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AUTOMATED REGISTER V1.0.3: User Manual for Using the Automated Register of Implemented Actions

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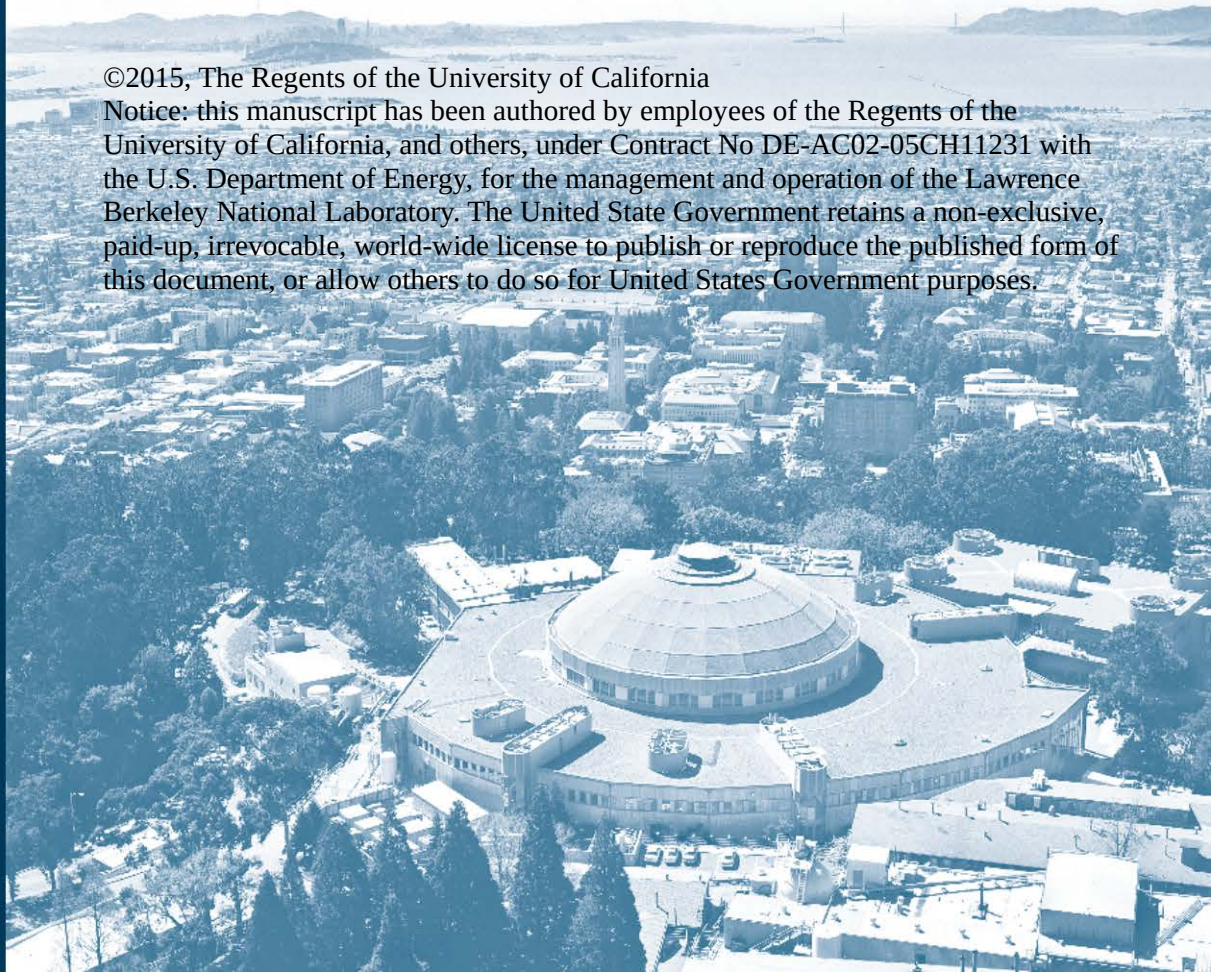

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DISCLAIMER

1 Introduction

1.1 Automated Register of Implemented Actions

The Automated Register of the Implemented Actions (The "Register") is designed to assist you in your path towards Superior Energy Performance (SEP®) certification and complements the SEP® Measurement and Verification (M&V) Protocol.

Completion of this Register **does not** guarantee certification. If you are not pursuing SEP® certification, you can still use this Register to organize and track your energy performance. This Register will summarize the key details of the implementation of each action, including action description, actual energy savings, source of energy savings determination, and responsible party. All actions affecting the energy performance improvement over the achievement period should be included, regardless of whether the action is associated with ISO 50001 "Action Plans" or "Significant Energy Uses". The Register should reflect energy savings over the reporting period; typically, this will be annual savings.

1.2 About This User Manual

This user manual is written to accompany the Quick Guide and the REGISTER GUIDE tab that exists in the Register. The purpose of this manual is to provide detailed explanation about the Register, input and output parameters, as well as guidance on how it should be completed and used.

2 The Register

2.1 Getting Started

The current version (V1.0.3) of the Register uses Microsoft Excel and you can access it by using a Macintosh or a Windows device. Figure 1 shows the landing page of the Register.

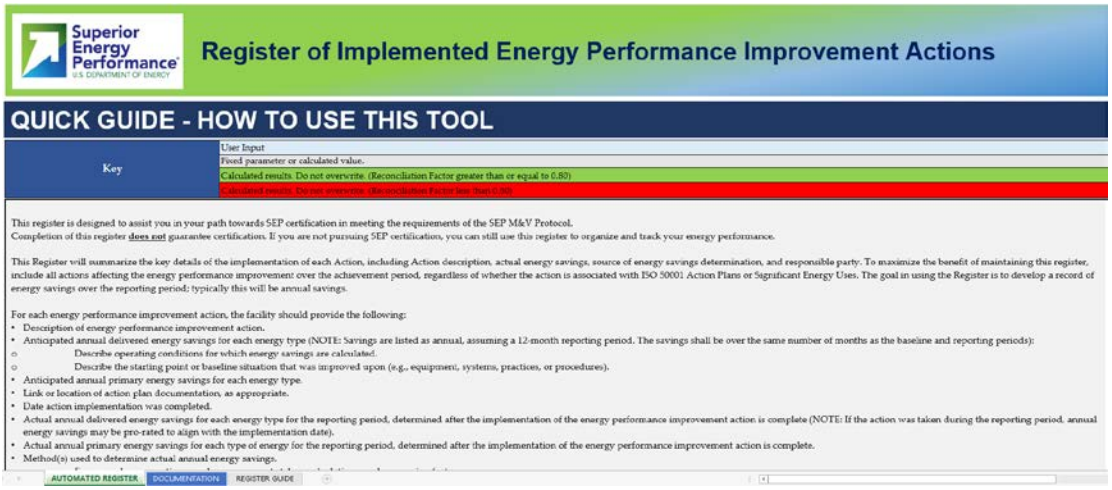


Figure 1: Landing Page of the Register

The Register is made up of three main tabs. In the following sections, we will walk you through each of the main tabs in detail.

2.2 Automated Register

2.2.1 Quick Guide

The Quick Guide section will help you understand the basics behind the color coding that is used throughout the Register. The input and output cells are color-coded so that user input, fixed parameters, and calculated results can be easily identified. Figure 2 summarizes this color-coding. Overwriting gray, green, and red cells will result in loss of the equation in that cell. Please save a copy of the original file before modifying those cells to avoid any loss of information.

Key	User Input
	Fixed parameter or calculated value
	Calculated results. Do not overwrite. (Reconciliation Factor greater than or equal to 0.80)
	Calculated results. Do not overwrite. (Reconciliation Factor less than 0.80)

Figure 2: Color Coding Key - Used to Identify Input, Output, and Fixed Parameters

The textbox after the table shown above reiterates the goal of the Register and reminds you that for each energy performance improvement action, the facility should provide the following as required by the SEP® M&V Protocol:

- Description of energy performance improvement action.
- Anticipated annual delivered energy savings for each energy type (NOTE: Savings are listed as annual, assuming a 12-month reporting period. The savings shall be over the same number of months as the baseline and reporting periods):
    - Describe operating conditions for which energy savings are

calculated.
    - Describe the starting point or baseline situation that was improved upon (e.g., equipment, systems, practices, or procedures).
- Anticipated annual primary energy savings for each energy type.
- Link or location of action plan documentation, as appropriate.
- Date action implementation was completed.
- Actual annual delivered energy savings for each energy type for the reporting period, determined after the implementation of the energy performance improvement action is complete (NOTE: If the action was taken during the reporting period, annual energy savings may be pro-rated to align with the implementation date).
- Actual annual primary energy savings for each type of energy for the reporting period, determined after the implementation of the energy performance improvement action is complete.
- Method(s) used to determine actual annual energy savings.
    - For example, assumptions used, measurements taken, calculations, and conversion factors.

2.2.2 Facility Information

In this section, you should identify the person filling out the Register, date the Register was filled, facility name, baseline period, and the reporting period. Figure 3 shows the Facility Information section.

FACILITY INFORMATION				
Name of the Person Completing This Register:				
Date This Register Was Completed (MM/DD/YYYY):				
Facility Name:				
Baseline Period (MM/DD/YYYY to MM/DD/YYYY):		to		
Reporting Period (MM/DD/YYYY to MM/DD/YYYY):		to		

Figure 3: Facility Information Input Section

2.2.3 Results

The results section condenses all the inputs into the Reconciliation Factor (RF) which is a way to measure the energy performance improvement for the purposes of demonstrating SEP® conformance and certification. Top Down energy savings by energy type should be manually entered by the user. Bottom Up energy savings by energy type will be automatically calculated by the tool based on the "Actions" documented in the Register and is further discussed in Section 2.2.4. RF is determined through a comparison of the results from the top down and bottom up energy savings. Details about the calculation of RF and implication on the verified energy performance improvement percentage is found in section 8.3 of the SEP® M&V Protocol.

RESULTS			
Primary Energy	Down (From linear regression analysis i.e. EnPI	om Up (Calculated from the inputs of this regis	Reconciliation Factor
Electricity		0.00	Reconciliation Factor (RF) is the ratio of bottom up estimated energy savings to energy savings estimated from the top down adjustment method used to calculate the SEnPI. It should be noted that ideally the RF will be 1.0 or higher
Natural Gas		0.00	
Coal		0.00	
Fuel Oil		0.00	
Propane		0.00	
Other 1		0.00	
Other 2		0.00	
Total	0.00	0.00	#DIV/0!

Figure 4: Results Section

Top-down energy savings is determined by using the Top-Down energy performance improvement percentage which is the facility-level improvement, calculated from energy consumption data at the whole facility level. You should enter the Top Down Energy Savings from a linear regression analysis (i.e. EnPI tool). Figure 5 shows the cells from the EnPI tool where the Top Down Energy Savings can be found (in this case forecasted for electricity and natural gas). To learn more about determining top down energy savings, please review section 8 of the SEP® M&V Protocol.

	2008	2009	2010	2011
Actual Electricity Source (MMBTU)	1,863,234	1,973,204	2,277,072	2,461,229
Actual Natural Gas (MMBtu)	637,268	549,437	540,410	535,287
TOTAL (MMBtu)	2,500,501	2,522,641	2,817,482	2,996,516
Adjustment Method	Model Year	Forecast	Forecast	Forecast
Modeled Electricity Source (MMBTU)	1,863,234	2,049,634	2,318,750	2,567,641
Electricity Source (MMBTU) Annual Savings	0	76,429	41,678	106,413
Modeled Natural Gas (MMBtu)	637,268	632,775	621,367	605,950
Natural Gas (MMBtu) Annual Savings	0	83,339	80,957	70,663
Total Modeled Energy Consumption (MMBtu)	2,500,501	2,682,409	2,940,117	3,173,592
SEnPI Cumulative	1.000	0.940	0.958	0.944
Cumulative Improvement (%)	0.00%	5.96%	4.17%	5.58%
Annual Improvement (%)	0.00%	5.96%	-1.79%	1.41%
Annual Savings (MMBtu/year)	0	159,768	122,635	177,076
Cumulative Savings (MMBtu)	0	159,768	282,403	459,479
Avoided CO2 Emissions (Metric Ton/year)	0	19,079	12,290	24,154

Figure 5: Planned Output of the latest EnPI Tool (v4.0)

Bottom-up energy savings is the facility-level energy savings calculated by analysis of individual actions taken at the facility. The Register calculates the Bottom Up Energy Savings, based on the actions entered. The next section provides a detailed discussion on how to enter, define, and document the Implemented Actions.

2.2.4 Actions

Figure 6 shows the input section and all the necessary input parameters that needs to be defined for each action.

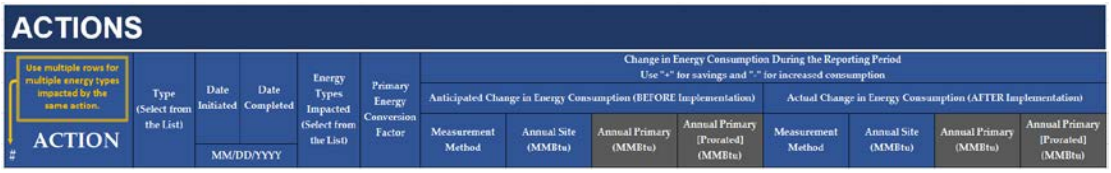


Figure 6: Actions Input Section

As shown in Figure 7, you can use drop down menus to select Action Type, Energy Type(s) Impacted, and Measurement Methods.

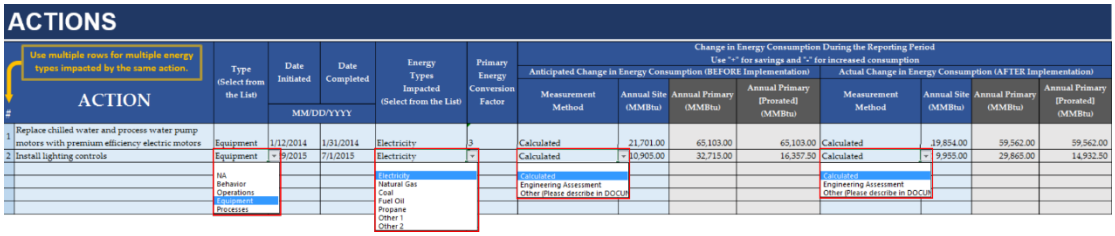


Figure 7: Defining Action Type, Energy Source(s) Impacted, and Measurement Methods

2.2.4.1 Action Title

To enter actions, start by entering the action number and a descriptive title for that action. Dedicate each row to a specific energy type impacted by that action. Use multiple rows for multiple energy sources impacted by the same action. For example, if an action affects both electricity and natural gas consumption, use one row for electricity and another row for natural gas.

2.2.4.2 Action Type

Actions should fall into one of the available four categories (Behavior, Operations, Equipment, and Processes). Select NA if the selected action does not fall into those categories and use the DOCUMENTATION tab for further explanation. The selection of the action type is for information only and does not affect calculation results.

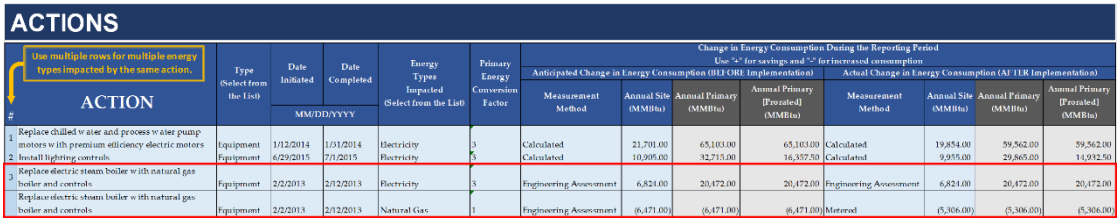
2.2.4.3 Initiation and Completion Dates

Identify the date on which the facility started implementing each action as well as the date when the action implementation was complete. Use MM/DD/YYY format when entering initiation and completion dates. The Register uses the action completion date to prorate the change in annual energy consumption. If an action is completed after the start of the reporting period, the change in annual energy consumption will be prorated to only account for the period after the action is complete. If an action is completed before the reporting period, the Register will not prorate the change in

annual energy consumption and values in columns K and L of the Register will be the same.

2.2.4.4 Energy Types Impacted

Select energy type(s) impacted from the drop down menu for each action. Dedicate each row to just one energy type and use multiple rows if multiple energy types are impacted by the same action. Figure 8, shows an example of an action that has impacted two energy types (Electricity and Natural gas).



ACTIONS

Use multiple rows for multiple energy types impacted by the same action.

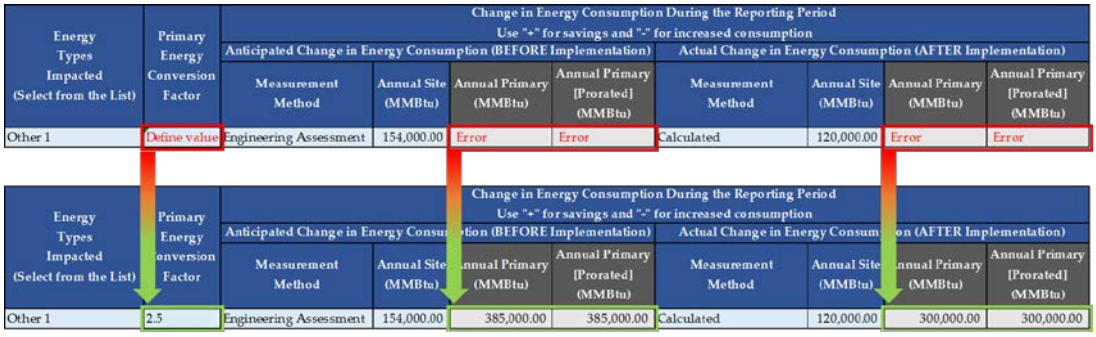
#	ACTION	Type (Select from the List)	Date Initiated (MM/DD/YYYY)	Date Completed (MM/DD/YYYY)	Energy Types Impacted (Select from the List)	Primary Energy Conversion Factor	Change in Energy Consumption During the Reporting Period. Use "+" for savings and "-" for increased consumption. Anticipated Change in Energy Consumption (BEFORE Implementation): Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)	Actual Change in Energy Consumption (AFTER Implementation): Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)
1	Replace chilled water and process water pump motors with premium efficiency electric motors	Equipment	1/12/2014	1/31/2014	Electricity	3	Calculated	21,701.00	65,103.00	65,103.00	Calculated	19,854.00	59,562.00	59,562.00
2	Install lighting controls	Equipment	6/29/2015	7/1/2015	Electricity	3	Calculated	10,905.00	32,715.00	16,357.50	Calculated	9,955.00	29,865.00	14,932.50
3	Replace electric steam boiler with natural gas boiler and controls	Equipment	2/2/2013	2/12/2013	Electricity	3	Engineering Assessment	6,824.00	20,472.00	20,472.00	Engineering Assessment	6,824.00	20,472.00	20,472.00
	Replace electric steam boiler with natural gas boiler and controls	Equipment	2/2/2013	2/12/2013	Natural Gas	1	Engineering Assessment	(6,471.00)	(6,471.00)	(6,471.00)	Metered	(5,306.00)	(5,306.00)	(5,306.00)

Figure 8: Example of an Action (Action 2) Impacting Multiple Energy Sources, Thus Multiple Rows are Used

You can use the dropdown menu to select your Energy Types Impacted. The drop down menu lists the most common energy types, which includes: Electricity, Natural Gas, Fuel Oil, Coal, and Propane. If the desired fuel types are not listed, please select "Other" and provide further detail in the documentation tab.

2.2.4.5 Primary Energy Conversion Factor

If the energy type is listed in the dropdown menu, the Register's built-in library will automatically populate the Primary Energy Conversion Factor. If you select "Other" as your impacted energy source, you will be prompted to manually enter the conversion factor. If the conversion factor is not defined, you will see "Error" messages appear in the next columns. Figure 9 shows this process.



Energy Types Impacted (Select from the List)	Primary Energy Conversion Factor	Change in Energy Consumption During the Reporting Period. Use "+" for savings and "-" for increased consumption. Anticipated Change in Energy Consumption (BEFORE Implementation): Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)	Actual Change in Energy Consumption (AFTER Implementation): Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)
Other 1	Define value	Engineering Assessment	154,000.00	Error	Error	Calculated	120,000.00	Error	Error

Energy Types Impacted (Select from the List)	Primary Energy Conversion Factor	Change in Energy Consumption During the Reporting Period. Use "+" for savings and "-" for increased consumption. Anticipated Change in Energy Consumption (BEFORE Implementation): Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)	Actual Change in Energy Consumption (AFTER Implementation): Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)
Other 1	2.5	Engineering Assessment	154,000.00	385,000.00	385,000.00	Calculated	120,000.00	300,000.00	300,000.00

Figure 9: Selecting an Energy Source not Listed in the Dropdown Menu.

2.2.4.6 Change in Energy Consumption

Next, enter anticipated and actual energy consumption during the reporting period as well as the method used to come up with those values. Measurement methods can be defined using a drop down menu. When entering change in energy consumption during the reporting period, please use "+" for savings and "-" for increased consumption. For example, there are certain actions which may save energy on one energy source but increase energy consumption on another energy source. These actions are also often referred to as “fuel switching” actions.

Once you have entered all your implemented actions in the AUTOMATED REGISTER tab, please go to the DOCUMENTATION tab and provide necessary documentation for all actions. The next section walks you through your action plan documentation.

2.3 Documentation

Use the DOCUMENTATION tab to provide further information for each action in the AUTOMATED REGISTER tab. For each action, please document the location of the action plan documentation, description of the action, and a detailed documentation on how the energy savings are calculated. The documentation should include equations, assumptions, parameters, operating condition before and after the action implementation. The documentation should be complete and detailed enough so that the calculations are repeatable. Documenting relevant calculations in the Register is optional. Please review the example actions provided in Figure 10 and use them as guidance for completing the DOCUMENTATION tab. The examples are not intended for guiding the users of the Register to choose the appropriate assumptions, measurements, or calculations. The validity and accuracy of the calculated or metered energy savings for the implemented actions as part of a SEP® certification application will be subject to the judgement of the SEP® performance verifier.

#	Action	Location of Action Plan Documentation	Name of Responsible Party/Person	Condition Before Implementation	Description of Action	Location of Technical Details [or provide details in columns J and L]	Assumptions Used to Calculate Energy Savings BEFORE Implementation	Relevant Calculations for Energy Savings BEFORE Implementation [OPTIONAL]	Assumptions Used to Calculate Energy Savings AFTER Implementation	Relevant Calculations for Energy Savings AFTER Implementation [OPTIONAL]
	Motor replacement	Facility engineer's office	John Smith	Old, inefficient pump motors need replacement	Replace chilled water and process water pump motors with premium efficiency electric motors		old motors = 85% eff; new motors = 93% eff; load factor = 0.75; 8760 hrs/yr	7,500 hp x 0.74 kW/hp x 0.75 load factor x 8,760 hrs/yr x 0.003412 MMBtu/kWh x (1/0.85 - 1/0.93) = 12,591 MMBtu/yr	old motors = 85% eff; new motors = 94% eff; load factor = 0.70; 7500 hours/yr	7,500 hp x 0.74 kW/hp x 0.70 load factor x 7,500 hrs/yr x 0.003412 MMBtu/kWh x (1/0.85 - 1/0.93) = 11,198 MMBtu/yr
	Install lighting controls	Facility engineer's office	John Smith	Lighting in warehouse and production areas operates 24/7	Install occupany sensors and energy management controls		operating hours will change from 8,760 hrs/yr to 5,000 hrs/yr	850 kW installed lighting x (8,760 - 5,000) x 0.003412 MMBtu/kWh= 10,905 MMBtu/yr	operating hours changed from 8,760 hours/year to 5,500 hours/year	850 kW installed lighting x (8,760 - 5,500) x 0.003412 = 9,955 MMBtu/yr
	Boiler replacement	Boiler room office	Jane Jones	Existing electric boiler is expensive to operate and maintain	Replace electric steam boiler with natural gas boiler and controls		Electricity savings = 100% of consumption of 400 kW existing boiler	400 kW x 5,000 hrs/yr x 0.003412 MMBtu/kWh = 6,824 MMBtu/yr	Electricity savings = 100% of consumption of 400 kW existing boiler	400 kW x 5,000 hrs/yr x 0.003412 MMBtu/kWh = 6,824 MMBtu/yr
	Boiler replacement	Boiler room office	Jane Jones	Existing electric boiler is expensive to operate and maintain	Replace electric steam boiler with natural gas boiler and controls		New natural gas usage for 85% eff. 1,100,000 Btu/hr natural gas boiler	(1,100,000 Btu/hr x 5,000 hrs/yr) / (1,000,000 Btu/MMBtu x 0.85) = 6,471 MMBtu/yr	Usage found to average 82% of full load	(1,100,000 Btu/hr x 5,000 hrs/yr x 0.82) / (1,000,000 Btu/MMBtu x 0.85) = 5,306 MMBtu/yr
	Process heating equipment enhancements	Facility engineer's office	John Smith	Process heating equipment lacks proper insulation and controls	Add controls and process controls to process heating equipment to reduce required steam		Insulation reduces steam needs by 420,000 Btu/hr; Controls reduce steam needs by 650,000 Btu/hr	(420,000 Btu/hr + 650,000 Btu/hr) x 5,000 hrs/yr / 1,000,000 Btu/MMBtu = 5,350 MMBtu/yr	Insulation reduces steam needs by 420,000 Btu/hr; Controls reduce steam needs by 590,000 Btu/hr	(420,000 Btu/hr + 590,000 Btu/hr) x 5,000 hrs/yr / 1,000,000 Btu/MMBtu = 1,550 MMBtu/yr
	Replace steam traps and repair steam leaks	Boiler room office	Jane Jones	Steam distribution system has many failed steam traps; leaking pipes and fittings	Replace failed and aging steam traps; repair leaking steam pipes; replace fittings		600 lbs/hr of steam lost; load factor = 0.82; boiler eff = 85%; latent heat = 960 Btu/lb	(600 lbs/hr x 5,000 hrs/yr x 0.82 x 960 Btu/lb) / (1,000,000 Btu/MMBtu x 0.85) = 2,778 MMBtu/yr	630 lbs/hr of steam lost; load factor = 0.82; boiler eff = 85%; latent heat = 960 Btu/lb	(630 lbs/hr x 5,000 hrs/yr x 0.82 x 960 Btu/lb) / (1,000,000 Btu/MMBtu x 0.85) = 2,778 MMBtu/yr

Figure 10: Action Plan Documentation

2.3.1 Action Title

To complete the DOCUMENTATION tab, start by entering the action number and a descriptive title for that action.

2.3.2 Location of Action Plan Documentation

You should provide a physical location or a link to where the action plan documentation can be found. If relevant, include name of the folder and document in which the action plan can be found.

2.3.3 Name of Responsible Party

Please provide the name of the responsible party in charge of the action. The responsible party should be able to provide documentation regarding the implemented action and should be able to support the values, assumptions, and measurements that are listed in the Register.

2.3.4 Condition before Implementation

In this cell, the user should describe the operating conditions (i.e. efficiencies, temperature, pressure, etc.) before implementation of the action.

2.3.5 Description of Action

The detailed description of the planned action. Try to specifically define the action type and the energy types it impacted. If any of your selections in the first tab require further explanation, please use this box to provide more information. Here you should also specify the new operating conditions in comparison with the “existing condition to be modified” to clearly indicate why the implemented action has resulted in energy savings claimed.

2.3.6 Location of Technical Details

If relevant calculation and technical details are documented outside of the Register, please provide their location here so that they can be easily accessed. Otherwise, use columns J and L to document technical details.

2.3.7 Assumptions Used to Calculate Energy Savings (BEFORE and AFTER Implementation)

This is the most important part of the Register. You should be as detailed as possible when filling out this section such that the calculation process can be repeated by the SEP® performance verifier. To document your calculations please list all the assumptions and measurements made, values used, and sources for those values (e.g. consultation with plant operators, CRC Handbook, etc.). The examples in Figure 10 are a good template to get you started.

2.3.8 Relevant Calculations for Energy Savings (BEFORE and AFTER Implementation)

Providing relevant calculations in the DOCUMENTATION Tab is optional, if relevant calculation and technical details are documented outside of the Register. Otherwise, use columns J and L to document technical details.