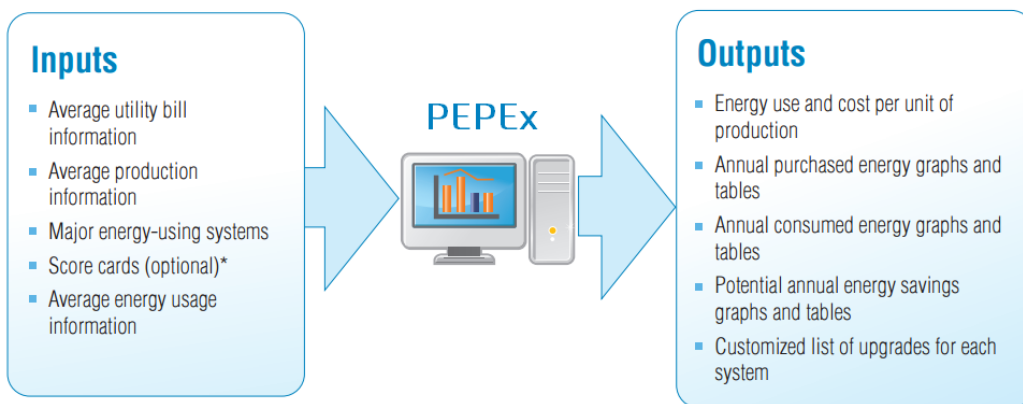


# PEPEX Tutorial

## What is PEPEX?

This software tool helps plants quickly “diagnose” their energy use and begin identifying opportunities for savings. It does this by providing an overview of the amount of energy that your plant purchases, identifying the major industrial systems that consume that energy, describing your plant’s savings potential, and pointing out specific measures you can take to realize savings. PEPEX is like a road map that directs you to specific, targeted ways to save energy and money.

Using PEPEX and information about your particular plant, you can complete a plant profile in about one hour. This tutorial explains the information you’ll need to complete the profile.



## Understanding Tool Layout

PHASTEx consist of 7 core excel worksheets. Based on its function the sheets are categorized as introduction sheets, user input sheets and result sheet. The user manually completes the input data sheets and the output graphs and tables are populated accordingly in the “Results” sheet

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The image shows two logos side-by-side. On the left is the official seal of the United States Department of Energy, featuring an eagle with wings spread, holding an olive branch and arrows, with a shield on its chest. The seal is circular with the text "DEPARTMENT OF ENERGY" and "UNITED STATES OF AMERICA". On the right is the logo for Oak Ridge National Laboratory, which features a stylized green oak leaf to the left of the text "OAK RIDGE" in a large, bold, green font, with "National Laboratory" in a smaller font below it.

The image shows the bottom portion of an Excel spreadsheet, specifically the worksheet navigation bar. The bar is divided into three main sections: "Introduction Sheets", "Input Sheets", and "Output/Result Sheet". Under "Introduction Sheets", there are tabs for "Disclaimer" and "Instruction". Under "Input Sheets", there are tabs for "Basic Info", "Energy & Production", "Energy Use System", and "Energy saving Opportunities". Under "Output/Result Sheet", there is a tab for "Results". The "Results" tab is currently selected and highlighted in red.

## Input Sheets – Color Scheme

All the fields in the input tabs follow the color scheme listed below.

Gray	User Input required
Orange	Choose from drop down list
Yellow	No inputs required – Formulas Inserted

### Mandatory and Non- Mandatory Fields

While the sheets have many input fields, only a couple are mandatory for the results to populate. These mandatory fields, in each sheet, have their headings marked in “Red” which turn “Black” when these fields are completed. The rest of the fields are provided for book keeping purposes.

### Step 1: Basic Information

The Basic Information sheet is the first step in PEPex. On this screen you will enter some basic information about your facility.

Mandatory Fields are marked in “Red” and turn “Black” when Complete

The screenshot shows an Excel spreadsheet titled "Basic Plant Information" with the Oak Ridge National Laboratory logo. The spreadsheet is organized into several sections:

- Plant Contact Information:** Rows 3-15. Fields include Corporation Name (Iron and Steel Private Company), Location (Knoxville, Tennessee), Plant Name (Knoxville Plant), Primary Product (Steel Beams), Industry Type (highlighted in orange with a red border), NAICS Code, Specify if other, Plant's Safety Protocol, and Specific Problems or Ideas of Interest related to Plant's Energy use.
- Plant's Operating Schedule:** Rows 16-24. A table with columns: Shift No., Hours of Operation/ Day, Days/Week, Weeks/ Year. Rows include shifts 1, 2, 3, Office Hours, and Others.
- Energy Management Questions:** Rows 25-27. Questions include "Does your company have a formal written Energy Management Plan?" and "Have you formed Energy Management Team at your plant?".

The spreadsheet footer shows navigation tabs: Disclaimer, Instruction, Basic Info, Energy & Production, Energy Use System, Energy saving Opportunities, Results.

The only mandated field in this sheet is the “Industry Type”. PEPex uses the industry type data to calculate default breakdown of the energy uses per system in Step 3.

The remaining questions which include basic information regarding the plant location, operating schedule and energy management are primarily for book keeping purposes and do not affect the results.

## Step 2: Energy and Production Data

The second input sheet in the PEPEX application is “Energy and Production”. You are asked to enter data from utility bills and/or sub meter recordings. Some of the important fields on this sheet are discussed below.

The screenshot shows the 'Energy and Production' input sheet with several callouts:

- Choose the unit of measurement for your energy sources:** Points to the 'Units of Measurement' section (rows 9-13).
- Leave the units blank if the fuel is not used in your facility. \*Steam is to be defined as an energy source only if user buys steam from a utility or a third-party enterprise.** Points to the 'Unit for Steam' field (row 12).
- Choose the energy metric for your output.** Points to the 'Output Energy Metric' field (row 11).
- Choose the interval for energy data input based on the granularity of data available.** Points to the 'Data Interval' dropdown (row 16).
- Input Energy, Cost and Production data for each** points to the main data table (rows 18-32).

**Units of Measurement:**

Unit for Electricity	kWh	Other Fuel	Propane	Output Energy Metric	MMBTU
Unit for Natural Gas	Therms	Unit for Other fuel	Therms		
Unit for Steam					

**Note:** Please provide either monthly or annual energy and production data. While most of the PEPEX results can be generated with just the annual data, some of them graphs/tables make use of monthly data.

**Facility's Energy and Production Data:**

Data Interval: Monthly

Year 1 ( Baseline Year):

Month	Monthly Site Electricity Consumption(kWh)	Total Monthly Electricity Cost(\$)	Monthly Natural Gas Consumption(The rms)	Total Monthly Natural Gas Cost (\$)	Monthly Steam Consumption (0)	Total Monthly Steam Consumption Cost (\$)	Monthly Other Fuel Consumption (Therms)	Total Monthly Other Fuel Cost (\$)	Monthly Production (Product 1) Unit	Mc
January	467,593	70,818	45,204	23,400			1324	1490	85681	
February	477,607	70,814	39,339	18,881			1219	1371	75777	
March	469,662	68,166	47,523	22,279			1179	1326	114956	
April	469,701	69,244	38,835	17,552			1049	1180	101291	
May	523,937	75,115	43,073	19,807			1066	1199	69347	
June	566,123	76,188	46,988	22,901			1115	1254	96315	
July	547,930	74,146	44,400	22,141			1115	1254	101789	
August	566,444	77,166	46,862	23,136			1006	1132	118622	
September	642,177	81,052	49,733	23,292			1105	1243	113167	
October	609,255	83,445	47,057	21,457			1016	1143		
November	633,266	83,626	48,707	20,335			1183	1331		
December	516,814	73,437	49,060	22,704			1269	1428		
Year 1 - Grand Total	6,490,509	\$903,217	546,781	\$257,886	0	\$0	13,646	\$15,352	876,946	

Year 2: 1

### Units of Measurement

PEPEX allows you to input your energy data for each fuel in the unit which is most familiar to you. Only when presenting results for the various energy sources together does PEPEX convert all units to a common output unit. The user further has the option to choose this output unit from a list of options from the dropdown box in cell I11.

### Facility's Energy and Production

On cell B16, the user can choose to use either annual or monthly data for energy and production inputs. The appropriate tables popup based on the selection. Most of the PEPEX results can be generated with just the annual data some of the graphs/tables need monthly data. These graphs/tables will be hidden from the results if annual data is used.

### Site to Source conversion (optional)

The user also has the option to input a source energy factor for each fuel used. The default factor of 1 is used for all cases. This results in the outputs being populated with site numbers.

The user may wish to make appropriate changes to this factor to account for losses associated with transmission, delivery, and production of each energy stream.

### Step 3: Energy Use Systems

19 4) Default energy distribution values are based on the Energy Information Administration 2010

20 5) If the user wants to use default value please use the table Energy Use Systems Used in the Plant (User

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22 Energy Use Systems Used in the Plant (User Defined):

System	Energy System in use (Please select Yes/No)	Primary Energy Source	Secondary Energy Source	% Primary Energy Source	% Secondary Energy Source	Annual Consumption(M MBTU)	Annual Cost(\$)
24 Combined Heat and Power (Cogeneration)	No					0	\$0
25 Compressed Air	Yes	Electricity				0	\$0
26 Electrochemical Processes	Yes	Electricity				0	\$0
27 Fans and Blowers	Yes	Electricity				0	\$0
28 Industrial Facilities (Lighting)	Yes	Electricity				0	\$0
29 Industrial Facilities (HVAC)	Yes	Electricity	Other Fuel		100%	1,365	\$15,352
30 Material Handling	Yes	Electricity				0	\$0
31 Material Processing	Yes	Electricity	Natural Gas		25%	13,670	\$64,471
32 Process Cooling and Refrigeration	Yes	Electricity				0	\$0
33 Process Heating	Yes	Natural Gas		75%		41,009	\$193,414
34 Pumps						0	\$0
35 Steam Generation Equipment	Yes					0	\$0
36	No						
36	N/A						

37 Energy Use Systems Used in the Plant (Default):

System	Energy System in use (Please select Yes/No)	Primary Energy Source	Secondary Energy Source	% Primary Energy Source	% Secondary Energy Source	Annual Consumption(MB)	Annual Cost(\$)
38 Combined Heat and Power (Cogeneration)	No	0	0	0%	0%		
39 Compressed Air	Yes	Electricity	0	5%			
40 Electrochemical Processes	Yes	Electricity	0	4%			
41 Fans and Blowers	Yes	Electricity	0	5%			
42 Industrial Facilities (Lighting)	Yes	Electricity	0	5%			
43 Industrial Facilities (HVAC)	Yes	Electricity	Other Fuel	9%	100%	3,358	\$96,641
44 Material Handling	Yes	Electricity	0	14%	0%	3,101	\$126,450
45 Material Processing	Yes	Electricity	Natural Gas	3%	25%	14,334	\$91,568
46 Process Cooling and Refrigeration	Yes	Electricity	0	2%	0%	443	\$18,064
47 Process Heating	Yes	Natural Gas	0	75%	0%	41,009	\$193,414
48 Pumps	0	0	0	0%	0%		
49 Steam Generation Equipment	0	0	0	0%	0%		
50							
51							

Annotations:

- 35-36: User defined percent energy used that overrides the default values
- 43-47: Default percent energy used by each system based on MECS database

In Step 3, select the energy end use systems that consume energy at your plant from the dropdown in Column C, rows 24 to 35. For each system that is used in the plant it is necessary to choose a primary energy source.

Based on this information PEPEX populates the default energy breakdown based on the industry type, defined in Step 1, in cells F39 – G50. The default percentages are based on data collected by the Manufacturing Energy Consumption Survey (MECS) administered by the U.S. Energy Information Administration in 2010.

The user may override these default values by providing an estimate of the facilities actual percentages in cells F24 – G35. For more accurate results, it is recommended that the user overrides the default values, even if it is with partial information. If you are not sure how much energy is used for each of the breakout categories, you can leave these cells blank and the default percentages will be used.

## Step 4: Energy Savings Opportunities

The fourth and final input sheet in the PEPEx application allows users to define the potential energy savings opportunities for each system. This is done by choosing between High/Medium and Low from the drop-down list in rows 17 – 28. A high level guideline to determine the existing potential can be found in the instructions above the table.

User also has the option to use a more rigorous approach to determine energy savings potential associated with a system by making use of the scorecards.

The screenshot displays the 'Energy saving Opportunities' sheet in the PEPEx application. It features a table with columns for 'Energy Use System' and 'Energy Saving Opportunity Level'. The systems listed include Combined Heat and Power (Cogeneration), Compressed Air, Electrochemical Processes, Fans and Blowers, Industrial Facilities (Lighting), Industrial Facilities (HVAC), Material Handling, Material Processing, Process Cooling and Refrigeration, Process Heating, and Pumps. The opportunity levels are N/A, Use Scorecard, Medium, and Low. A callout box provides a high-level guideline for determining the existing potential based on system assessment completion. Another callout points to a scorecard sheet that is 'unhidden' based on selection. The bottom navigation bar shows tabs for Disclaimer, Instruction, Basic Info, Energy & Production, Energy Use System, Energy saving Opportunities, Compressed Air, and Results.

Energy Use System	Energy Saving Opportunity Level
Combined Heat and Power (Cogeneration)	N/A
Compressed Air	Use Scorecard
Electrochemical Processes	Medium
Fans and Blowers	Medium
Industrial Facilities (Lighting)	Low
Industrial Facilities (HVAC)	
Material Handling	High Medium Low N/A
Material Processing	
Process Cooling and Refrigeration	
Process Heating	
Pumps	
Steam Generation Equipment	

**Instructions:**

- Use the following table to characterize the potential energy savings opportunities for the various
- If the user wants to use scorecard to characterize the potential energy saving opportunities fro

High = No system assessment completed in the last three years/ Don't know  
 Medium = System assessment completed but little or no implementation completed in the last three years  
 Low = System assessment completed and substantial implementation completed in the last three years

**Scorecard sheet "unhidden" based on selection**

**Instructions:** Please provide short decription of Energy efficient project implemented in your plant

Name of the Project	Description of the project

All systems in use at the facility defined in Step 3, require a "Energy Savings opportunity level"

### Energy use System Scorecard (Optional)

When you first arrive at the "Energy savings Opportunities" sheet, each of the scorecards will be hidden by default. To "Unhide" a scorecard, click on the arrow in the right corner of the corresponding cell and choose "Use scorecard". This will make the scorecard to open so the questions can be viewed.

Scorecards are not available for electrochemical processes, industrial facilities, fans and blowers, materials handling, or materials processing.

You are not required to answer all of the questions in Scorecard, although it is recommended to answer as many questions as possible to help PEPEx more accurately profile your facility.

After completing the scorecard questions, simple go back to the "Energy Savings Opportunities" tab to continue your data input.

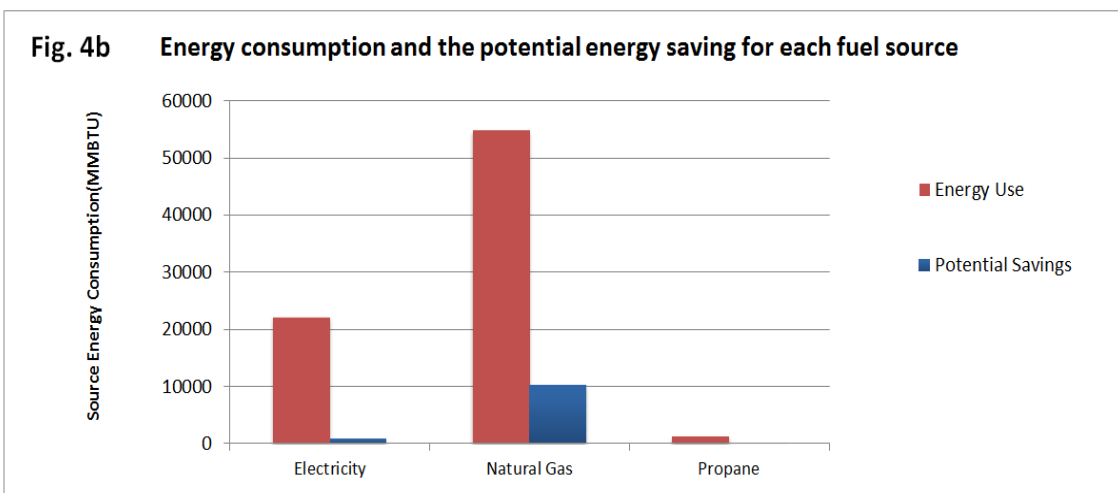
## Results

The final step in PEPEX is the results screen. The PEPEX results report has tables and graphs that show how much energy you are purchasing (and how much it costs), how you are consuming that energy, and potentially how much energy and money you could save. The graphs and tables in the results page can be broadly categorized into 5 groups listed below.

### I. Energy Usage Summary - Tables/ Figures 1 to 3.

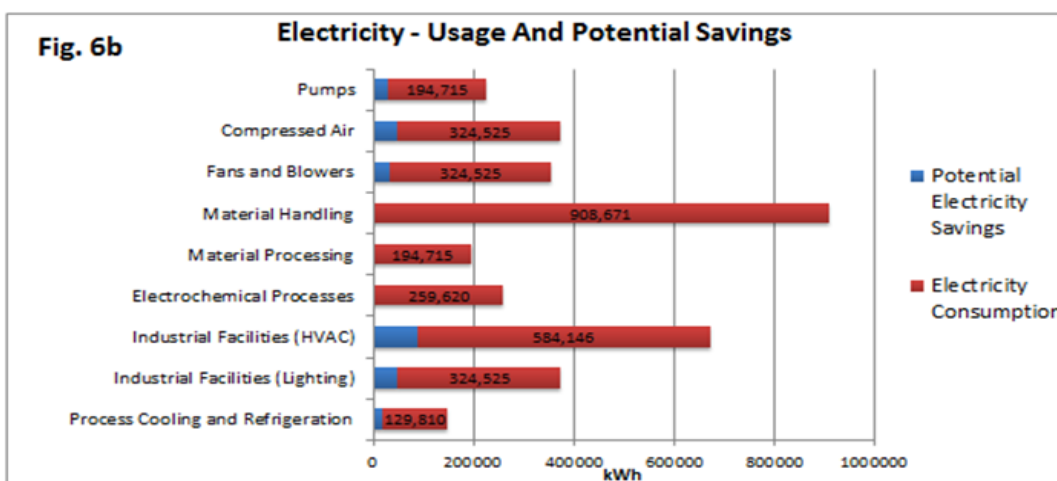
Energy Type	Site Energy Use	Source Energy Use (MMBTU)	Site Energy Cost(\$)
Electricity	6,490,509 kWh	22,147	\$903,217
Natural Gas	546,781 Therms	54,678	\$257,886
Steam			
Propane	13,646 Therms	1,365	\$15,352
<b>Grand Total</b>		<b>78,189</b>	<b>\$1,176,454</b>

### II. Total Energy Savings Potential – Tables/ Figures 4.

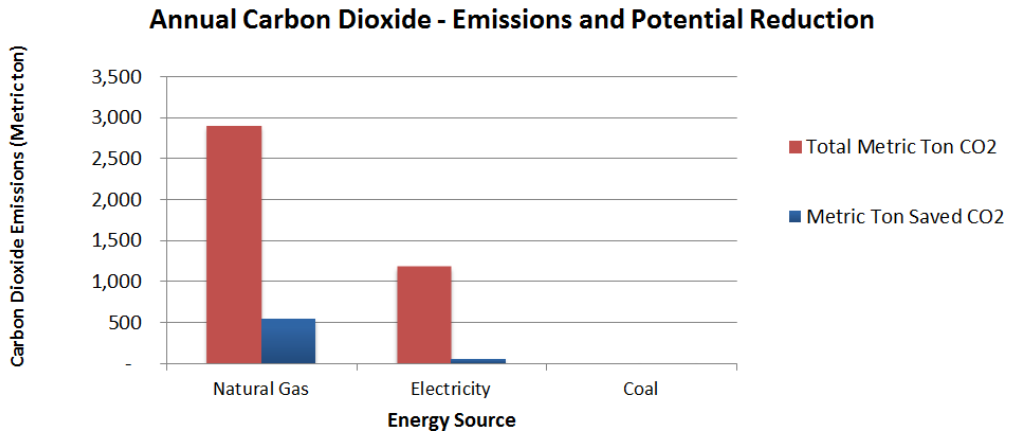


### III. Energy Savings Potential by Energy Source - Tables / Figures 5 to 9.

Figures 6b presents the breakdown of the annual electricity consumption and the potential electricity saving by system in a stacked bar chart.



#### IV. Potential Emission Reductions



#### V. Energy Efficiency Opportunities

Steam Generation Equipment	<ol style="list-style-type: none"> <li>1) Implement a Best Practices based leak management program</li> <li>2) Improve boiler efficiency by proper air/fuel control</li> <li>3) Improve boiler efficiency by proper blowdown management</li> <li>4) Improve condensate recovery</li> <li>5) Improve thermal insulation of the overall steam system</li> <li>6) Perform a detailed Steam Energy System Assessment at your site.</li> </ol>
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