eTRM
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PROCESS

CIRCULATING BLOCK HEATER

SWPR004-01

CONTENTS

MEASURE NAME

Circulating Block Heater

STATEWIDE MEASURE ID

SWPR004-01

TECHNOLOGY SUMMARY

According to the Washington State University and Bonneville Power Administration, block heaters typically consist of a simple resistance heater affixed at one of several locations to the engine. [1] Convection circulates heated fluids in a process known as thermosiphon. These systems heat the engine block unevenly and inefficiently and may deteriorate piping materials. Replacing thermosiphon heaters with electrical pump heaters can reduce energy use.

This circulating block heater measure includes an integrated electric pump that circulates coolant throughout the engine block ensuring that there is a minimal temperature difference between the supply and return temperatures. The pump/heater (CBH) is an integral assembly.

The existing (base case) thermosiphon heater is removed as a unit and the new CBH is inserted into the exact same location. It is a single-unit installation within one housing with the mechanical element (pump) enclosed in the same "shell" as the smaller resistance heating element (relative to the thermosiphon) integral to the circulating block heater. Disconnect and reconnect points to existing hoses would not change unless improperly plumbed in the first place.

Along with the pump, a small resistance heater is used to heat the coolant within the engine block. By pumping the heated coolant, a more uniform temperature is obtained throughout the engine block. As a result of using a recirculation pump, a smaller electric resistance heater can be used to heat the coolant as there will be a more uniform temperature achieved through the mixing of fluid throughout the engine block.

MEASURE CASE DESCRIPTION

This measure is defined as a recirculation pump with a downsized electric resistance heater to a backup diesel generator. This measure will replace an existing thermosiphon pump and heater with a recirculation pump and a smaller electric resistance heater. The measure will be tiered based upon the backup generator sizes, shown in Table 1.

[1] Copyright 2012, Washington State University and Bonneville Power Administration - Energy Efficient Stationary Engine Block Heater

Table 1. Measure Case Specification

Base Case Thermosiphon Heater Size	Back-up Generator Size (kW)
Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater	37-199
	200-799
	800-1,099
Backup Generator with Circulating Block Heater replacing Properly Sized Thermosiphon Heater	37-199
	200-799
	800-1,099

BASE CASE DESCRIPTION

The base case is defined as the existing thermosiphon heater that relies on the change in density, buoyancy, to circulate the heated coolant within the generator. A thermosiphon heater relies on the change in density (impacting buoyancy) to circulate the heated coolant. This type of circulation leads to non-uniform temperature distribution – the coolant is warmer at the top of the block and colder at the bottom, thus the electric resistance heater must operate for a longer duration. This type of circulation also means that there is waste heat in sections of the block – the heater must operate to maintain a certain temperature, so the top of the block will always be hotter than necessary.

The industry standard practice (base case) assumptions are supported by a pump-driven block heater study conducted by Avista in September 2012.[2] The study indicates that historically, the thermosiphon heater technology has dominated the block heater market. The ubiquity of the thermosiphon heater is driven primarily by original equipment manufacturers because they install them at the factory.

CODE REQUIREMENTS

The circulating block heater measure is not covered by either State or Federal efficiency standards. Air quality management districts have established standards that define the requirements of emergency backup generators and the allowable air emissions. However, the allowable air emissions do not impact savings calculations, as backup generators are required to be ready at all times for use. Thus, emission standards are not specified in the eTRM for this measure. NFPA code 110 for Emergency Power Systems requires that standby generator engine blocks shall be heated as necessary to allow full power within 10 seconds.

Table 1. Applicable State and Federal Codes and Standards

Code	Applicable Code Reference	Effective Date
CA Appliance Efficiency Regulations – Title 20	None.	n/a
CA Building Energy Efficiency Standards – Title 24	None.	n/a
Federal Standards	NFPA 110	2019

[2] Avista. 2012. *Pump-Driven Block Heaters: A Study in Energy Efficiency.*

NORMALIZING UNIT

Each.

PROGRAM REQUIREMENTS

Measure Implementation Eligibility

Table 3 specifies all measure application type, delivery type, and sector combinations that are established for this measure. Measure application type is a categorization based on the circumstances and timing of the measure installation; each measure application type is distinguished by its baseline determination, cost basis, eligibility, and documentation requirements. Delivery type is the broad categorization of the delivery channel through which the market intervention strategy (financial incentives or other services) is targeted. This table also designates the broad market sector(s) that are applicable for this measure.

Table 2. Implementation Eligibility

Measure Application Type	Delivery Type	Sector
Normal Replacement	DnDeemed	Com
Normal Replacement	DnDeemed	Ind
Normal Replacement	DnDeemed	Ag
New Construction	DnDeemed	Com
New Construction	DnDeemed	Ind
New Construction	DnDeemed	Ag
Normal Replacement	UpDeemed	Com
Normal Replacement	UpDeemed	Ind
Normal Replacement	UpDeemed	Ag
New Construction	UpDeemed	Com
New Construction	UpDeemed	Ind
New Construction	UpDeemed	Ag

Eligible Products

For normal replacement installation (NR), the existing backup generator is eligible if it is not currently fitted with a circulating block heater or device utilizing similar electro-mechanical system to heat and circulate generator block pre-warming fluid.

A new generator installation (NC), for which the base design prescribes a pre-heating device (e.g., thermosiphon heater) other than a circulating block heater or similar device is eligible to upgrade from base design to efficient design including a circulating block heater.

In addition, eligibility requirements regarding the installation include:

- Installation of Circulating Block Heater should be performed by a qualified technician (i.e. generator maintenance technician or mechanical service technician).
- Installer should follow manufacturer’s installation requirements and assess and perform (if necessary) fluid hose adjustments that may be associated with the retrofit to enable the Circulating Block Heater to function at optimal energy efficiency.

- Installation shall meet all applicable regulations including but not limited to latest NFPA Code 110 for Emergency Power Systems and NEC.

Eligible Building Types and Vintages

This measure is applicable to the following non-residential building types, of any vintage:

- Assembly
- Education - Community College
- Education - Primary School
- Education - Relocatable Classroom
- Education - Secondary School
- Education - University
- Grocery
- Health/Medical - Hospital
- Health/Medical - Nursing Home
- Lodging - Guest Rooms
- Lodging - Hotel
- Lodging - Motel
- Manufacturing - Bio/Tech
- Manufacturing - Light Industrial
- Office - Large
- Office - Small
- Restaurant - Fast-Food
- Restaurant - Sit-Down
- Retail - Multistory Large
- Retail - Single-Story Large
- Retail - Small
- Storage - Conditioned
- Storage - Unconditioned
- Warehouse - Refrigerated

Eligible Climate Zones

This measure is applicable to any California climate zones.

PROGRAM EXCLUSIONS

This measure is not eligible for residential buildings.

USE CATEGORY

ProcHeat

ELECTRIC SAVINGS (KWH)

The unit energy savings (UES) of this measure are based on field monitoring data from the Bonneville Power Administration (BPA)[3]. The data was collected from numerous case studies developed through the BPA Emerging Technology program. The data collected included average daily kWh and outside air (OA) temperature for both the preexisting thermosiphon heater and the retrofitted circulating block heater. The BPA data includes 17 sources of data from different sites including waste water plants and data centers. The data was collected for different periods of time for each site, but on average, there are two months pre- and post-installation for each site used in the savings analysis.

The BPA field monitoring data was used to create multiple regression models for the different backup generator sizes specified for this measure. These regression models, along with the circulating block heater tool used for SCE's customized program can be found in the measure data spec.

The Emerging Products study ET08SCE1020 "Air Source Heat Pump for Preheating of Emergency Diesel Backup Generators"[4] investigated usage of air source heat pumps for this measure but found that the use of air source heat pumps was not cost effective.

Since initial workpaper development, no new studies with latest version of HotStart products has been conducted. The analysis should be updated should additional data become available.

A PG&E ET paper "Forced Circulation Engine Generator Block Heater Energy Performance Assessment" ET Project Number: ET13PGE1091, which found out that there are no savings with forced circulation retrofits for ambient temperatures greater than 68 ^{o}F. The current calculation methodology does not take this into account since most of the test data is below 68 ^{o}F.

Data Exploration

Temperature and Daily kWh Variation within Size Categories

Sites were assigned to one of four size categories (1-4), which loosely correspond to the actual (baseline) usage and is highly dependent on base case heater size. There is significant variation and overlap across categories in generator size, heater size, and observed kWh usage.

[3] Copyright 2012, Washington State University and Bonneville Power Administration - Energy Efficient Stationary Engine Block Heater

[4] Copyright 2009, Southern California Edison – Air Source Heat Pump for Preheating of Emergency Diesel Backup Generators

Table 3. Site-Specific Heater Sizes

Site	Site Size Category	Generator Size (kW)	Baseline Heater Size (kW)	Existing Measured kW	Avg Baseline kWh	New Rated Heater Size (kW)	New Measured kW	Avg Treatment kWh
COCCH	1	15	0.5	0.46	11.0	1	0.99	6.8
Kid Kare	1	40	1	0.89	21.1	1	0.99	13.4
TCWWTP	1	15	1	0.93	10.9	1	1.03	8.2
HCNW	1	600	6	4.3	52.0	6	5.4	46.8
COCFD	2	75	1	0.88	20.9	1	0.94	11.6
COCTV	2	100	1	0.88	20.9	1	0.92	7.2
COMKR	2	50	1	0.93	20.7	1	1	11.7
COMW	2	100	1	0.95	22.7	1	0.98	16.1
KE ECAM	2	65	1	0.93	22.3	1	0.99	12.5
TCWP	2	20	1	0.97	22.3	1	1.05	10.5
BLDG210	2	250	2.5	2.22	47.1	3	2.8	24.2
PCDC	2	900	6[5]	4.62	48.4	6	5.5	44.1
BayView	3	150	1.5	1.39	33.3	1.5	1.34	14.9
BNS GEN	3	500	4.95	1.85	44.3	2.5	1.89	26.3
KRMC[6]	3	1000	6	4.5	87.7	6	5.7	21.0
COCWWTP	3	664	6	5.9	112.8	3	2.9	40.8
NQ	4	1000	10	9.54	228.4	10	10.15	110.3

Observations were recorded at varying times of year and reveal significant variation in range of temperatures observed across sites and from baseline to treatment periods. Some sites reveal significant temperature dependence in base case usage, and other sites show no temperature dependence (often displaying remarkably consistent usage). Temperature dependence is observed at sites with larger baseline heater sizes (within a size category) and is consistent with a properly-sized heater. Temperature independence (flat baseline) is observed at sites with smaller baseline heater sizes and is consistent with an undersized heater (reflecting the heater is running consistently on full).

[5] PCDC was reported to have a baseline heater size of 12 kW; this value is anomalously large and not consistent with other observable data. Based on measured kW and usage levels, a heater size of 6 is more plausible and more consistent.

[6] Runtime logging for KRMC strongly suggest that the replacement heaters were significantly oversized for their needs. Therefore, the usage data are not representative of a site with an appropriately-sized heater. As a result, KRMC data are excluded from the analysis.

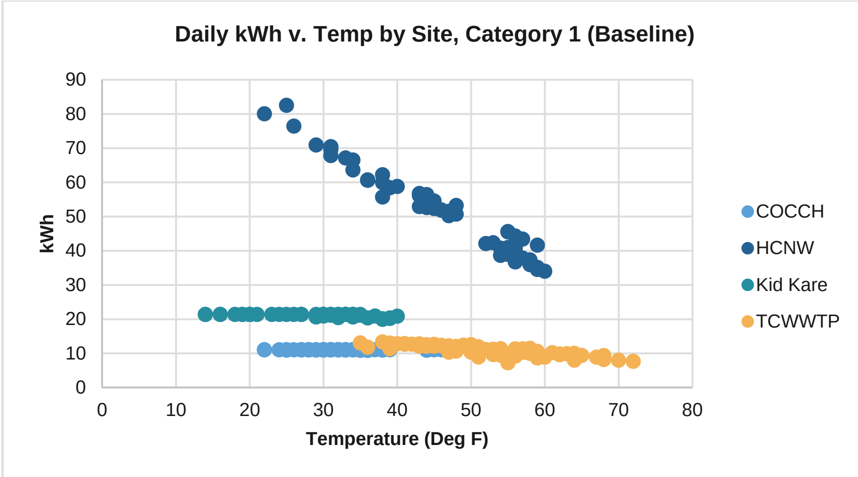

Figure 1 Category 1 Daily kWh v. Temp by Site

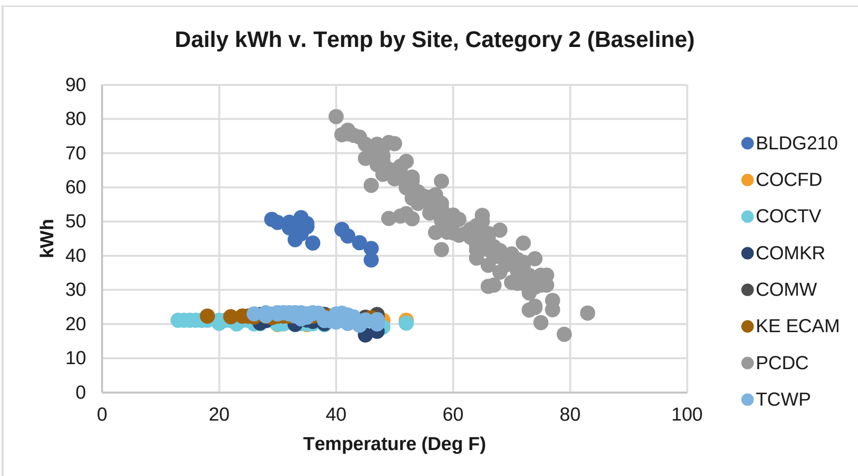

Figure 2 Category 2 Daily kWh v. Temp by Site

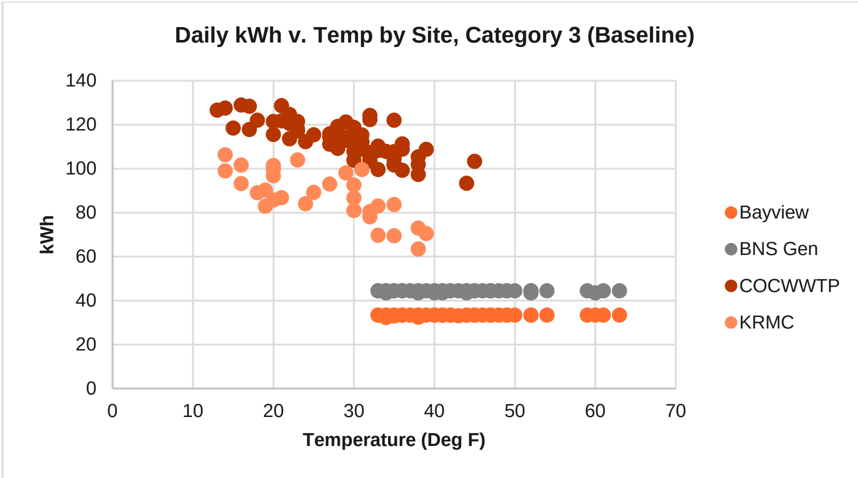

Figure 3 Category 3 Daily kWh v. Temp by Site

The sites per size category that exhibit flat baselines (indicative of undersized heaters) suggest the following designation of undersized v. proper-sized heaters:

Table 4. Baseline Heater Size Ranges (as suggested by data)

Site Size Category	Undersized Heater Range	Proper-sized Heater Range
1	1 kW and below	2 kW and above
2	1 kW and below	2 kW and above
3	5 kW and below	6 kW and above

Note: there was not enough data to determine the proper sizing range for category 4 sites. Only one category 4 site was observed, with base case heater size of 10 kW, and the data for this site suggests the heater was undersized. The heater range applies only to base case heater sizes; the new heaters all exhibit temperature dependence.

Methodology

Undersized and proper-sized sites operate differently, and thus were modeled separately. Each is described below.

Base Case Usage

Undersized Units: The base case usage of undersized sites frequently showed remarkable consistency; individual sites did not display enough variation to warrant modeling. Therefore, a single expected base case usage was attributed for each site. (At sites where an overwhelming mode value was observed, the mode was used as the expected baseline usage.) Otherwise, the mean baseline usage was used. Across sites, the usage exhibited a fairly linear relationship with heater size across site size categories.

Properly-Sized Units: The base case usage of properly-sized sites was modeled (for each size category) as a function of temperature. There were not enough sites or variation in the baseline heater size to model usage as a function of heater size as well as site size category. The regression model applied (per site size category) is represented as:

$$daily\_kWh = \beta_0 + \beta_1 * Temperature + \varepsilon$$

where:

Daily_kWh = the daily usage (kWh) as collected
Temperature = the observed average outside air temperature (°F)

Measure Case Usage

Measure undersized heaters were not an issue as in the baseline periods, therefore treatment usage was modeled as a function of temperature and new heater size for all sites. The regression model (per site size category) is:

$$daily\_kWh = \beta_0 + \beta_1 * New\_Heater\_Size + \beta_2 * New\_Heater\_Size * Temperature + \varepsilon$$

where:

Daily_kWh = the daily usage (kWh) as collected
New_Heater_Size = the recorded new heater size (kW)
Temperature = the observed average outside air temperature (°F)

Note that interactive effects are not applied in the calculation of the energy savings as the equipment will either be installed outside or in a room. Due to the equipment being installed either outside or in an unconditioned room, the energy savings will not vary by building type.

Savings Estimation Results

Equation 1. Estimated Baseline Usage for Undersized Sites

$$daily\_kWh = 20.2 * Baseline\_Heater\_Size$$

Estimated Baseline Usage for Properly-Sized Sites (regression results)

Site Size Category	Regression Coefficients	
	Intercept	Temp.
1	105.91	-1.178
2	88.92	-0.701
3	139.85	-0.932

Estimated Treatment Usage (regression results)

Site Size Category	Regression Coefficients		
	Intercept	Heater Size	Heater Size * Temp.
1	3.70	13.135	-0.136
2	5.86	13.195	-0.133
3	10.26	16.688	-0.179
4	*229.52*	*0*	*-2.577*

As only one site of size category 4 was observed, estimated treatment was not a function of new heater size (regression model was a function of temperature only).

Savings Estimates

Using the estimation results to estimate savings from a CBH installation requires the following items:

- Site size category
- Baseline heater size
- New heater size
- Climate zone (to determine average temperature)

Note that the range of observed temperatures are generally lower than those observed in SCE territory climate zones, particularly for baseline regression. These savings estimates thus are projecting heater performance for temperatures generally outside the observed range. Savings estimation is determined by the following steps:

- Determine whether baseline heater is *undersized* or *properly-sized* for the site size category[7].
  - For *undersized* baseline heaters, average daily kWh is determined using Equation (1).
  - For *properly-sized* heaters, averaged daily kWh is determined for climate zone average temperature, using regression results in **Error! Reference source not found.**.
- Estimate treatment usage based on new heater size and climate zone average temperature, using regression results in **Error! Reference source not found.**.
- The difference in daily kWh can be projected into annual saving using preferred assumed days of operation.

Sample Calculations

<u>Sample 1</u>: Climate Zone 6, site size category 1, baseline heater size 1 kW, new heater size 1 kW, annual operation 334 days / year.

- Designation: Undersized
- Annual Average Temperature: 61.5°F
- Baseline Daily kWh: 20.2 * [Baseline Heater Size] = 20.2 kWh / day.
- Treatment Daily kWh: 3.70 + 13.135 * [New Heater Size] – 0.136 * [New Heater Size] * [61.5°F] = 8.4 kWh / day
- Annual Savings: (20.2 kWh/day – 8.4 kWh/day) * 334 days/year = **3,928 kWh/year.**

[7] Until more data are collected for additional category 4 sites, savings for category 4 sites can only be estimated using the undersized heater methodology.

Sample Calculation - Climate Zone 6

	Baseline Heater Size	New Heater Size	Baseline Heater Designation	Baseline Daily Usage (kWh)	Treatment Daily Usage (kWh)	Annual Savings (kWh)
1	1	1	Undersized	20.2	8.4	3,928
	3	3	Proper-Sized	33.4	17.9	5,181
2	1	1	Undersized	20.2	10.9	3,124
	6	6	Proper-Sized	45.8	35.8	3,349
3	2	2	Undersized	40.4	21.6	6,293
	6	6	Proper-Sized	82.5	44.2	12,817
4	10	10	Undersized	202.0	71.0	43,753

Sample 2: Climate Zone 8, site size category 3, baseline heater size 6 kW, new heater size 6 kW, annual operation 334 days per year.

- Designation: Proper-sized
- Annual Average Temperature: 63.4°F
- Base Case Daily Usage (kWh): 139.85 – 0.932 * [63.4°F] = 80.8 kWh / day.
- Measure Case Daily Usage (kWh): 10.26 + 16.688 * [New Heater Size] – 0.179 * [New Heater Size] * [63.4°F] = 42.1 kWh / day
- Annual UES (kWh): (80.8 kWh/day – 42.1 kWh/day) * 334 days/year = 12,908 kWh/year.

Sample Calculation - Climate Zone 8

	Baseline Heater Size	New Heater Size	Baseline Heater Designation	Baseline Daily Usage (kWh)	Treatment Daily Usage (kWh)	Annual Savings (kWh)
1	1	1	Undersized	20.2	8.2	4,014
	3	3	Proper-Sized	31.2	17.1	4,693
2	1	1	Undersized	20.2	10.6	3,208
	6	6	Proper-Sized	44.5	34.3	3,412
3	2	2	Undersized	40.4	20.9	6,521
	6	6	Proper-Sized	80.8	42.1	12,908
4	10	10	Undersized	202.0	66.1	45,389

Sensitivity Analysis

A sensitivity analysis was conducted to examine the validity of using the annual average temperature instead of daily average temperature to estimate the UES for this measure.[8] For climate zone 6, the

[8] Analysis can be found in "SWPR004-01 Sensitivity Analysis.xslx"

savings using daily average temperature were on average, within 0.08% of the savings results using the yearly average temperature. For climate zone 15, the savings estimated with daily average temperature were on average, within 0.03% of the savings estimated using the yearly average temperature. Based on the results of the sensitivity analysis, the savings using the yearly average temperature seems to be an appropriate assumption for this work paper.

Sensitivity Analysis Results – Climate Zone 6

Measure	Sensitivity Analysis Savings (kWh)	Original Savings (kWh)	% Difference in Savings
37-199 kW Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater	3,926	3,928	0.04%
200-799 kW Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater.	3,122	3,124	0.05%
800-1099 kW Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater	6,289	6,293	0.07%

Sensitivity Analysis – Climate Zone 15

Measure	Sensitivity Analysis Savings (kWh)	Original Savings (kWh)	% Difference in Savings
37-199 kW Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater	4,553	4,552	-0.01%
200-799 kW Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater	3,735	3,734	-0.02%
800-1099 kW Backup Generator with Circulating Block Heater replacing Undersized Thermosiphon Heater	7,937	7,936	-0.02%

PEAK ELECTRIC DEMAND REDUCTION (KW)

The peak demand reduction for this measure was calculated by dividing the estimated annual unit energy savings by the total operating hours. Because circulating block heaters are typically installed on backup generators that are required to kick on when needed (when the power goes out), the energy savings calculations assume that the circulating block heaters are enabled continuously for 334 days out of the year (accounting for maintenance). A sample calculation is provided below.

<u>Sample 3</u>: Climate Zone 6, site size category 1, baseline heater size 1 kW, new heater size 1 kW, annual operation 334 days / per year.

- Designation: Undersized
- Annual Average Temperature: 61.5°F
- Base Case Daily Usage (kWh): 20.2 * [Baseline Heater Size] = 20.2 kWh / day.
- Measure Case Daily Usage (kWh): 3.70 + 13.135 * [New Heater Size] – 0.136 * [New Heater Size] * [61.5°F] = 8.4 kWh / day
- Annual UES: (20.2 kWh/day – 8.4 kWh/day) * 334 days/year = 3,928 kWh/year.
- Annual peak demand reduction (kW): 3,928 kWh/year / (334 days/year * 24 hours/day) = 0.4900 kW

GAS SAVINGS (THERMS)

Not applicable.

LIFE CYCLE

Effective useful life (EUL) is an estimate of the median number of years that a measure installed through a program is still in place and operable. Remaining useful life (RUL) is an estimate of the median number of years that a technology or piece of equipment replaced or altered by an energy efficiency program would have remained in service and operational had the program intervention not caused the replacement or alteration.

The EUL and RUL specified for a circulating block heater is presented in Table 6. The estimated lifetime for this measure is based upon a water loop pump and is supported by several retention studies conducted by California investor-owned utilities. Note that RUL is only applicable for Add-on Equipment (AOE) measures, thus not applicable.

Table 5. Effective Useful Life and Remaining Useful Life

Parameter	Value	Source
EUL (yrs)	15.0	SDGE 1994 & 1995 Commercial Energy Efficiency Incentives - Ninth Year retention Evaluation SCE's Commercial/Industrial/Agricultural Energy Efficiency Incentives Program, 6th Year retention. SDGE 1996 & 1997 Agricultural Energy Efficiency Incentives 6th Year Retention Evaluation READi v2.5.1, EUL ID: Motors-pump
RUL (yrs)	n/a	n/a

BASE CASE MATERIAL COST ($/UNIT)

See Measure Case Material Cost.

MEASURE CASE MATERIAL COST ($/UNIT)

The base and measure equipment costs were obtained in 2017 from HotStart®, a major equipment manufacturer of engine heaters that supplies components to generator companies like Quinn, CAT, and Cummins. The methodology to calculate the base case and measure case costs from the data provided by HotStart is summarized below:

- HotStart representative provided a list of recommended thermosiphon and forced circulation heater models corresponding to engine displacement in liters ranging from 2.4 L to 76.3 L.
- These engine displacements in liters are converted to generator capacities in kW using manufacturer websites (Generac and Kohler). The resultant range of generator capacities after the conversion is 30 kW to 2,500 kW. These conversions were reviewed with the HotStart representative.

- The engine heaters are designed for different voltages, phases, frequencies and features based on the application. Some variations in features include with-thermostats, adjustable thermostats, and without thermostats[9].
- Pricing information for a variety thermosiphon models was provided by HotStart. However, for the forced circulation heaters, cost data was limited to a few recommended models:
  Backup Generator 40 to 600 kW – Single phase and 120 Volts
  Backup Generator 750 to 2000 kW – Single phase and 208 Volts
  Backup Generator 2500 kW – Three phase and 208 Volts
- To provide an accurate cost analysis, the above forced circulation heater models were compared with the thermosiphon counterparts with the same features.
- The thermosiphon heaters for generators greater than 350 kW were assumed to be the with-power cord and without-thermostat models.
- The average price for the base and measure equipment was calculated for the four size categories of the generator capacities identified for measure savings.
- HotStart representative was not aware of the concept of properly sized and undersized thermosiphon heaters as defined in the calculation methodology. It is assumed that the base case cost is the same for properly sized and undersized. There is no under sizing of the forced circulating heater. Hence, measure cost will always be properly sized circulating block heater.

BASE CASE LABOR COST ($/UNIT)

See Measure Case Labor Cost.

MEASURE CASE LABOR COST ($/UNIT)

The labor installation cost was derived from RSMeans Data Year 2017 Quarter 4 for installing a 2 HP size 00 motor, Magnetic FVNR with enclosures and heaters (Line Number 262419400080). Based on discussions with HotStart®, the installation of the thermosiphon and circulating block heaters typically requires a couple of hours and there is no variation in the installation times across different sized units.

NET-TO-GROSS (NTG)

The net-to-gross (NTG) ratio represents the portion of gross impacts that are determined to be directly attributed to a specific program intervention. The relevant NTG value for the circulating block heater is specified in Table 6. This NTG value is documented in the 2011 DEER Update Study conducted by Itron, Inc. This sector average NTGs (“default NTGs”) is applicable to all energy efficiency measures that have been offered through residential or nonresidential sector energy efficiency programs for two years or less and for which impact evaluation results are not available.

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[9] Detailed listing of all the different specifications is provided in “SWPR004-01 Cost Analysis.”

Table 6. Net-to-Gross Ratios

Parameter	Value	Source
NTG – Commercial	0.60	Itron, Inc. 2011. *DEER Database 2011 Update Documentation.* Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.
NTG – Industrial	0.60	Itron, Inc. 2011. *DEER Database 2011 Update Documentation.* Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.
NTG – Agriculture	0.60	Itron, Inc. 2011. *DEER Database 2011 Update Documentation.* Prepared for the California Public Utilities Commission. Page 15-4 Table 15-3.

GROSS SAVINGS INSTALLATION ADJUSTMENT (GSIA)

The gross savings installation adjustment (GSIA) rate represents the ratio of the number of verified installations of the measure to the number of claimed installations reported by the utility. This factor varies by end use, sector, technology, application, and delivery method. The GSIA rate specified for a circulating block heater is included in Table 8. This GSIA rate is the current "default" rate specified for measures for which an alternative GSIA has not been estimated and approved.

Table 7. Gross Savings Installation Adjustment

Parameter	Circulating Block Heater	Source
GSIA	1.0	California Public Utilities Commission (CPUC), Energy Division. 2013. *Energy Efficiency Policy Manual Version 5*. Page 31.

NON-ENERGY IMPACTS

Non-energy benefits for this measure have not been quantified.

DEER DIFFERENCES ANALYSIS

This section provides a summary of DEER-based inputs and methods, and the rationale for inputs and methods that are not DEER-based. Currently, DEER does not address this type of measure. Also, DEER interactive effects are not incorporated, as most backup generators are kept in a non-conditioned or exterior space.

Table 8. DEER Difference Summary

DEER Item	Comment / Used for Workpaper
Modified DEER methodology	No
Scaled DEER measure	No
DEER Base Case	No
DEER Measure Case	No
DEER Building Types	No
DEER Operating Hours	No
DEER eQUEST Prototypes	No
DEER Version	n/a
Reason for Deviation from DEER	n/a
DEER Measure IDs Used	n/a
NTG	The NTG of 0.60 is associated with NTG ID: *Com-Default>2yrs, Ind-Default>2yrs, and Ag-Default>2yrs*
GSIA	The GSIA of 1.0 is associated with GSIA ID: *Def-GSIA*
EUL/RUL	The value of 15 years is associated with EUL ID: *Motors-pump*.

REVISION HISTORY

Table 9. Measure Characterization Revision History

Revision Number	Date	Primary Author, Title, Organization	Revision Summary and Rationale for Revision Effective Date and Approved By
01	06/30/2018	Jennifer Holmes Cal TF Staff	Draft of consolidated text for this statewide measure is based upon: SCE17HC055 Revision 0 (November 16, 2017) SCE13HC055 Revision 0 (September 19, 2014) Consensus reached among Cal TF members.
	3/28/2019	Jesse Manao	Text and cost data updated using the latest workpaper: SCE17HC055 Revision 2 (May 9, 2018)