

Lawrence Berkeley National Laboratory

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

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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.

Superior Energy Performance us obversion or based	Register of Implemente	d Energy Performance Improvement	nt Actions
QUICK GUIDE -	HOW TO USE THIS TOO)L	
Key	User Input Fixed parameter or calculated value. Calculated results. Do not overwrite. (Reconciliation Factor gnat Calculated results in the calculated results in the calculat	ter than or equal to 0.50) Banco By	
This register is designed to assist you in y Completion of this register <u>does not</u> guar This Register will summarize the key det include all actions affecting the energy pe energy savings over the reporting period:	our path towards SEP certification in meeting the requirements of inshee certification. If you are not pursuing SEP certification, you can also of the implementation of each Action, including Action descript foremanon improvement over the activevenent period, regardless o typically this will be aroual savings.	the SEP M&V Protocol. In still use this register to organize and task your energy performance. tion, actual energy savings, source of energy savings determination, and responsible party. To if whether the action is associated with ISO 30001 Action Plans or Significant Energy Uses. The	naximize the benefit of maintaining this register, goal in using the Register is to develop a record of
For sach energy performance improveme • Description of energy performance in Anticipated annual delivered energy is • Describe operating contrib • Anticipated annual primary energy as • Link of location of action plan docume • Date action implementation wax comp • Achual annual delivered energy asving • Achual annual delivered energy asving • Achual annual delivered energy asving • Achual annual primary energy asving • Method(o) used to determine achual an	nt action, the facility should provide the following: reverement action, wrong for each energy type (NOTE: Savings are latted as annual, as one for which energy are grant and activated. Or baseline situation that was improved upon (e.g., equipment, sys intigs for each energy type. I for each energy type for the reporting particl, determined after th giv with the implementation date). For each energy for the reporting particl, determined after th gain energy average.	suming a L2-month reporting period. The savings shall be over the same number of months as items, practices, or procedures). In implementation of the energy performance improvement action is complete (NOTE: If the ac the implementation of the energy performance improvement action is complete.	the baseline and reporting periods): ion was taken during the reporting period, annual
AUTOMATED REGISTER	TATION REGISTER GUIDE	1 E (0)	

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.

	User Input
Vor	Fixed parameter or calculated value
кеу	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):
 - o 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 (RE) is the ratio of									
Natural Gas		0.00	bottom up estimated energy savings to									
Coal		0.00	energy sayings estimated from the top									
Fuel Oil		0.00	down adjustment method used to									
Propane		0.00	calculate the SEpPL It should be poted									
Other 1		0.00	that ideally the RE will be 1.0 or higher									
Other 2		0.00	that literary the Ki will be 1.0 of higher									
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.

	ACTIONS													
٢	Use multiple rows for multiple energy types impacted by the same action.	Туре	Date	Date	Energy Types	Primary Energy	Anticipated Char	nge in Energy Cons	Change in I Use "+" sumption (BEFORE	inergy Consumptio for savings and "-" Implementation)	n During the Repo for increased const Actual Chang	rting Period umption e in Energy Consu	mption (AFTER Im	plementation)
 #	ACTION	(Select from the List)	MM/DD/YY	יייייסס	(Select from the List)	Conversion Factor	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMEtu)	Annual Primary [Prorated] (MMBtu)

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.

4	ACTIONS													
4	Use multiple rows for multiple energy types impacted by the same action.	Date	Energy Prim	Primary	Change in Energy Consumption During the Reporting Period Use ** for savings and ** for increased consumption Autor of house in Energy Consumption (REFOR Inclumentation). A data of house in Energy Consumption (AETER Inclumentation).									
ļ	ACTION	(Select from the List)	Initiated	d Completed	Impacted C (Select from the List)	Energy Conversion Factor	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated]	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated]
-	Perlan shilled surjet and measure surjet numer		MM/1	D/YYYY						(MMBtu)				(MMBtu)
1	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	· 9/2015	7/1/2015	Electricity	Ψ	Calculated	✓ 10,905.00	32,715.00	16,357.50	Calculated	· 9,955.00	29,865.00	14,932.50
					The shale in the		Particulation of				Colordated			
		Behavior			Natural Gas		Engineering Assessment				Engineering Assessment			
		Operations			Coal Evel Oil		Other (Please describe in DOC	101			Other (Please describe in DO	UN.		
		Processes			Propane									
					Other 1									

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.	Туре	Date	Date Completed	Energy	Primary	Anticipated Change in	Energy Cons	Change in Use "+' umption (BEFOR	Energy Consumption ' for savings and "-" fe E Implementation)	During the Reporting Pe or increased consumption Actual Change in En	riod ergy Consum	ption (AFTER Im	plementation)
	ACTION	(Select from the List)	, Initiated		Impacted (Select from the List)	Conversion Factor	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated]	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated]
1	Replace chilled w ater and process w ater pump motors with premium efficiency electric motors Install lighting controls	Equipment Fauipment	1/12/2014	1/31/2014	Electricity Floctricity	3	Calculated Calculated	21,701.00	65,103.00 32,715.00	65,103.00 16,357.50	Calculated Calculated	19,854.00 9,955.00	59,562.00 29,865.00	59,562.00 14,932.50
з	Replace electric steam boiler with natural gas boiler and controls Replace electric steam boiler with natural gas	Fquipment	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
L	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	Primary Energy	Anticipated Change in E	nergy Consur	Change in En Use "+" fo nption (BEFORE	ergy Consumptio or savings and "-" Implementation)	on During the Reporting for increased consumpt Actual Change in E	, Period ion nergy Consum	ption (AFTER Imj	plementation)	
Impacted (Select from the List)	Conversion Factor	Measurement Method	Annual Site (MMBtu)	Annual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)	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	Primary			Change in En Use "+" fo	ergy Consumptio or savings and "-"	on During the Reporting for increased consumpt	Period ion			
Types	Energy	Anticipated Change in E	nergy Consu	tion (BEFORE	Implementation)	Actual Change in E	nergy Consum	on (AFTER Im	plementation)	
Impacted (Select from the List)	onversion Factor	Measurement Method	Annual Site (MMBtu)	nnual Primary (MMBtu)	Annual Primary [Prorated] (MMBtu)	Measurement Method	Annual Site (MMBtu)	nnual 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/MBtu = 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.