11	1.10	-3.6%

Step 4

Calculate the CO_2 production factor (kg CO_2/ton production) for the Base Year by dividing the Base Year CO_2 emissions (4.1 million kg CO2, as cited in Figure 3-11) by the production of that year (shown as 2800 tons in Figure 3-17). The result comes to 1464 kg CO2 per ton of product in this example.

Calculate kg CO_2/ton production in the Target Year (2016) by applying the company's reduction goal (20 percent) to the Base Year value (shown in Figure 3-19). Target year (2016) kg CO_2 per ton production = (100% – 20%) × 1464 kg CO_2 = 1171 kg CO_2 per ton production.

Figure 3-19 Calculation of CO_2 Emissions per Ton of Production

	2010	2011	2012	2013	2014	2015	2016	% Change
Revenue (million $US)	3,200	3254.0	3308.8	3364.6	3421.3	3479.0	3523.7	10.12%
Production (ton)	2,800	2,890	2,930	2,990	3,057.6	3,126.8	3,197.5	14.2%
Revenue per ton production	1.14	1.13	1.13	1.13	1.12	1.11	1.10	-3.6%
BAU CO_2 Emissions (kg)	4,100,000						3,745,642	-8.6%
kg CO_2/ton production	1464						1171	-20.0%

Step 5

Calculate the equivalent intensity factor for the goal's Target and Base Years by dividing the CO_2 production factor (kg CO_2 per ton production, calculated in Step 4) by the revenue-production ratio (calculated in Step 3). The result will be in kg CO_2 per million dollars of revenue. The result is 1281 in the Base Year and 1063 in the Target Year for this example, as shown in the gray row in Figure 3-20.

The percent change in these two values (negative 17.0 percent, as seen in Figure 3-20) can be used to show equivalent revenue based goals. It could be said for this example that a 20 percent reduction in CO_2 per ton of production is equivalent to a 17 percent reduction in CO_2 per million dollars of revenue. This can then be compared to the -2.8 percent BAU change in CO_2 per million dollars of output. This type of analysis allows for different intensity metrics to be compared.

Figure 3-20 Calculation of Base Year and Target Year Intensity Values

	2010	2011	2012	2013	2014	2015	2016	% Change
Revenue (million US$)	3,200	3254.0	3308.8	3364.6	3421.3	3479.0	3523.7	10.12%
Production (ton)	2,800	2,890	2,930	2,990	3,057.6	3,126.8	3,197.5	14.2%
Revenue per ton production	1.14285	1.13	1.13	1.13	1.12	1.11	1.102017	-3.6%
BAU CO_2 Emissions (kg)	4,100,000						3,745,642	-8.6%
kg CO_2/ton production	1464						1171	-20.0%
kg CO_2/ million US$ Revenue	1281						1063	-17.0%

4.0 OTHER MANUALS AND GUIDES

4.0 OTHER MANUALS AND GUIDES

The following are links to documents intended to compliment this document:

- *Overview of the EPA Corporate GHG Goal Evaluation Model: A Model for Benchmarking GHG Reductions and Evaluating Corporate Climate Performance*, U.S. EPA, August 2014

- *The EPA Corporate GHG Goal Evaluation Model: Update Process Manual*, U.S. EPA, August 2014

- *Evaluating Corporate Climate Performance: A Model for Benchmarking GHG Reductions*, Bella Tonkonogy, Jim Sullivan, and Gregory A. Norris, American Council for an Energy Efficient Economy Summer Study Paper, Summer 2007