



JCP&L Energy Management Program

Triennium 2
Program and Technical Guidelines
Version 1.3

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Disclaimer

The information provided in these guidelines do not guarantee realization of energy savings. Actual energy savings depend on behavioral factors and other uncontrollable variables, such as changes in operating conditions, occupant behavior, variations in equipment performance and installation, unforeseen circumstances, among other factors. As a result, TRC shall in no event have any liability should actual energy savings vary from projections developed by trade allies and reviewed by TRC.

TRC does not warrant or guarantee the performance, reliability, or suitability of any particular technology, equipment, or system. These guidelines do not constitute an endorsement, recommendation, or promotion of any specific product, manufacturer, vendor, contractor, or service provider. By using these guidelines, TRC shall not be held liable for any discrepancies between the estimated and actual energy savings or for any decisions made based on this information. We encourage customers and their representatives to perform their own due diligence and consult with qualified professionals to ensure that selected technologies or measures meet their specific needs and requirements.

Trade allies may estimate material and labor costs using RS Means cost manuals, our experience at similar facilities, technical resource manuals, and estimates provided by the customer's contractor, when available. Cost estimates often include material and labor pricing associated with one-for-one equipment replacements. Cost estimates may not include demolition, removal, recycling, or disposal of hazardous waste. The actual implementation costs for energy savings projects could be significantly higher based on the specific conditions, labor requirements, and location of site(s). TRC strongly recommends that customers work with their design engineers or contractors to develop actual project costs for your specific scope of work for the installation of high-efficiency equipment. TRC encourages customers to obtain multiple estimates when considering measure installations. Actual installation costs can vary widely based on selected products and installers. TRC does not guarantee cost estimates and shall in no event be held liable should actual installed costs vary from these material and labor estimates.

Incentive values provided in these guidelines are based on current efficiency program offerings. Incentive levels are not guaranteed. Please refer to the relevant efficiency program's terms and conditions. In addition, please review all program incentives and eligibility requirements prior to selecting and installing any energy conservation measures.

The customer and their respective contractor(s) are responsible to implement energy conservation measures in complete conformance with all applicable local, state, and federal requirements and codes.

Because these are new program offerings, there may be periodic updates and additions to technical guidelines. Prior to beginning a project, please download the latest version of these guidelines or request an update from the Program Manager.

Participants should refer to the most recent version of the Program's Incentive Guide for official incentive rates, eligibility criteria, and terms and conditions. Actual incentive eligibility and final incentive values are subject to review and approval by the Program. All incentives are subject to change and are not guaranteed until confirmed through the formal application and review process.



How to Best Use These Guidelines

This document provides comprehensive technical guidelines to support the successful implementation of energy efficiency measures throughout a project's lifecycle. It is designed for Energy Management program allies, customers, and other stakeholders. Each section outlines key processes and requirements to facilitate a structured, consistent approach to project execution.

All sections are hyperlinked in the [Table of Contents](#), allowing users to quickly access relevant information. Readers should refer to the sections most applicable to their roles. To maximize the effectiveness, users are encouraged to review applicable sections early in the project lifecycle to understand program expectations and minimize rework.

These guidelines are organized into the following sections:

- **Introduction** provides a brief overview of the program including high-level eligibility, available sub programs, and program ally roles and responsibilities.
- **General Requirements** cover measure eligibility, site inspection and M&V requirements, and subprogram specific procedures and requirements.
These general requirements are applicable to all Energy Management subprograms.
- **Retrocommissioning (RCx)** contains RCx program overview and eligibility, project phases, incentive structure, program processes, and required documentation.
This section is only applicable to customers participating in the RCx subprogram.
- **Retrocommissioning – Lite (RCx-Lite)** contains RCx-Lite program overview and eligibility, project phases, incentive structure, program processes, and required documentation.
This section is only applicable to customers participating in the RCx-Lite subprogram.
- **Strategic Energy Management (SEM)** contains SEM program overview and eligibility, project phases, incentive structure, program processes, and required documentation.
This section is only applicable to customers participating in the SEM subprogram.
- **Pre-Study Screening Guidelines** contains best practices to screen projects prior to submitting an application.
This section is for informational purposes only.
- **Calculation Guidelines** contains requirements for establishing baseline, calculating decarbonization savings, model/study calibration, and requirements for specific measures.
This section is required for all subprograms, where customized calculations are developed.
- **Measurement & Verification (M&V) Guidelines** establishes protocols for tracking, measuring and validating realized energy savings following measure installation.
This section is required for all subprograms where M&V is required.



Program and Technical Guidelines Updates

Version	Date	Updates
1.0	07/01/2025	<ul style="list-style-type: none">Initial Release
1.1	10/01/2025	<ul style="list-style-type: none">Ineligible measures list updatedUpdated invoice requirements to provide requirements for measure installation and implementation costs and program ally services costsUpdated RCx Program Requirements<ul style="list-style-type: none">Removed 300 kW minimum peak demand requirement for RCx (any project with savings greater than 200,000 kWh in savings can participate).Removed \$70,000 program ally incentive cap; updated services to be capped at the lesser of energy savings potential/realized savings or 70% of service costs.Added MBCx Pathway for projects interested in using specialized software to support site investigation and M&V efforts.Updated RCx Plan and Reporting requirements regarding M&V and savings calculation methods.Updated RCx-Lite Program Requirements<ul style="list-style-type: none">Program Ally requirements for RCx-Lite changes from Closed to an Open Network, allowing any approved Program Ally and any customer to participate.Removed minimum peak demand for RCx-Lite (any size building can participate)Added Custom Pathway for projects not pursuing study and RCx-Lite Services incentives.Removed \$14,000 program ally incentive cap; updated services to be capped at the lesser of energy savings potential/realized savings or 70% of service costsAdded Special Requirements for Compressed Air Optimization and Leak Repair.Updated SEM Program Requirements<ul style="list-style-type: none">Reduced minimum peak demand for SEM from 500 to 300 kWRemoved \$70,000 program ally incentive cap; updated services to be capped at the lesser of energy savings potential/realized savings or 70% of service costsAdded technology specific requirements to Section 7 Calculation Guidelines



Version	Date	Updates
1.2	11/11/2025	<ul style="list-style-type: none">• Updated RCx Program<ul style="list-style-type: none">• Updated Program Ally incentive to be capped at the lesser of energy savings potential/realized savings or 100% of the service costs.• Updated RCx-Lite Program<ul style="list-style-type: none">• Updated Program Ally incentive to be capped at the lesser of energy savings potential/realized savings or 100% of the service costs.



1 Introduction

The JCP&L Energy Management Program is a portfolio of energy management offerings designed to help commercial, industrial, institutional, and governmental customers reduce energy use, lower operating costs, and improve building performance. The Energy Management program includes the following offerings available to eligible customers and their Program Allies:

- Retro-Commissioning (RCx)
- RCx-Lite
- Strategic Energy Management (SEM)
- Virtual Commissioning (VCx)
- Virtual Strategic Energy Management (vSEM)

The guide outlines key participation requirements, incentive structures, and application processes for each offering under Triennium (January 1, 2025 – June 30, 2027). For information about other C&I efficiency opportunities available through Energy Management, please visit [JCPL Bizsolutions](#).

1.1 High-Level Eligibility Summary

The following figure provides high-level eligibility based on utility bill peak demand and project size. Exceptions may be permitted with prior approval from the Program Manager and/or JCP&L.

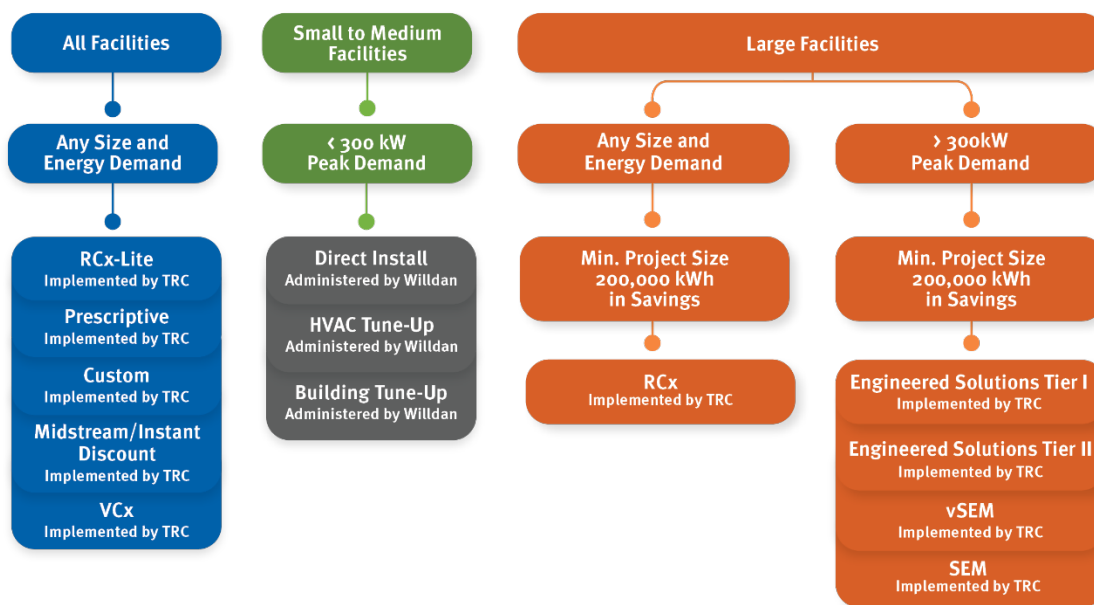


Figure 1. High-Level Energy Management Eligibility



1.2 Available Subprograms

The following table provides a summary of available subprograms.

Subprogram	Description
Retro-commissioning (RCx)	<p>The RCx Program helps C&I customers improve energy efficiency by optimizing their building management systems (BMS) and controls. Through a detailed investigation, the program identifies opportunities to restore mechanical, electrical, and thermal systems to their original or enhanced performance, reducing energy waste and lowering costs.</p> <p>RCx Program Allies will guide customers through RCx activities, including site investigation, implementation, and measurement & verification (M&V).</p>
Retro-commissioning – Lite (RCx-Lite)	<p>The RCx-Lite Program allows small and medium businesses to proceed through RCx at a faster pace. Under the Study Pathway, Program Allies will identify RCx-Lite measures using TRC’s RCx-Lite Assessment Tool or provide their own study targeted systems such as air compressors, refrigeration, chillers, ventilation, HVAC controls, lighting, and motors. Under the Custom Pathway, Program Allies can submit calculations for system and controls optimization measures. No study is required.</p>
Strategic Energy Management (SEM)	<p>The SEM program supports large C&I facilities in reducing energy use through continuous improvement of operations and long-term energy management practices. SEM emphasizes a holistic approach, combining operational changes, behavioral strategies, and performance monitoring to achieve sustained savings.</p> <p>Participants receive expert support from a qualified SEM Program Ally to develop and implement a customized SEM Action Plan. Program services may include system monitoring, benchmarking, staff training, and project planning. Incentives are provided based on verified energy savings.</p>
Virtual Commissioning (VCx)	<p>The VCx program helps C&I customers optimize existing systems through remote investigation and analysis. By leveraging smart meter utility data, the program identifies operational improvements that can lead to measurable energy savings without requiring major capital upgrades or on-site visits.</p> <p>The program emphasizes low- to no-cost measures, quick turnaround, and minimal disruption to facility operations. Customers benefit from expert support in identifying, prioritizing, and implementing no cost measures.</p>
Virtual Strategic Energy Management (vSEM)	<p>The vSEM program is designed for customers seeking to improve energy performance through ongoing, data-driven operations and behavioral strategies, delivered entirely virtually over a 12-month period. vSEM helps customers build internal energy management capacity while optimizing major systems over time.</p> <p>Participants receive remote coaching to support performance tracking, benchmarking, staff engagement, and continuous improvement. Energy savings are achieved through improved system operations, informed decision-making, and strategic planning rather than capital upgrades.</p>

Table 1. Description of Subprograms



1.3 Program Ally Roles and Responsibilities

1.3.1 Program Ally Network

The RCx and SEM subprograms of the Energy Management Program are delivered in collaboration with a network of qualified Program Allies. These trusted partners work directly with JCP&L's commercial and industrial customers to identify and implement energy-saving opportunities. Program Allies support a wide range of efforts across the Energy Management portfolio, including system optimization, equipment tune-ups, strategic energy management, virtual assessments, and capital upgrades, helping participants improve performance, reduce energy waste, and lower operating costs.

Participation in the program requires the use of an approved Program Ally, who will guide customers through project completion while meeting program and technical requirements and standards.

The list of approved program allies is maintained [Program Ally Search - JCPL Bizsolutions](#).

1.3.2 How to Apply – RCx and SEM Only

Prospective Program Allies must submit an Energy Management Program Ally Application and sign a Program Ally Agreement, both of which can be downloaded from [Become a Program Ally – JCPL Bizsolutions](#).

Along with a completed Energy Management Program Ally Application, the following documentation must be attached:

- Completed W-9 Form with a written signature & dated within 2 years.
- New Jersey Division of Revenue Registration (Copy of Business Registration Certificate from the NJ Division of Revenue website for your company https://www1.state.nj.us/TYTR_BRC/jsp/BRCLLoginJsp.jsp)
- Current Alternate Name form (dba) filed with the state of NJ, if applicable.
- Certificate of insurance from your insurer.
- At least two (2) examples each of a RCx and SEM projects (as applicable to your application) completed in the past three (3) years.

Program Allies are responsible for making sure that all employees, representatives, and subcontractors understand and follow program rules and requirements. They must also maintain safe working conditions and comply with all applicable safety standards. Any actions that pose a risk to human health or safety are considered a major violation of program rules and may result in probation, suspension, or removal from the program in accordance with the JCP&L's Code of Conduct.

1.3.3 JCP&L Program Ally Portal

Approved Program Allies receive credentials to access the JCP&L Program Ally Portal. The portal provides real-time visibility into project and application status, incentive totals, and energy savings.

Visit [JCP&L Program Ally & Distributor Application Portal Login](#) to manage your projects, your dashboard access Program Ally resources, or submit an online application.



2 General Requirements

2.1 Ineligible Measures

When applicable, all proposed measures must meet or exceed current energy codes such as ASHRAE 90.1-2019, appliances standards or common market practice¹. The following measures are not eligible for incentives under this program and shall not be included in project scopes of work.

- On-site renewable energy such as solar photovoltaics and wind turbines.
- Distributed energy resources such as combined heat and power, fuel cells, energy storage, and battery storage.
- Demand response and load shifting measures
- Stand-alone operations and maintenance measures (such as cleaning coils, dampers, sensors, and heat exchangers, routine calibration of systems, and filter replacements). Exception: O&M measures may be part of a broader RCx, RCx-Lite, and SEM scope of work.
- UV-C-based measures (such as coil cleaning, reducing pressure drop, ventilation adjustments)
- Sub-metering and monitoring equipment
- Power factor correction equipment
- Refrigerant or hydronic additives
- Cool roofs
- Behavioral measures (except for VCx, vSEM, and SEM programs).
- Other measures that have not been historically incentivized in utility prescriptive, custom, energy management, and whole building programs.

Retro-commissioning (RCx) itself cannot be proposed as a standalone recommended measure if no specific details and calculations are provided for individual control strategies. However, measures identified through the RCx process may be eligible for incentives (e.g., hot water supply temperature resets, nighttime setbacks, and outdoor air reductions).

If individual measures for a project are receiving incentives from another program, the measure shall not be included in the Energy Management scope of work.

Emerging technologies, unless supported by third party evaluation/study, will be reviewed and permitted at the Program Manager's discretion.

2.2 Site Inspections and M&V

Energy Management programs are subject to inspections to confirm existing and upgraded site conditions.

¹ Most measures in the Energy Management program will not trigger code requirements since replacement of equipment is generally outside the scope of this program. However, if a measure triggers code requirements, the measure shall meet or exceed code requirements.



The Program Manager will schedule inspections with the contact person identified on the application, with the assistance of a Program Ally when necessary.

The Program Ally is required to satisfy each program’s M&V requirements. Projects with savings greater than 500,000 kWh will generally be subject to M&V.

The following table summarizes inspection and M&V requirements for each program.

Subprogram	Pre-inspection	Post-inspection	M&V
RCx	Required	Required	Required
RCx-Lite	Random Selection	Random Selection	None
SEM	Random Selection	Random Selection	Required
VCx	Not Required	Not Required	Required
vSEM	Not Required	Not Required	Required

Table 2. Summary of M&V Requirements

2.3 Pre-Approvals

Pre-approval is required prior to moving onto the next program phase. TRC will issue a “Notice to Proceed” or “Pre-Approval” via email indicating the current phase has been approved and the customer/Program Ally may proceed with the next phase.

Applicants who proceed with the next phase prior to receiving a Notice to Proceed or Pre-approval are proceeding at risk and may not be eligible for incentives.

2.4 Invoices

Invoices for measure installation, project implementation, and program ally services shall meet the following requirements:

- All submitted documentation may be subject to additional review by the program team.
- The program reserves the right to request:
- Additional backup documentation, such as timesheets, supplier/vendor invoices, or contracts.
- Clarifications regarding any line items that appear inconsistent with the scope of work or program requirements.
- Invoices must be legible and submitted in PDF format unless otherwise specified.
- Costs included in invoices will be used to determine final incentive levels and must be accurate, transparent, and auditable.
- Invoices submitted without sufficient detail may be returned for revision or result in delayed incentive payments.

2.4.1 Measure Installation and Implementation Costs

The Customer or the Program Ally shall submit measure installation and implementation invoices. These invoices shall exclude Program Ally technical services costs such as site investigation, M&V,



and program reporting. If the project was self-installed, documentation must follow special guidelines (see below).

Required invoice documentation includes:

- Customer / Facility Name
- Project Address
- Invoice Date
- Unique Invoice Number (if applicable)
- Name of Installation Contractor (if not self-installed)
- Itemized Description of Work and Materials:
 - Description of each measure or equipment item installed
 - Quantity of units installed
 - Unit price and total material cost
 - Description of labor activities performed
 - Total labor hours and labor rate (or lump sum labor fee)
 - Applicable sales tax, freight, or disposal fees (if relevant)
- Total Installed Cost (Before Incentives)
- Installation Start and End Dates

For self-installed projects, customers must provide a written attestation in place of a formal invoice, including:

- Statement that the project was self-installed
- Installation start and end dates
- Total labor hours
- Internal labor rate (and whether it includes burden or fringe)
- Total calculated labor cost
- Signature of facility manager or appropriate representative

For Energy Management Programs, measure installation and implementation costs must not include any Program Ally professional service fees.

2.4.2 Program Ally Services Costs

The Program Ally shall submit invoices that clearly align with the scope of work and expectations for each sub-program (RCx, RCx-Lite, SEM).

Required invoice documentation includes:

- Program Ally Company Name
- Customer / Facility Name
- Project Address
- Invoice Date
- Unique Invoice Number
- Itemized Description of Services Rendered:
 - Phase or task name (e.g., site investigation, opportunity identification, data analysis,



- planning support, SEM coaching, M&V, etc.)
- Brief description of each service performed
- Date range or service delivery period
- Percent completion (if applicable)
- Total fee per task or phase
- Total Program Ally Invoice Amount

For Energy Management Programs, Program Ally professional technical services fees shall exclude measure installation and implementation costs.

2.5 Deficient Applications

If an application package is incomplete, information is missing or deemed insufficient by JCP&L or TRC, a deficiency notice will be sent to Customer requesting additional information via email or through the online portal system. The information or documentation requested must be received by TRC as soon as possible to continue through the process. If Customer fails to respond to a deficiency request within 30 days, the application may be cancelled. If an application is cancelled, Customer may re-apply under the Program Incentives and requirements in place at the time of re-submittal.

2.6 W-9, ST-4, or ST-5

This form must be completed by the entity receiving incentive payment. Certain private business entities may hold a “Sales Tax Exempt Organization Certificate (Form ST-5).” This form applies solely to purchases of tangible personal property or services.

2.7 Expirations and Extensions

Approved projects are given a 120-day approval in which the proposed measures are to be installed and operational. When a project has expired, the customer will have 30 days to either submit a request for an extension OR submit final project paperwork. If no response is received within 30 days of expiration, the project will be cancelled.

Extension requests must be in writing from the customer and include the circumstances that led to the extension request, amount of extension requested, and the percentage of the project completed.

Extension requests will be reviewed and may be granted by JCP&L staff. However, extension requests are not guaranteed.

2.8 Incentive Processing and Payment

Incentives are processed upon receipt of each respective deliverable as defined in the program processes above.

The incentive will be paid to the Program Ally and/or customer as defined in the program application and program incentive tables. However, the customer may re-assign payment to a third-party payee or their Program Ally, where applicable.



3 Retrocommissioning (RCx)

3.1 Program Description and Goals

The Retrocommissioning (RCx) Program helps large commercial and industrial (C&I) customers improve energy efficiency by optimizing their building management systems (BMS) and controls. Through a detailed investigation, the program identifies opportunities to restore mechanical, electrical, and thermal systems to their original or enhanced performance—reducing energy waste and lowering costs. The program is delivered through a network of approved RCx Program Ally, who help guide you through the process. Incentives are available to help offset the cost of RCx activities, including site investigation, implementation, and measurement & verification (M&V).

3.2 Customer and Building Eligibility

Customer and building eligibility requirements include:

- The customer must be a commercial or industrial building within the JCP&L territory
- The building floor area must exceed 100,000 square feet
- The first-year project savings must exceed 200,000 kWh
- The facility is not a new construction building and must not have been commissioned in the last 3 years
- The project should have potential for significant energy savings, with agreement the customer will implement all upgrades identified during investigation that have a 2-year payback or less
- The customer must use an approved RCx Program Ally
- Program Incentives and requirements are defined at the time of submission of the application.

Exceptions to eligibility requirements require approval by the Program Manager and JCP&L.

3.3 Project Phases

Phases	Description
Phase 1 Site Investigation Phase	The customer's RCx Program Ally performs a detailed site investigation to identify low and no cost operational improvements. The RCx Program Ally develops an RCx implementation plan outlining identified RCx measures (such as system optimization, setpoint adjustments, and HVAC control strategies), estimated savings potential, and implementation timeline.
Phase 2 Implementation and Optimization Phase	The customer and their contracted RCx Program Ally implement approved RCx measures. Key activities include adjusting system parameters (HVAC scheduling, control sequences, and economizer operation), optimizing equipment performance, verifying measure functionality through short-term monitoring, and developing a long-term monitoring strategy to maintain performance gains.



Phases	Description
Phase 3 Measurement and Verification Phase	After implementation, the RCx Program Ally conducts savings verification and the customer and RCx Program Ally receive incentive payments based on achieved performance.

Table 3. Project Phases (RCx)

3.4 Incentive Structure and Payment Milestones

3.4.1 Customer Incentives

Phases	Description
Phase 1 Site Investigation Phase	<p>None</p> <p>Customers receive the RCx study at a reduced cost.</p>
Phase 2 Implementation and Optimization Phase	<p>Optional</p> <p>Customers may choose to receive 50% of the Phase 3 payment following installation.</p> <p>Otherwise, the full payment will be issued at the end of Phase 3.</p>
Phase 3 Measurement and Verification Phase	<p>Up to \$0.30/kWh for non-lighting, up to \$0.16/kWh for lighting, and up to \$0.40/therm.</p> <p>Customers will receive incentives for realized savings covering up to 70% of the project cost.</p> <p>The gas incentive rate cannot exceed the published incentive rate published by the gas utility</p>

Table 4. Customer Incentives (RCx)

3.4.2 Program Ally Incentives

The RCx Program Ally will be eligible for incentives to cover up to 100% of the cost the site investigation study and RCx services. Services will be capped at the lesser of the projected/realized energy savings or 100% of the service costs. All service costs are subject to review prior to pre-approval and payment.

Phases	Description
Phase 1 Site Investigation Phase	<p>Up to \$0.10/kWh and up to \$1.20/therm</p> <p>Capped at 50% of RCx services cost. The gas incentive rate cannot exceed the published incentive rate published by the gas utility.</p>
Phase 2 Implementation and Optimization Phase	None



Phases	Description
Phase 3 Measurement and Verification Phase	Tier 1 (Savings Below Study Target): Up to \$0.15/kWh and up to \$1.20/therm
	Tier 2 (Savings at or above Study Target): Up to \$0.20/kWh and up to \$1.20/therm Capped at up to 100% of the remaining RCx services cost. The gas incentive rate cannot exceed the published incentive rate published by the gas utility.

Table 5. Program Ally Incentives (RCx)

3.5 Eligible Measures

The first phase of the program begins with a site investigation study performed by an approved Program Ally. The study identifies operational improvements and provides a report outlining recommended measures. **Customers participating in the program must agree to implement all identified upgrades with a simple payback of 24 months or less.**

The Program Ally oversees the implementation of selected measures, tracks performance, and reports verified savings to the program administrator. The program covers 70% of the cost of the site investigation study and provides incentives to both the customer and the Program Ally at key phases throughout the project lifecycle.

Common RCx measures include, but are not limited to:

Measure Category	Measures
Airflow and Ventilation Improvements	<ul style="list-style-type: none"> • Airflow balancing • Duct leakage reduction • Demand-controlled ventilation (CO₂-based) • Ventilation system tune-ups • Optimization and scheduling of ventilation systems
Temperature Reset Strategies	<ul style="list-style-type: none"> • Chilled water supply reset • Hot water supply reset • Condenser water temperature reset • Supply air temperature reset • Duct static pressure reset • Pump pressure reset
Scheduling and Setpoint Adjustments	<ul style="list-style-type: none"> • Air handler scheduling • Optimal start/stop scheduling • Unoccupied scheduling • Nighttime setbacks • Zone temperature deadband adjustments • Lighting scheduling • Economizer dry bulb temperature adjustments • Static pressure setpoint adjustment



Measure Category	Measures
	<ul style="list-style-type: none"> • Pump pressure setpoint adjustment • Chilled and condenser water setpoint adjustments
Equipment Optimization and Tune-Ups	<ul style="list-style-type: none"> • Cooling and heating systems • Reheat systems optimization • Domestic hot water (DHW) system • Fan and pump systems • Refrigeration systems • Lighting systems • Other equipment/systems
Staging and Load Control	<ul style="list-style-type: none"> • Staging strategies for heating, cooling, and other systems • Pump pressure reset controls • Static pressure reset
Occupancy-Based Controls	<ul style="list-style-type: none"> • HVAC controls • Lighting controls • Other system controls
Controls and Sensors Upgrades	<ul style="list-style-type: none"> • Enhancements to economizer controls • Enhancements to programmable and smart thermostats
Specialized System Improvements	<ul style="list-style-type: none"> • Tuning of motors and variable frequency drives (VFDs) • Vending machine controls • Data center optimization • Compressed air system improvements • Agricultural applications • Process system optimization

Table 6. List of Eligible Measures (RCx)

While capital improvements, such as new VFDs, lighting retrofits or controls, and system redesigns may be identified during the site investigation study, they are not eligible for incentives under the RCx program. These measures must be submitted separately through the Prescriptive or Custom incentive pathways.

Simple operations and maintenance (O&M) activities, such as filter replacement, coil cleaning, or insulation repair, as well as behavioral measures, should not be classified as RCx measures. However, if included as part of the overall RCx scope, they should be documented in the site investigation study and shared with the customer as recommendations. Savings from these measures may contribute to savings calculated during the M&V phase.

RCx measures are generally expected to be implemented through the building automation system (BAS). Lighting scheduling improvements, when implemented through the BAS, may also be included.

If it is unclear if a measure qualifies as an RCx measure, please reach out to the Program Manager for clarification.



3.6 Program Process

The RCx Program consists of the following phases:

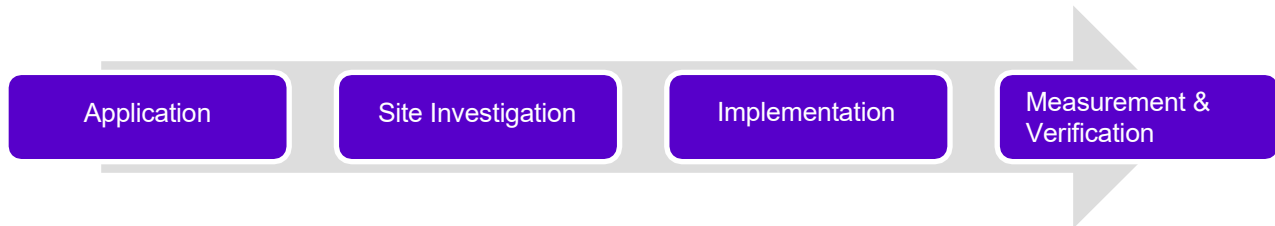


Figure 2. RCx Program Process

3.6.1 Application

The purpose of this phase is to:

- Confirm the customer’s eligibility for participation in the RCx offering.
- Review and approve the proposed scope of work, savings target and Program Ally fee.
- Conduct a kickoff call with the customer and Program Ally to discuss the project scope and outline the RCx process.

When evaluating the proposed site investigation (study) fee and Program Ally incentive, several factors are considered:

- Anticipated energy savings target
- Facility size (particularly conditioned square footage) and annual energy usage
- System complexity and diversity of opportunities
- Building automation system (BAS) capabilities, including data access, trending, and storage limitations
- Cost-effectiveness of the project (e.g., simple payback, energy cost savings)

The Program Ally and/or Customer will provide general facility information which is collected using a project screening workbook provided by the program. If the project passes the initial screening, the application will be approved, and both the customer and Program Ally will receive confirmation to move forward with the next phase.

This phase typically spans up to one month.

Application Phase Checklist

- Complete Application** submitted through the Customer or Program Ally portal.
- Energy Management Project Screening Workbook** containing general details of the project.
- Customer W9, ST-4, or ST-5**, which is required for all incentive payments



Application Phase Checklist

- Customer Proposal / Agreement** including
 1. **Project and Customer Overview** – Brief description of the site, customer objectives, and known systems or opportunities.
 2. **Proposed Scope of Work** – Description of services to be provided for this specific site.
 3. **Project Approach and Timeline** – Summary of the methodology and estimated timeline for each project phase (e.g., study, installation, M&V).
 4. **Pricing** – Itemized pricing for Site Investigation, Implementation Oversight, Measurement & Verification (M&V), and Additional services (as applicable)
 5. **Customer Signature and Acceptance** – Executed agreement between the customer and program ally, signed by both parties.

Table 7. Application Checklist (RCx)

3.6.2 Site Investigation Study

Once the application is approved, TRC will schedule and lead a kickoff meeting with the customer and the approved Program Ally. During this phase, the Program Ally conducts a detailed site investigation to identify and evaluate potential energy conservation measures (ECMs). Key activities include:

- Collecting and analyzing baseline facility energy usage, including trended data from the building automation system (BAS) or supplemental data loggers.
- Estimating savings for each proposed ECM using either the Program Ally's custom calculation method or the RCx program calculator (available for standard measures).
- Gathering cost estimates from the customer's preferred contractor(s).
- Participating in monthly check-in calls with the customer and TRC to track progress and address questions.

RCx Plan

Before submitting the final Investigation Report, the Program Ally is required to develop and submit an **RCx Plan**, which outlines the selected ECMs and includes a corresponding **Measurement & Verification (M&V) Plan**. The RCx Plan should identify:

- Each ECM to be implemented
- Estimated savings and cost
- Simple payback
- A proposed timeline
- The M&V approach for each measure (e.g., spot measurement, trend data review, short-term logging)

The RCx Plan must be submitted to TRC for review and approval before the final RCx Investigation Report is submitted.



The Program Ally may complete TRC provided RCx Plan and M&V plan templates or provide a template in their own format, as long as the plans contain the same level of detail.

Site Investigation Phase Checklist – Prior to Beginning Site Investigation Report

- Completed RCx Plan** (See [Section 3.7.2 RCx Plan](#) for content requirements)

Table 8. RCx Plan Checklist

RCx Site Investigation Report

Once the RCx Plan is approved, the Program Ally prepares the **RCx Site Investigation Report** using the template provided by the program or a template in their own format. The report must include:

- Existing facility conditions
- All proposed and selected ECMs
- Savings and cost estimates, with supporting assumptions
- Simple payback calculations
- Any relevant data, observations, and findings from the field investigation

TRC may conduct a pre-approval site inspection for selected projects. **The Investigation Report must be reviewed and approved by TRC before it is shared with the customer.**

Once approved, the Program Ally will lead a meeting with the customer to present the findings and discuss the implementation path forward. This phase typically spans up to four months.

Site Investigation Phase Checklist – Site Investigation Report Submission

- Completed RCx Site Investigation Report** (See [Section 3.7.4 RCx Report](#) for content requirements)
- Completed RCx ECM Summary Form**
- Completed M&V Plan** (See [Section 3.7.3 M&V Plan](#) for content requirements)
- Estimated Energy Savings Calculations** (developed in accordance with the Energy Management Technical Guidelines)
- Trended/logged BAS data** and any spot measurements, per program M&V Guidelines
- Contractor Quotes** for ECM implementation (from customer's preferred contractors)
- Program Ally Invoice** for Investigation Phase milestone (submitted upon TRC approval of all deliverables)
- Ongoing **Monthly Progress** updates provided during the phase



Table 9. Site Investigation Report Checklist (RCx)

3.6.3 Implementation Phase

Implementation of the selected ECMs begins at the facility, led by the customer's preferred contractor(s) and/or in-house staff. The Program Ally remains engaged throughout this phase to support the customer, coordinate with contractors, and track progress.

Routine monthly check-ins involving the customer, Program Ally, contractor(s), and TRC will be scheduled to monitor project status, resolve questions, and confirm that ECMs are proceeding in alignment with the approved RCx Plan.

The Program Ally should collect copies of invoices from the customer or contractors for all implemented ECMs. These invoices will be included in the Final RCx Report, submitted in the next phase.

The customer must notify TRC when all ECMs have been installed and may request a partial 50% incentive payment at this phase. This communication initiates the start of the Measurement and Verification (M&V) phase. TRC may conduct a post-implementation inspection on select projects prior to M&V.

The implementation phase is expected to last up to four months.

Implementation Phase Checklist

- Customer Email Confirming** all measures were installed.

- Program Ally Progress Invoice** for services provided to date.

- Copies of invoices collected from customer and/or contractors** for all implemented ECMs

- Updated RCx ECM Summary Form**, with updated savings, measures, and costs to reflect the installed scope of work.

- TRC Post-Inspection**, if required.

3.6.4 M&V Phase

Once implementation is complete, the Program Ally begins data collection to validate the energy savings achieved through the installed ECMs. Trending duration and data requirements vary depending on the measure type and are detailed in the RCx and M&V plans.

The Program Ally develops an a Final RCx Report that provides:

- A summary of the implementation process and project scope, including any scope changes or issues encountered
- Confirmation of installed ECMs, including installation date(s)
- Final implementation costs (based on submitted invoices)
- Final measured or calculated energy savings, consistent with the approved M&V Plan
- M&V results and data, including trended or logged data, spot measurements, and analysis



- Any updates to the original RCx Plan or ECM list
- Photos or documentation of installed measures, if applicable

TRC reviews and approves the Verification Report before it is presented to the customer.

Following approval, the Program Ally leads a verification meeting with the customer and TRC to review findings, close out the project, and confirm any remaining documentation or deliverables.

This phase is expected to last approximately three months.

M&V Phase Checklist	
<input type="checkbox"/>	Final RCx Report (updates to the RCx Site Investigation report including implemented ECMs, verified energy savings, final costs, M&V methodology and results, and all required appendices)
<input type="checkbox"/>	Verified energy savings calculations prepared in accordance with the project's RCx and M&V plans
<input type="checkbox"/>	Trended/logged data and any spot measurements submitted per the M&V Plan (including clean / analyzed data)
<input type="checkbox"/>	Updated RCx ECM Summary Form including final verified savings.
<input type="checkbox"/>	Program Ally Progress Invoice for services provided to date.

Table 10. M&V Checklist (RCx)

3.7 Required Documentation

3.7.1 RCx Plan

Program Allies may use the RCx plan template to document project details, RCx processes, and expected results. Alternatively, Program Allies may submit RCx plans in their own templates and formats. The following table provides a list of contents that should be included in RCx plans.

Section	Contents
Introduction	<ul style="list-style-type: none"> • Purpose (Why the RCx Plan is being developed) • Scope (Systems and spaces included in the RCx study) • Objectives (Primary goals for the RCx engagement) • Investigation (Brief intro to the upcoming site investigation phase)
RCx Team, Roles, and Responsibilities	<ul style="list-style-type: none"> • Project Team Info (Names, organizations, and contact information) • Roles & Responsibilities (Who is responsible for what throughout the RCx process) • Communication Protocols (Meeting cadence, reporting expectations, and escalation procedures)
Project Schedule	<ul style="list-style-type: none"> • RCx schedule (Anticipated timeline for all major RCx phases)



Section	Contents
	and deliverables)
Building Description	<ul style="list-style-type: none"> • General Info (Building size, location, use type, hours of operation) • HVAC System (Equipment type, age, known issues) • Building Automation System (Capabilities, data points, and limitations)
Documentation and Data Requirements	<ul style="list-style-type: none"> • Requested Documents and Data (List of documents and data the program ally should request from the customer)
RCx Process and Methodology	<ul style="list-style-type: none"> • Planning Phase (Site selection, kickoff meeting, initial data collection) • Investigation Phase (Fieldwork, trending, testing, and preliminary findings) • Implementation Support Phase (Planning and coordinating ECM implementation) • Verification Phase (M&V data collection and results review) • Final Reporting Phase (Structure and expectations for the Final RCx Report) • Deliverable Summary (Checklist of required deliverables across each RCx phase)
Issues and Resolution Log	<ul style="list-style-type: none"> • Issues and Resolutions (A working log of issues discovered and how they were resolved) • If no issues reported, include a sample issues and resolution log form or template.
Appendices	<ul style="list-style-type: none"> • Appendix A: M&V Plan (see following section)

Table 11. RCx Plan Table

3.7.2 M&V Plan

Program Allies may use the M&V plan template to document project details, M&V processes, and expected results. Alternatively, Program Allies may submit M&V plans in their own templates and formats. The following table provides a list of contents that should be included in M&V plans.

Section	Contents
Introduction	<ul style="list-style-type: none"> • Purpose (Why the M&V Plan is being developed) • Scope (Systems and spaces included in the M&V plan) • Overview of the facility and project
Measure Descriptions	<ul style="list-style-type: none"> • Baseline description (existing equipment/system types, sizes, controls, performance characteristics) • Proposed description (selected equipment/system types, sizes, controls, performance characteristics) • Controls and operational strategies implemented • Expected energy performance improvements (e.g., %



Section	Contents
	efficiency increase, demand reduction)
IPMVP Option and Measurement Boundary	<ul style="list-style-type: none"> IPMVP option and measurement boundary (Selected protocol and physical/virtual boundaries) Interactive effects (Consideration of interactions between measures)
Pre-installation Reporting	<ul style="list-style-type: none"> Establishing baseline energy consumption (Methodology for baseline per measure) Sampling approach (Sampling methodology during baseline) Energy-influencing parameters (Variables affecting baseline energy) Non-metered data points (Handling data not directly metered)
Post-installation Reporting	<ul style="list-style-type: none"> Reporting period (Post-installation data collection timeframe) Establishing post-installation energy consumption (Methodology for post-installation per measure) Sampling approach (Sampling methodology post-installation) Non-metered data points (Handling non-metered data post-installation)
Basis for Adjustment	<ul style="list-style-type: none"> Routine adjustments (Planned operational or environmental changes) Non-routine adjustments (Unplanned or one-time events)
Savings Calculation Methodology	<ul style="list-style-type: none"> Analysis approach (Statistical and analytical techniques) Key equations (Formulas used for savings calculations) Independent variables (Inputs for savings models) Dependent variables (Measured outputs) Statistical metrics (Metrics for evaluating results)
Meter Specification and Data Collection	<ul style="list-style-type: none"> Meter inventory (List and specs of meters used) Additional procedures and notes (Supplementary metering/data collection instructions)
Expected Accuracy and Uncertainty	<ul style="list-style-type: none"> Expected accuracy (Accuracy targets or thresholds) Confidence and precision levels (Statistical confidence aims) Expected uncertainties (Potential uncertainty sources)
M&V Report Format	<ul style="list-style-type: none"> Outline and structure of the final M&V report
Owner Acknowledgement	<ul style="list-style-type: none"> Confirmation of owner understanding and approval of the M&V Plan

Table 12. M&V Plan Contents

3.7.3 RCx Report

Program Allies may use the RCx report template to document project details, RCx processes, and results. Alternatively, Program Allies may submit RCx reports in their own templates and formats. The following table provides a list of contents that should be included in RCx reports.



Section	Contents
Introduction	<ul style="list-style-type: none"> • Purpose (Why the RCx Report is being developed) • Scope (Systems and spaces evaluated during RCx) • Objectives (Primary goals for the RCx effort) • Project Summary (High-level overview of RCx project and findings) • Investigation Report Measures (Summary of initial ECMs identified) • Verification Report Measures (Summary of ECMs implemented and verified)
RCx Team, Roles, and Responsibilities	<ul style="list-style-type: none"> • Project Team Info (Names, organizations, and contact info) • Roles & Responsibilities (Who was responsible for what throughout the RCx process)
Project Schedule	<ul style="list-style-type: none"> • RCx schedule (Anticipated and actual timeline for all major RCx phases and deliverables)
Building Description	<ul style="list-style-type: none"> • General Info (Building size, location, use type, hours) • HVAC System (Equipment type, age, known issues) • Building Automation System (Capabilities, data points, and limitations)
Utility Data Summary	<ul style="list-style-type: none"> • Summary of historical utility usage and costs (pre-RCx baseline), ideally 24 months of data.
RCx Process and Methodology	<ul style="list-style-type: none"> • Planning Phase (Site selection, kickoff meeting, initial data collection) • Investigation Phase (Fieldwork, trending, testing, and preliminary findings) • Implementation Support Phase (Planning and coordinating ECM implementation) • Verification Phase (M&V data collection and results review) • Final Reporting Phase (Structure and expectations for the Final RCx Report) • Deliverable Summary (Checklist of required deliverables across each RCx phase)
Measurement and Verification	<ul style="list-style-type: none"> • Tools and methods used to track performance • Measurement period (dates and durations) • Energy data and key influencing variables collected • Independent variables, static factors and assumptions • Summary of site inspection and operational verification activities • Summary of post-implementation performance data • Comparison to baseline and goals • Adjustments made based on findings
Savings Calculations and Methodology	<ul style="list-style-type: none"> • Data analysis and calculation methodology • Assumptions and sources used in calculations • Baseline and post-installation adjustments (routine and non-



Section	Contents
	routine)
Issues and Resolution Log	<ul style="list-style-type: none"> Summary of issues identified and how each was addressed or resolved
Appendices	<ul style="list-style-type: none"> Appendix A: Equipment Lists (Nameplate data, quantities, locations) Appendix B: Site Photos (Pre and Post-installation photos) Appendix C: RCx Plan (Final version of the RCx Plan) Appendix D: Functional Performance Test Forms (Templates used to document the testing of system operation against the design intent and sequences of operation) Appendix E: BAS Data (Trend Logs / BAS Screenshots) Appendix F: M&V Plan (Final version of the M&V Plan) Appendix G: Detailed Calculations (Savings / Costs / Assumptions / M&V Analysis) Appendix H: Issues and Resolution Log (Tracks all Cx deficiencies and corrective actions)

Table 13. RCx Report Contents

3.8 Special Requirements – Monitoring Based Commissioning (MBCx) Projects

Monitoring-Based Commissioning (MBCx) projects are eligible for RCx program incentives. This section provides requirements for MBCx in addition to the general RCx requirements described in the previous section.

Through MBCx, an approved Program Ally uses advanced monitoring software integrated with a building’s energy automation system (BAS) to continuously identify energy savings opportunities and optimize building performance.

The MBCx approach leverages real-time data analytics and fault detection diagnostics (FDD) to uncover inefficiencies, track equipment performance, and alert building staff to operational issues in near real time. Working in close coordination with the customer, the Program Ally helps to prioritize corrective actions and implement improvements that lead to sustained energy and cost savings.

MBCx is incorporated as an enhanced service within the RCx program and is designed to help participating customers:

- Maximize incentives through deeper energy analysis and actionable fault diagnostics.
- Identify and quantify cost savings opportunities over time.
- Continuously improve occupant comfort and building energy performance.
- Extend equipment life and improve operational efficiency through early detection of issues.

3.8.1 Customer Eligibility

In addition to general RCx program requirements, to be eligible for MBCx services under the RCx program:



- The facility must have an existing, functional Building Automation System (BAS).
- A BACnet-based BAS with Direct Digital Control (DDC) is strongly recommended to enable robust integration and automated data collection.
- The customer must commit to participating in MBCx for a minimum of 18 months following software integration, via a signed agreement with the Program Ally.

3.8.2 Minimum Technical Requirements for MBCx Software

Software packages must meet the following technical requirements:

- Support for real-time data acquisition and storage
- Ability to trend and archive high-frequency data (≤ 5 -minute intervals)
- Open protocol compatibility (BACnet/IP, Modbus, etc.)
- Fault detection and diagnostics (FDD) capabilities
- Visualization dashboards (e.g., performance charts, alerts)
- Role-based user access and audit trails
- Secure data handling (e.g., SOC 2 Type II compliance)

System integration standards include:

- Standardized data mapping methodology (e.g., standardized naming convention such as Haystack or Brick)
- Data integrity checks (e.g., missing points, stale data)
- Time synchronization between BAS and MBCx software
- Process for resolving IT or cybersecurity hurdles (VPNs, firewalls, third-party access protocols)
- Temporary data logging solution if BAS integration is delayed

The Program Manager (TRC) does not warrant, endorse, or assume any liability for third-party software or system integration services provided by Program Allies or affiliated vendors. Any issues arising from the installation, configuration, performance, cybersecurity, or compatibility of MBCx software, including but not limited to system disruptions, IT conflicts, data loss, or BAS malfunctions are the sole responsibility of the Program Ally, the software provider, and/or the participating customer.

The Program Implementer is not a party to, nor responsible for, any agreements or disputes between the customer and the Program Ally or software provider related to the use or performance of MBCx software.

Customers are strongly encouraged to:

- Review all software agreements and terms of service before installation
- Engage their internal IT teams during the integration process
- Request documentation of cybersecurity protocols and technical specifications from the Program Ally or vendor.



3.8.3 Integration Phase Requirements

Before any site investigation or measure development begins, the Trade Ally must complete a software integration phase with the customer's BAS. This step is essential to enable remote access, continuous monitoring, and fault detection analytics.

The RCx Program for MBCx projects consists of the following phases, where software integration is an additional phase following application and before site investigation.



Figure 3. RCx Program Process for MBCx Projects

The following deliverables must be submitted and accepted before progressing to the next project phase:

Software Integration Phase Checklist	
<input type="checkbox"/>	Email Confirmation of Integration (Trade Ally must confirm successful software integration and connectivity with the building BAS.)
<input type="checkbox"/>	Signed Monitoring Agreement (Signed agreement between the Trade Ally and customer committing to a minimum of 18 months of monitoring following integration.) List of Monitored Equipment <ul style="list-style-type: none">• Chillers• Cooling Towers• Boilers• Air Handling Units (AHUs)• Variable Air Volume (VAV) boxes• Fan-Powered Boxes (FPBs)• Other end uses (e.g., lighting systems where available)
<input type="checkbox"/>	Points List (Complete list of monitored points, submitted in .xls or .csv format, identifying the data points being trended for each system and piece of equipment.)
<input type="checkbox"/>	Sample Interval Trend Data (Collected remotely from the BAS at 5-minute intervals or lower. File must be in .xls or .csv format.)
<input type="checkbox"/>	Top Fault Detection Diagnostic Algorithms (List of the top 10-20 fault detection diagnostics used by the MBCx software to identify opportunities for ECMs)
<input type="checkbox"/>	Sample Exception/Error Report (Typical exception report that highlights areas of concern, abnormal equipment behavior, or energy-saving potential. This sample does not require technical review but provides insight into system alerting capabilities.)



Software Integration Phase Checklist

- Reporting Capabilities Statement** (Brief description of automated reporting features, such as energy dashboards, weekly/monthly summaries, or automated alerts. No technical review required.)

- Customer MBCx Web Portal Access** (Read-only login credentials or credentials for a demo account must be provided for program review purposes.)

- Live Software Demo** (Trade Ally must schedule a live demo of the MBCx interface to show how faults are detected, tracked, and translated into actionable energy efficiency recommendations.)

Table 14. MBCx Software Integration Phase Checklist

3.8.4 M&V and Reporting Requirements

For MBCx projects, RCx and M&V plans shall also describe:

- How MBCx-based findings will be translated into measures
- What constitutes an “implementable” measure from FDD outputs
- Whether persistence verification will be automated or require manual review
- MBCx M&V duration expectations vs. standard RCx
- Frequency and format of customer-facing reports (monthly, quarterly, etc.)
- Energy trends and dashboards available to facilitate review of trends and savings
- Description how identified faults or alerts were addressed

3.8.5 Project Costs and Incentives

MBCx software, licensing fees, and program ally technical services fees shall meet the following requirements in addition to general requirements described in [Section 2.4](#).

- MBCx software integration and license costs are considered eligible Customer Project Costs under the RCx incentive structure. There are no stand-alone incentives available for software and licensing costs at this time.
- These costs may count toward the customer’s overall incentive cap, as long as they directly support the identification and implementation of eligible measures.
- Program Ally fees associated with MBCx (e.g., analytics review, issue resolution support, reporting) must be invoiced separately under the Program Ally Services category and should not be included with measure installation and implementation costs.



4 Retrocommissioning Lite (RCx-Lite)

4.1 Program Description and Goals

The Retrocommissioning Lite (RCx-Lite) Program is a fast-track pathway designed for small- to medium-sized buildings that qualify for a simplified RCx process. This offering moves less complex RCx projects more quickly from assessment to implementation and payment, reducing administrative steps and accelerating the realization of energy savings. RCx-Lite streamlines program requirements and documentation to minimize delays and maximize customer impact.

All RCx-Lite projects must be delivered through an approved JCP&L Program Ally. The RCx-Lite offering is open-network, meaning any approved Program Ally may participate, and any eligible JCP&L customer may apply. The Program Ally is responsible for managing the project on behalf of the customer, including conducting assessments, identifying opportunities, and submitting required documentation.

Customers participating in RCx-Lite are eligible to receive financial incentives based on projected energy savings. Incentives are calculated using TRC's RCx-Lite Assessment Tool, a stand-alone RCx-Lite study or through custom analysis, depending on the participation pathway.

Participation Pathways

- **Study Pathway:** The Program Ally completes an RCx-Lite study using TRC's RCx-Lite Assessment Tool **or** submits a stand-alone study based on the list of eligible system optimization studies. In this pathway, Program Allies receive an incentive for developing and submitting the study in addition to the customer incentives tied to implementation.
- **Custom Pathway:** The Program Ally submits a direct analysis for system and control optimization measures. No formal RCx-Lite study or tool is required, and no Program Ally incentive is provided. Customers remain eligible for incentives tied to implementation savings.

4.2 Customer and Building Eligibility

Customer and building eligibility requirements include:

- The customer must be a commercial or industrial building within the JCP&L territory
- The first-year project savings must exceed 25,000 kWh
- The facility is not a new construction building and must not have been commissioned in the last 3 years
- The project should have potential for significant energy savings, with agreement the customer will implement all upgrades identified during investigation that have a 2-year payback or less.
- Any approved Program Ally can participate in this program.
- Program Incentives and requirements are defined at the time of submission of the application.

Exceptions to eligibility requirements require approval by the Program Manager and JCP&L.



4.3 Project Phases

Phases	Study Pathway	Fast Track Custom Pathway
Phase 1 Site Investigation and Energy Analysis Phase	The Program Ally performs a detailed site investigation to identify low and no cost operational improvements using TRC's RCx-Lite Assessment Tool or submits a stand-alone targeted study based on the list of eligible system optimization measures.	The Program Ally develops and submits energy savings calculations for review and approval. No study is required, and no Program Ally incentive is provided.
Phase 2 Implementation and Optimization Phase	The customer and their contracted Program Ally implement approved RCx measures. Key activities include adjusting system parameters (HVAC scheduling, control sequences, and economizer operation), optimizing equipment performance, verifying measure functionality through short-term monitoring, and developing a long-term monitoring strategy to maintain performance gains.	
Phase 3 Verification Phase	After implementation, TRC will conduct a post-inspection to verify installed measures. M&V is required for projects with savings greater than 500,000 kWh annually. At the program's discretion, M&V may also be required for complex projects or projects with a high degree of savings uncertainty.	

Table 15. Project Phases (RCx-Lite)

4.4 Incentive Structure and Payment Milestones

4.4.1 Customer Incentives

Phases	Description
Phase 1 Site Investigation Phase	None Customers may receive an RCx-Lite study at a reduced cost.
Phase 2 Implementation and Optimization Phase	None
Phase 3 Verification Phase	<p style="color: green;">Up to \$0.30/kWh for non-lighting, up to \$0.16/kWh for lighting, and up to \$0.40/therm.</p> Customers will receive incentives for realized savings covering up to 70% of the project cost. The gas incentive rate cannot exceed the published incentive rate published by the gas utility



Table 16. Customer Incentives (RCx-Lite)

4.4.2 Program Ally Incentives (Study Pathway)

The Program Ally will be eligible for incentives to cover up to 100% of the cost the site investigation study and RCx services. Services will be capped at the lesser of the projected/realized energy savings or 100% of service costs. All service costs are subject to review prior to pre-approval and payment.

Phases	Description
Phase 1 Site Investigation Phase (Optional)	Up to \$0.10/kWh and up to \$0.40/therm Capped at 50% of RCx services cost. The gas incentive rate cannot exceed the published incentive rate published by the gas utility.
Phase 2 Implementation and Optimization Phase	None
Phase 3 Installation and M&V Phase	Up to \$0.10/kWh and up to \$0.40/therm Capped at up to 100% of the remaining RCx services cost. The gas incentive rate cannot exceed the published incentive rate published by the gas utility.

Table 17. Program Ally Incentives (RCx-Lite | Study)

4.4.3 Program Ally Incentives (Custom Pathway)

The Custom Pathway does not offer program ally incentives for technical assistance, studies, or M&V. Program allies should pursue the study pathway if requesting these incentives.

4.5 Eligible RCx-Lite Targeted Studies and Measures

The first phase of the program begins with a site investigation study performed by an approved Program Ally. The study identifies operational improvements and provides a report outlining recommended measures. **Customers participating in the program must agree to implement all identified upgrades with a simple payback of 24 months or less.**

The Program Ally oversees the implementation of selected measures, tracks performance, and reports verified savings to the program administrator. The program covers 70% of the cost of the site investigation study and provides incentives to both the customer and the Program Ally at key phases throughout the project lifecycle.

The following table provides a list of eligible targeted studies and measures.

Measure Category	Measures
Compressed Air	<ul style="list-style-type: none"> Leak Survey & Repair (ultrasonic, pump-up/decay test) Staging & Trim Compressor (sequencing, base-load vs trim logic) Pressure Band Optimization (lower header psig) Blow-off / Purge Reduction (controls, storage use)



Measure Category	Measures
Refrigeration Systems	<ul style="list-style-type: none"> Heat Recovery from Compressor Jacket/Air End (if applicable)
	<ul style="list-style-type: none"> Floating Head Pressure Control (reset based on ambient conditions) Floating Suction Pressure Control Compressor Staging (lead/lag, sequencing) Defrost Optimization (timing, temperature termination) Anti-Sweat Heater Control (humidity sensors, duty cycle) Evaporator Fan VFD / Cycling Door Heater & Strip Curtain
	<ul style="list-style-type: none"> Chiller Staging & Sequencing (optimize kW/ton load profile) Chilled Water Reset (reset supply temp vs load or OAT) Condenser Water Reset (approach ambient wet-bulb) Cooling Tower Fans Pump VFD / Differential Pressure Reset Free Cooling / Economizer Enablement
	<ul style="list-style-type: none"> Occupancy Scheduling (reduce off-hours operation) Economizer Enablement / Control Repair Static Pressure Reset (supply fans with VFD) Supply Air Temperature Reset CO₂-based Demand Control Ventilation (DCV) Simultaneous Heating & Cooling Elimination
	<ul style="list-style-type: none"> Occupancy Sensor Optimization Daylight Harvesting Controls Interior & Exterior Scheduling Task Lighting Substitution
	<ul style="list-style-type: none"> BAS Trend Analysis & Override Correction Scheduling Consolidation Sensor Calibration & Repair
	<ul style="list-style-type: none"> Domestic Hot Water Temperature Reset Kitchen Hood Demand Ventilation Data Center Airflow Management Plug Load Scheduling (smart strips, timers) Elevator / Escalator Idle Mode Optimization

Table 18. RCx-Lite Targeted Studies and Measures

While capital improvements, such as new VFDs, lighting retrofits or controls, and system redesigns may be identified during the site investigation study, they are not eligible for incentives under the RCx-Lite program. These measures must be submitted separately through the Prescriptive or Custom incentive pathways.



4.6 RCx-Lite Assessment Tool Fast Track Measures

The RCx-Lite Assessment Tool provides a streamlined, deemed-savings approach for common low- and no-cost measures. By standardizing assumptions and calculation methods, the tool allows Program Allies to quickly quantify savings without the need for extensive custom analysis. Measures included in this tool represent proven optimization strategies for building systems and controls, offering a clear and efficient route from assessment to implementation.

Fast Track Measures included in the RCx-Lite Assessment Tool include:

Measure Category	Measures
Building Envelope	<ul style="list-style-type: none"> • Implement air-sealing and infiltration reduction • Repair ceiling/roof • Use window treatments/coverings
HVAC Controls	<ul style="list-style-type: none"> • Practice proper use of thermostats, schedules, temperature resets • Reduce simultaneous heating and cooling • Ensure economizers are functioning properly • Adjust HVAC equipment temperature set-points • Inspect control devices regularly
Pumps and Motors	<ul style="list-style-type: none"> • Optimize pump operation • Reduce motor short cycling • Perform routine motor maintenance • Optimize VFD operation
Ventilation	<ul style="list-style-type: none"> • Reduce outdoor air rates to code • Close outdoor air intake dampers when unoccupied • Program exhaust fans • Clean and/or replace air filters • Seal duct leakage • Repair/install duct insulation • Clean air inlets or outlets • Fan maintenance and best practices
Heating	<ul style="list-style-type: none"> • Perform proper boiler maintenance • Perform boiler/furnace tune-up • Clean/repair radiators, convectors, baseboards, and heaters
Cooling	<ul style="list-style-type: none"> • Perform chiller tune-up • Tune-up air conditioning systems • Install/repair cooling pipe insulation • Clean and maintain cooling towers
Service Hot Water	<ul style="list-style-type: none"> • Reduce DHW temperature • Install or repair DHW tank insulation • DHW system tune-up • Install water-saving devices • Reduce pool water temperature • Reduce dishwasher final rinse temp to code



Measure Category	Measures		
Lighting	<ul style="list-style-type: none"> • Install or repair DHW pipe insulation 		
	<ul style="list-style-type: none"> • Replace incandescent lamps • Proper lighting maintenance • Ensure lighting controls operate properly • Reduce/control decorative lighting • Tune interior lighting scheduling • Tune exterior lighting scheduling 		
	Receptables and Plug Loads	<ul style="list-style-type: none"> • Transformer maintenance • Vending machine controls • Compressed air system maintenance • Compressed air leak repair • Install plug load controls • Computer management software • Replace computers/monitors with ENERGY STAR • Enable office equipment sleep settings 	
		Refrigeration	<ul style="list-style-type: none"> • Clean refrigeration coils • Turn off ice makers when unoccupied

Table 19. RCx-Lite Fast Track Measures

Other RCx-Lite measures outside this measure list may be included as Custom RCx-Lite measures within the tool subject to review and approval by the Program Manager. If it is unclear if a measure qualifies as an RCx-Lite measure, please reach out to the Program Manager for clarification.

4.7 Program Process

The RCx-Lite Program consists of the following phases:

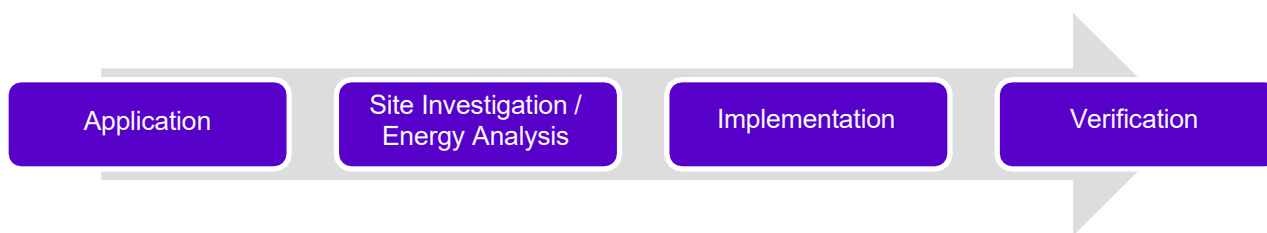


Figure 4. RCx-Lite Program Process

4.7.1 Application

The purpose of this phase is to:

- Verify the customer’s eligibility for participation in the RCx-Lite program.
- Confirm the pathway (Study or Custom) the customer will pursue
- Review and approve the proposed Program Ally fee and/or scope of work.



For the study pathway, when evaluating the proposed site investigation study fee and Program Ally incentive, several factors are considered:

- Anticipated energy savings target
- Facility size (particularly conditioned square footage) and annual energy usage
- System complexity and diversity of opportunities

The Program Ally and/or Customer will provide general facility information which is collected using a project screening workbook provided by the program. If the project passes the initial screening, the application will be approved, and both the customer and Program Ally will receive confirmation to move forward with the next phase.

This phase typically spans up to one month.

Application Phase Checklist

- Complete Application** submitted through the Customer or Program Ally portal.

- Energy Management Project Screening Workbook** containing general details of the building and project.

- Customer W9, ST-4, or ST-5**, which is required for all incentive payments

- Customer Proposal / Agreement** including
 - 1. Project and Customer Overview** – Brief description of the site, customer objectives, and known systems or opportunities.
 - 2. Proposed Scope of Work** – Description of services to be provided for this specific site.
 - 3. Project Approach and Timeline** – Summary of the methodology and estimated timeline for each project phase (e.g., study, installation).
 - 4. Pricing** – Itemized pricing for RCx-Lite Services and/or Project Costs.

For the **Study Pathway**, pricing shall include Site Investigation, Implementation Oversight, and Additional services (as applicable).

For the **Custom Pathway**, pricing shall reflect labor and material costs of measures.
 - 5. Customer Signature and Acceptance** – Executed agreement between the customer and program ally, signed by both parties.

Table 20. Application Phase Checklist (RCx-Lite)

4.7.2 Pre-approval Phase

RCx Plan

RCx Plans are not required for the RCx-Lite Program.



RCx-Lite Assessment Tool, Targeted Study, and/or Savings Calculations

Once the application is approved, the Program Ally either (1) conducts a detailed site investigation using TRC's RCx-Lite Assessment Tool to identify and evaluate potential measures (Study Pathway), (2) develops a targeted study (Study Pathway), or (3) submits custom calculations (Custom Pathway).

Key activities include:

Key Activities	RCx-Lite Assessment Tool	Targeted Study	Custom Pathway
Collect and analyze baseline facility energy usage, including existing equipment parameters.	✓	✓	✓
Identify measures and estimating savings for each proposed measure using TRC's RCx-Lite Assessment Tool	✓		
Develop customized measure calculations	Optional / As Needed	✓	✓
Gather cost estimates from the customer's preferred contractor(s).	✓	✓	✓
Perform M&V to establish baseline conditions		When Required	When Required
Compile Targeted Study Report		✓	

Table 21. RCx-Lite Assessment Tool, Targeted Study, and Custom Pathway Table

TRC may conduct a pre-approval site inspection for selected projects. Once projects are pre-approved, the Program Ally will lead a meeting with the customer to present the findings and discuss the implementation path forward. This phase typically spans up to two months.

Pre-Approval Phase Checklist

- Completed RCx-Lite Assessment Tool** or **Targeted Study** (Study Pathway only).
- Signed Energy Savings Report** confirming acceptance to move forward with selected measures (this report is an output of the RCx-Lite Assessment Tool and only required when using the RCx-Lite Assessment Tool)
- Estimated Energy Savings Calculations** to support custom calculations
- Trended/logged BAS data** and any spot measurements to support custom calculations (Optional)



Pre-Approval Phase Checklist

- Contractor Quotes** for ECM implementation (from customer's preferred contractors)
- Program Ally Invoice** for Investigation Phase milestone, submitted upon TRC approval of all deliverables (Study Pathway only)

Table 22. Pre-Approval Phase Checklist (RCx-Lite)

4.7.3 Implementation Phase

Implementation of the selected measures begins at the facility, led by the customer's preferred contractor(s) and/or in-house staff. The Program Ally remains engaged throughout this phase to support the customer, coordinate with contractors, and track progress.

The Program Ally should collect copies of invoices from the customer or contractors for all implemented ECMs. These invoices will be submitted in the next phase.

TRC may conduct a post-implementation inspection on select projects. M&V may be required for projects with savings greater than 500,000 kWh or as required by the Program Implementer (e.g., in cases where new or complex technologies are involved or there is a high degree of uncertainty in calculated savings)

The implementation phase is expected to last up to four months.

Implementation Phase Checklist

- Customer Email Confirming** all measures were installed.
- Program Ally Progress Invoice** for services provided to date.
- Copies of invoices collected from customer and/or contractors** for all implemented ECMs
- Updated RCx-Lite Assessment Tool, targeted study, or custom calculations**, with updated savings, measures, and costs to reflect the installed scope of work.
- TRC Post-Inspection**, if required.
- Post-installation M&V**, if required.



Table 23. Implementation Phase Checklist (RCx-Lite)

4.8 Required Documentation

4.8.1 RCx-Lite Assessment Tool

To complete the RCx-Lite Workbook effectively, proceed left to right, starting with the **Project Info** tab and continuing through each section. While the tool supports both electric and gas measures, the primary focus of the study should be electric energy efficiency opportunities.

Project Info Tab

The Program Ally should complete **all shaded cells** with general project details including:

- Site and building name
- Facility type and operating characteristics
- Contact information
- Major heating and cooling system descriptions

These inputs affect the default values and calculations throughout the workbook. Measures may not calculate or calculate correctly in inputs in this tab are missing.

Utility Data Tab

The Program Ally must collect and enter **12 months** of utility bill data for **electricity and gas** including costs. These entries are used to assess measure savings as a percentage of total site consumption. Program Allies should be mindful of how the total building consumption aligns with estimated measure savings. For example, after completing the tool, if the project is indicating a 30-50% reduction in energy consumption, the Program Ally should revisit tool inputs.

Measure Tabs

There are 11 tabs organized by building systems and equipment that contain all inputs required to calculate savings.

- Building Envelope
- HVAC Controls
- Fan and Pump Motors
- Ventilation
- Heating
- Cooling
- Service Hot Water
- Lighting
- Receptacles and Plug Loads
- Refrigeration
- Custom

Program Allies should only complete measures that were evaluated as part of the study. If measures are not applicable, they can be left blank.



For each selected measure, the Program Ally should enter all shaded inputs to estimate energy savings and input an estimated cost (which can be updated later based on actual costs).

Measure Interactivity

Several measures within the RCx-Lite tool interact with one another in ways that can significantly affect overall energy savings estimates. To produce accurate results, measures must be applied in a logical order and each measure should establish a new post-condition that becomes the baseline for subsequent measures. When multiple measures target the same system or interact, the program ally should confirm that savings are not double counted. If the project includes custom measures, custom measures should reflect a baseline after all other standard RCx-Lite measures are addressed.

Data Collection

Program allies should collect and save key documentation for all recommended measures to support future technical review, quality assurance, or follow-up questions. This includes field notes, equipment nameplate photos, system settings, screen captures, trend data, and general site photos. Thorough documentation helps verify baseline conditions, clarify assumptions, and provide evidence of operational issues. TRC technical reviewers may request supplemental information to support inputs used in the tool, especially for measures that are complex, have interactive effects, or may require additional explanation.

Report Tables – ECM Summary tab

This tab compiles all calculated savings, estimated costs, paybacks, and potential incentives for each measure. In the **Measure Status** column, the Program Ally should select one of the following options for each evaluated measure:

- **Installed:** Already installed, following completion of the study. This status should be used until measures are implemented.
- **Recommended:** Included in the proposed project scope.
- **Not Recommended:** Evaluated but not recommended for implementation.
- **Not Recommended – Alternate Selected:** A viable option, but another measure was selected in its place.

Energy Savings Report tab

This tab auto-generates a project summary based on selected **recommended** measures:

- Energy savings
- Estimated costs
- Incentives and payback metrics
- Program benefits

This report must be signed by the customer prior to implementation.

4.8.2 Targeted Studies

Targeted studies document system-specific investigations where custom analysis is needed to support RCx-Lite measures. These reports provide a concise but complete record of the project,



summarizing baseline conditions, proposed optimization strategies, and expected savings. Each report should offer the program implementer and customer enough detail to validate assumptions, understand potential benefits, and guide decision-making. Minimally, targeted studies should contain the following contents:

Section	Contents
Executive Summary	<ul style="list-style-type: none"> Brief project overview, site description, systems reviewed, and study objectives.
Baseline Conditions	<ul style="list-style-type: none"> Description of existing equipment, controls, and operating parameters. Supporting data (spot measurements, trend logs, nameplate info, photos).
Proposed Measures	<ul style="list-style-type: none"> Description of each ECM, control change, or optimization strategy. Assumptions used in analysis.
Savings Analysis	<ul style="list-style-type: none"> Methodology (TRM references, engineering equations, variables, and sources). Estimated energy savings (kWh, kW, therms if applicable).
Cost and Implementation	<ul style="list-style-type: none"> Cost estimates (program ally or contractor provided). Simple payback or ROI with and without incentives
Appendices	<ul style="list-style-type: none"> Appendix A: Equipment Lists (Nameplate data, quantities, locations) Appendix B: Site Photos (Pre and post-installation photos) Appendix C: M&V Plan (if required)

Table 24. Targeted Studies (RCx-Lite)

4.9 Special Requirements – Compressed Air Optimization and Leak Repair

Compressed air system leak detection and operational optimization projects are now eligible for participation under RCx-Lite at the same incentive rates. These projects are not eligible under the Custom program and are uniquely supported under RCx-Lite. Projects should aim to reduce total system losses to below 10–15% of compressor capacity, where feasible.

4.9.1 Eligibility Requirements

Compressed air projects must meet the following criteria:

- Existing System Only:** The project must involve an existing and operational compressed air system.
- Tunable Measures:** Measures must focus on operational and maintenance improvements, such as:
 - Leak detection and repair
 - Pressure setpoint optimization
 - Load/unload control adjustments



- Operating schedule adjustments
- Elimination of inappropriate uses of compressed air
- Header or zone balancing to reduce waste
- **No Major Equipment Replacements:** Replacing compressors, dryers, or controls is not allowed under this track. New system installations or major capital upgrades (e.g., new compressors, dryers, receivers) are not eligible.

4.9.2 Compressed Air Study Requirements

To qualify for incentives, the Program Ally shall submit a study including:

- Description of the existing system (compressors, operating pressure, system configuration)
- Leak detection method (manual, ultrasonic, third-party audit, etc.)
- Leak survey including leak ID, location, leak size, operating pressure, and repair recommendations (if applicable)
- Estimated baseline energy usage (kWh/year) and leak rate (CFM or % of system capacity)
- M&V plan with data sources, logging periods, and methodology used to quantify savings
- Calculated estimated energy savings for each measure
- Compressed air leak savings shall be calculated in accordance with Section 3.12.2 of the NJ TRM (Compressed Air Leak Detection). Program Allies are encouraged to use program's Compressed Air Leak Detection Calculator.
- Minimum of 2 weeks of pre-implementation M&V trend data, including:
 - **Unprocessed data** (raw logger output, e.g., power draw, pressure, runtime)
 - **Processed data** (normalized summaries, charts, and key metrics)
- M&V data must be gathered from power meters, current transducers, onboard compressor logs, or other approved sources. Use of estimated or assumed run hours is not sufficient.

4.9.3 Post-installation Requirements

Following implementation, the Program Ally shall submit the following documentation:

- Description of measures implemented and any changes from original study
- Summary of completed repairs (including number and location of leaks sealed)
- Minimum of 2 weeks of post-implementation M&V trend data, including:
 - **Unprocessed data** (raw logger output, e.g., power draw, pressure, runtime)
 - **Processed data**, showing reductions in energy use, runtime, or system pressure
- Brief qualitative assessment of operational impact (e.g., reduced compressor cycling, improved pressure stability)



5 Strategic Energy Management

5.1 Program Description and Goals

The SEM program is designed to help large commercial and industrial (C&I) facilities achieve sustained energy savings by improving the way energy is managed across the organization. Through a holistic approach that emphasizes operational efficiency, behavioral change, and continuous performance tracking, participants can unlock deeper, longer-term energy reductions.

Participants receive expert support from a trusted SEM Program Ally to develop and execute a customized energy management plan. This includes guidance on system monitoring, staff training, benchmarking, and project planning.

Facilities may choose to participate individually or as part of an industry cohort, where peer collaboration and the exchange of best practices can enhance outcomes. Financial incentives are provided based on verified energy savings achieved throughout the engagement.

5.2 Customer and Building Eligibility

Customer and building eligibility requirements include:

- The customer must be a commercial or industrial building within the JCP&L territory
- The building must have a minimum peak demand of 300 kW
- The first-year project savings must exceed 200,000 kWh
- Commitment from executive leadership to make employees and resources available to prioritize energy efficiency.
- The project should have potential for significant energy savings, with agreement the customer will implement recommendations that have a 2-year payback or less
- The customer must use an approved SEM Program Ally
- Program Incentives and requirements are defined at the time of submission of the application.

Exceptions to eligibility requirements require approval by the Program Manager and JCP&L.

5.3 Project Phases

The SEM program is delivered in three key phases, each designed to build internal capacity, drive measurable savings, and establish a lasting culture of energy management.

Phases	Description
Phase 1 SEM Action Plan Phase	The SEM Program Ally collaborates with the customer to establish a baseline for energy performance, define an energy policy, and conduct a detailed site investigation. This phase identifies low- and no-cost operational improvements and lays the foundation for long-term energy savings. The Program Ally develops an SEM Action Plan , outlining energy savings goals, key strategies, and a measurement and verification (M&V) approach. The Program Ally also secures engagement from organizational leadership is secured to support implementation and long-term success.



Phases	Description
<p>Phase 2 Implementation and Optimization Phase</p>	<p>During this phase, the customer and Program Ally work together to implement the strategies defined in the SEM Action Plan. This includes:</p> <ul style="list-style-type: none"> Operational and behavioral changes Optimization of HVAC, lighting, and equipment controls Training for staff and formation of a cross-functional energy team <p>Energy performance is actively tracked using monitoring tools, and performance feedback is used to fine-tune systems and reinforce continuous improvement.</p>
<p>Phase 3 Measurement and Verification Phase</p>	<p>The Program Ally verifies energy savings comparing actual energy use to the established baseline, using normalized data to account for variables such as weather and occupancy. The program provides incentives based on documented savings and successful completion of program milestones. The customer is supported in sustaining SEM practices through continuous monitoring, recurring assessments, and ongoing staff engagement to ensure long-term persistence of savings.</p>

Table 25. Project Phases (SEM)

5.4 Incentive Structure and Payment Milestones

5.4.1 Customer Incentives

Phases	Description
<p>Phase 1 Site Investigation Phase (SEM Action Plan)</p>	<p>None Customers receive the SEM Action Plan at a reduced cost.</p>
<p>Phase 2 Implementation and Optimization Phase</p>	<p>None Customers receive SEM coaching and benefits at no cost.</p>
<p>Phase 3 Measurement and Verification Phase</p>	<p>Up to \$0.30/kWh and up to \$0.50/therm. A 50% payment may issued following 6 months of engagement and the balance after 12 months of engagement, or whenever M&V is complete. Customers will receive incentives for realized savings covering up to 70% of the project cost. The gas incentive rate cannot exceed the published incentive rate published by the gas utility</p>



Table 26. Customer Incentives (SEM)

5.4.2 Program Ally Incentives

The SEM Program Ally will be eligible for incentives to cover up to 70% of the cost the SEM Action Plan and SEM services. Services will be capped at the lesser of the projected/realized energy savings or 70% of service costs. All service costs are subject to review prior to pre-approval and payment.

Phases	Description
Phase 1 Site Investigation Phase (SEM Action Plan)	Up to \$0.10/kWh Capped at 30% of SEM services. There are no gas incentives available for this phase.
Phase 2 Implementation and Optimization Phase	None
Phase 3 Measurement and Verification Phase	Tier 1 (Savings Below Study Target): Up to \$0.15/kWh and up to \$1.20/therm Tier 2 (Savings at or above Study Target): Up to \$0.20/kWh and up to \$1.20/therm Capped at the remaining SEM services cost, up to 70% of the total SEM services. The gas incentive rate cannot exceed the published incentive rate published by the gas utility.

Table 27. Program Ally Incentives (SEM)

5.5 Eligible Measures

The first phase of the SEM program begins with a collaborative assessment led by an approved Program Ally. This includes establishing an energy performance baseline, identifying operational and behavioral improvement opportunities, and developing a strategic SEM Action Plan. The plan outlines measurable goals and recommended actions to drive continuous energy performance improvement.

Unlike traditional one-time studies, SEM supports ongoing implementation of energy-saving practices and projects over a sustained engagement period. Customers participating in the program commit to pursuing operational improvements and efficiency measures identified through the SEM process, particularly those with short payback periods or no upfront capital cost.

To increase the potential for deeper savings, targeted audits or system-level diagnostics may be conducted as part of the SEM Action Plan to supplement SEM planning efforts, with findings incorporated into the energy management strategy.

The SEM Program Ally provides technical support, tracks performance through normalized data analysis, and reports verified savings to the TRC. Incentives are awarded based on achieved energy savings and completion of key milestones.

The Program Ally oversees the implementation of selected measures, tracks performance, and reports verified savings to the program administrator. The program covers 70% of the cost of the site



SEM Action Plan and provides incentives to both the customer and the Program Ally at key phases throughout the project lifecycle.

Typical measures and strategies supported through SEM Include:

- Optimization of building system schedules and controls (HVAC, lighting, etc.)
- Identification and correction of operational inefficiencies
- Staff training and creation of an internal energy team
- Enhanced use of building automation and monitoring systems
- Load shifting and peak demand management
- Maintenance scheduling and fault detection response
- Engagement of occupants in energy-saving behaviors
- Low- and no-cost measures aligned with persistent performance goal

Where applicable, measures implemented during the SEM engagement may be included as part of the project scope, **excluding any measures eligible for prescriptive incentives**. If it is unclear if a measure can be included in the SEM scope, please reach out to the Program Manager for clarification.

5.6 Customer Engagement and Energy Team Development

A successful SEM program requires strong customer engagement and the formation of an internal energy team. These teams act as the driving force behind sustained energy improvements by coordinating activities, promoting energy awareness, and fostering a culture of accountability across departments. While technical analysis and data tracking are essential, lasting success is only possible when customers are actively involved and invested in the process.

The energy team should include a cross-functional group of employees with representation from operations, maintenance, finance, and management. This diversity ensures that identified energy-saving strategies are practical, prioritized, and supported across the organization. The team is responsible for leading internal communications, implementing operational changes, supporting training efforts, and monitoring progress toward goals. **The customer should designate an energy champion** to coordinate with the Program Ally and serve as the internal lead. Key roles include:

Role	Description
Energy Champion	Time Commitment: 4–16 hours/month Serves as the main point of contact for the SEM program, coordinating activities between the facility, Energy Coach, and Energy Team. Oversees scheduling, data collection, and internal communications. Typically holds a role such as Energy Manager, Facilities Manager, or Operations Manager.
Energy Data Manager	Time Commitment: 2–16 hours/month Responsible for collecting and managing utility and operational data needed for energy tracking and M&V. Often overlaps with the Energy Champion role in smaller organizations.
Executive Sponsor	Time Commitment: 1–3 hours/month A senior leader (e.g., COO, Plant Manager) who approves participation,



Role	Description
	allocates staff time, and supports SEM goals at the organizational level. Participates in key meetings and milestone reviews.
Energy Team Members	Time Commitment: 2–8 hours/month per member A cross-functional team including staff from operations, facilities, finance, and other departments. Participates in workshops, treasure hunts, and implementation planning. Helps drive and sustain energy-saving actions.

Table 28. SEM Roles and Responsibilities

Ongoing staff engagement is critical. Program Allies are encouraged to help facilitate energy treasure hunts, training sessions, and periodic check-ins that keep energy management top of mind. Clear communication of goals, milestones, and results should be built into team meetings and performance reviews. By involving staff at every level, from senior leadership to front-line operators, the SEM process can unlock insights, drive continuous improvement, and embed energy efficiency into the organization’s day-to-day operations.

Establishing a committed energy team is also key to long-term program success beyond the initial SEM engagement. These teams help institutionalize energy management practices and maintain savings after the initial implementation period ends. The program provides tools and guidance to help customers formalize their teams, assign roles, and build lasting internal capacity to manage energy as a core business practice.

5.7 Program Process

The SEM Program consists of the following phases:

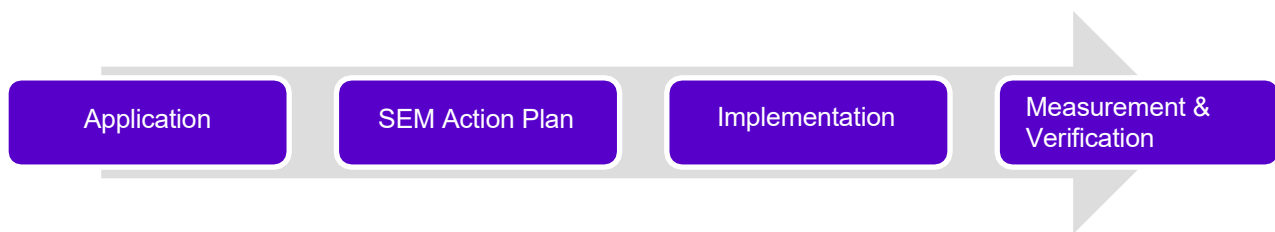


Figure 5. SEM Program Process

5.7.1 Application

The purpose of this phase is to:

- Confirm the customer’s eligibility for participation in the SEM offering.
- Review and approve the proposed scope of work, savings target and Program Ally fee.
- Conduct a kickoff call with the customer and Program Ally to discuss the project scope and outline the SEM process.

When evaluating the proposed Strategic Energy Management Action Plan (study) fee and Program Ally incentive, several factors are considered:



- Anticipated energy savings target
- Facility size (particularly conditioned square footage) and annual energy usage
- System complexity and diversity of opportunities
- Building automation system (BAS) capabilities, including data access, trending, and storage limitations
- Cost-effectiveness of the project (e.g., simple payback, energy cost savings)

The Program Ally and/or Customer will provide general facility information which is collected using a project screening workbook provided by the program. If the project passes the initial screening, the application will be approved, and both the customer and Program Ally will receive confirmation to move forward with the next phase.

This phase typically spans up to one month.

Application Phase Checklist

- Complete Application** submitted through the Customer or Program Ally portal.

- Energy Management Project Screening Workbook** containing general details of the project.

- Customer W9, ST-4, or ST-5**, which is required for all incentive payments

- Customer Proposal / Agreement** including
 1. **Project and Customer Overview** – Brief description of the site, customer objectives, and known systems or opportunities.
 2. **Proposed Scope of Work** – Description of services to be provided for this specific site.
 3. **Project Approach and Timeline** – Summary of the methodology and estimated timeline for each project phase (e.g., SEM Action Plan, study, implementation, M&V).
 4. **Pricing** – Itemized pricing for Site Investigation, SEM Action Plan, Implementation Oversight, Measurement & Verification (M&V), and Additional services (as applicable)
 5. **Customer Signature and Acceptance** – Executed agreement between the customer and program ally, signed by both parties.

Table 29. Application Phase Checklist (SEM)

5.7.2 SEM Action Plan

Once the application is approved, TRC will schedule and lead a kickoff meeting with the customer and the approved Program Ally. During this phase, the Program Ally conducts a detailed site investigation to identify and evaluate potential energy conservation measures (ECMs). Key activities include:

- **Identifying the customer's Energy Champion(s)** to serve as the liaison between the Program Ally and the organization
- Developing Energy Team Roles and Responsibilities including commitment to a 1 Year SEM



process

- **Collecting and analyzing baseline energy usage** across the facility, using utility data, Building Automation System (BAS) trends, submetering, or other tracking tools.
- **Identifying operational and behavioral improvement opportunities** through on-site walkthroughs, staff engagement, and performance analysis.
- **Developing an SEM Action Plan** that includes energy savings goals, key strategies, an M&V approach, and a framework for ongoing monitoring and improvement.
- **Supporting the customer in gathering cost estimates** for any capital or operational improvements that may be implemented as part of the engagement.
- **Participating in regular check-in meetings** with the customer and TRC to review progress, share insights, and adjust strategies as needed.

Once approved, the Program Ally will lead a meeting with the customer to present the findings and discuss the implementation path forward. This phase typically spans up to three months.

Site Investigation Phase Checklist – SEM Action Plan Submission

<input type="checkbox"/>	Completed SEM Action Plan (See Section 5.8.1 SEM Action Plan for content requirements)
<input type="checkbox"/>	Completed SEM ECM Summary Form
<input type="checkbox"/>	Completed M&V Plan (See Section 5.8.2 M&V Plan for content requirements)
<input type="checkbox"/>	Estimated Energy Savings Calculations (developed in accordance with Energy Management Technical Guidelines)
<input type="checkbox"/>	Trended/logged BAS data and any spot measurements, per program M&V Guidelines
<input type="checkbox"/>	Contractor Quotes for ECM implementation (from customer's preferred contractors)
<input type="checkbox"/>	Program Ally Invoice for Investigation Phase milestone (submitted upon TRC approval of all deliverables)
<input type="checkbox"/>	Ongoing Monthly Progress updates provided during the phase

Table 30. Site Investigation Phase Checklist (SEM)

5.7.3 Implementation Phase

Implementation of the selected ECMs begins at the facility, led by the customer's preferred contractor(s) and/or in-house staff. The Program Ally remains engaged throughout this phase to support the customer, coordinate with contractors, and track progress.

Routine monthly check-ins involving the customer, Program Ally, contractor(s), and TRC will be scheduled to monitor project status, resolve questions, and confirm that ECMs are proceeding in alignment with the approved SEM Action Plan.



The Program Ally should collect copies of invoices from the customer or contractors for all implemented ECMs. These invoices will be included in the Final SEM Action Plan Report, submitted in the next phase.

The customer must notify TRC when all ECMs have been installed and may request a partial 50% incentive payment as soon as after 6 months of engagement. This communication initiates the start of the Measurement and Verification (M&V) phase. TRC may conduct a post-implementation inspection on select projects prior to M&V.

Implementation Phase Checklist

- Customer Email Confirming** all measures were installed (as applicable)

- Program Ally Progress Invoice** for services provided to date.

- Copies of invoices collected from customer and/or contractors** for all implemented ECMs

- Updated SEM ECM Summary Form**, with updated savings, measures, and costs to reflect the installed scope of work.

- TRC Post-Inspection**, if required.

Table 31. Implementation Phase Checklist (SEM)

5.7.4 M&V Phase

Once implementation is complete, the Program Ally begins data collection to validate the energy savings achieved through the installed ECMs. Trending duration and data requirements vary depending on the measure type and are detailed in the SEM Action and M&V plans.

The Program Ally develops a final SEM report that provides:

- A summary of the implementation process and project scope, including any scope changes or issues encountered
- Confirmation of installed ECMs, including installation date(s)
- Final implementation costs (based on submitted invoices)
- Final measured or calculated energy savings, consistent with the approved M&V Plan
- M&V results and data, including trended or logged data, spot measurements, and analysis
- Any updates to the original SEM Action Plan or ECM list
- Photos or documentation of installed measures, if applicable

TRC reviews and approves the Final M&V Report before it is presented to the customer.

Following approval, the Program Ally leads a verification meeting with the customer and TRC to review findings, close out the project, and confirm any remaining documentation or deliverables.



M&V Phase Checklist	
<input type="checkbox"/>	Final SEM Action Plan (updates to the SEM Action Plan including implemented ECMs, verified energy savings, final costs, M&V methodology and results, and all required appendices)
<input type="checkbox"/>	Verified energy savings calculations prepared in accordance with the project's M&V plans
<input type="checkbox"/>	Trended/logged data and any spot measurements submitted per the M&V Plan (including clean / analyzed data)
<input type="checkbox"/>	Updated SEM ECM Summary Form including final verified savings.
<input type="checkbox"/>	Program Ally Progress Invoice for services provided to date.
<input type="checkbox"/>	TRC Post-Inspection , if required.

Table 32. M&V Phase Checklist (SEM)

5.8 Required Documentation

5.8.1 SEM Action Plan

Program Allies may use the SEM Action Plan template or provide an SEM Action Plan in their own format. The following table provides a list of contents that can be included in SEM Action plans.

Section	Contents
Introduction	<ul style="list-style-type: none"> • Purpose (Why the SEM Action is being developed) • Overview of the organization's SEM goals • Summary of baseline performance and expected savings • Key strategies, timeline, and leadership commitment
Energy Policy Statement	<ul style="list-style-type: none"> • Organization's formal commitment to energy efficiency and sustainability • Guiding principles and long-term energy goals • Signed policy or leadership endorsement document (if available)
Energy Management Team	<ul style="list-style-type: none"> • List of core SEM team members and roles including the Energy Champion • Internal reporting structure for SEM activities • Evidence of executive or senior management support (e.g., kickoff letter, policy endorsement) • Description of leadership engagement in driving SEM culture • Communication Protocols (Meeting cadence, reporting expectations, and escalation procedures)
Project Schedule	<ul style="list-style-type: none"> • SEM schedule (Anticipated timeline for all major SEM phases)



Section	Contents
	and deliverables)
Building Description	<ul style="list-style-type: none"> • General Info (Building size, location, use type, hours of operation) • HVAC System (Equipment type, age, known issues) • Building Automation System (Capabilities, data points, and limitations)
Baseline Energy Analysis	<ul style="list-style-type: none"> • Defined baseline period and data sources (utility bills, submetering, BAS, etc.) • Energy consumption and demand by fuel type • Key Energy Performance Indicators (KPIs) • Normalization factors (weather, production, occupancy)
Opportunity Identification and Field Assessment	<ul style="list-style-type: none"> • Description of site walkthroughs or “energy treasure hunts” • Input gathered from building operators and staff • List of identified operational, behavioral, and low-cost ECM opportunities • Notes on any supplemental audits or diagnostics
Action Plan and Implementation Strategy	<ul style="list-style-type: none"> • Prioritized list of projects and initiatives • Measure list (description, estimated savings and cost, implementation timeline) • Implementation roadmap (e.g., Gantt chart or milestone tracker)
Monitoring and Continuous Improvement	<ul style="list-style-type: none"> • Plan for ongoing tracking using dashboards or data tools • Routine performance review schedule (monthly, quarterly) • Process for applying lessons learned and adjusting strategies • Maintaining staff engagement over time
Training and Engagement	<ul style="list-style-type: none"> • Training topics (controls optimization, awareness, maintenance best practices) • Schedule and delivery format (in-person, virtual, hands-on) • Communication and outreach strategies to involve occupants and staff • Creation or support of an internal energy team
Risk Management and Barriers	<ul style="list-style-type: none"> • Known or potential challenges to implementation • Strategies to overcome common obstacles (e.g., funding, staffing, competing priorities) • Escalation pathways for SEM delays or issues
Appendices	<ul style="list-style-type: none"> • Appendix A: Equipment Inventory Forms (Nameplate data, quantities, locations) • Appendix B: Site Photos (Pre-installation photos, where applicable) • Appendix C: M&V Plan • Appendix D: Training Materials • Appendix E: Signed Energy Policy



Table 33. SEM Action Plan Contents

5.8.2 M&V Plan

Program Allies may use the M&V plan template to document project details, M&V processes, and expected results. Alternatively, Program Allies may submit M&V plans in their own templates and formats. The following table provides a list of contents that should be included in M&V plans.

Section	Contents
Introduction	<ul style="list-style-type: none"> • Purpose (Why the M&V Plan is being developed) • Scope (Systems and spaces included in the M&V plan) • Overview of the facility and project
Measure Descriptions	<ul style="list-style-type: none"> • Baseline description (existing equipment/system types, sizes, controls, performance characteristics) • Proposed description (selected equipment/system types, sizes, controls, performance characteristics) • Controls and operational strategies implemented • Expected energy performance improvements (e.g., % efficiency increase, demand reduction)
IPMVP Option and Measurement Boundary	<ul style="list-style-type: none"> • IPMVP option and measurement boundary (Selected protocol and physical/virtual boundaries) • Interactive effects (Consideration of interactions between measures)
Pre-installation Reporting	<ul style="list-style-type: none"> • Establishing baseline energy consumption (Methodology for baseline per measure) • Sampling approach (Sampling methodology during baseline) • Energy-influencing parameters (Variables affecting baseline energy) • Non-metered data points (Handling data not directly metered)
Post-installation Reporting	<ul style="list-style-type: none"> • Reporting period (Post-installation data collection timeframe) • Establishing post-installation energy consumption (Methodology for post-installation per measure) • Sampling approach (Sampling methodology post-installation) • Non-metered data points (Handling non-metered data post-installation)
Basis for Adjustment	<ul style="list-style-type: none"> • Routine adjustments (Planned operational or environmental changes) • Non-routine adjustments (Unplanned or one-time events)
Savings Calculation Methodology	<ul style="list-style-type: none"> • Analysis approach (Statistical and analytical techniques) • Key equations (Formulas used for savings calculations) • Independent variables (Inputs for savings models) • Dependent variables (Measured outputs) • Statistical metrics (Metrics for evaluating results)
Meter Specification and Data Collection	<ul style="list-style-type: none"> • Meter inventory (List and specs of meters used) • Additional procedures and notes (Supplementary



Section	Contents
	metering/data collection instructions)
Expected Accuracy and Uncertainty	<ul style="list-style-type: none"> • Expected accuracy (Accuracy targets or thresholds) • Confidence and precision levels (Statistical confidence aims) • Expected uncertainties (Potential uncertainty sources)
M&V Report Format	<ul style="list-style-type: none"> • Outline and structure of the final M&V report
Owner Acknowledgement	<ul style="list-style-type: none"> • Confirmation of owner understanding and approval of the M&V Plan

Table 34. M&V Plan Contents

5.8.3 Final SEM Report

Program Allies may use the Final SEM Report template or provide a Final SEM Report in their own format. The following table provides a list of contents that can be included in Final SEM Reports.

Section	Contents
Executive Summary	<ul style="list-style-type: none"> • Summary of SEM engagement and outcomes • Total estimated energy and cost savings • Key successes and lessons learned
Project Overview	<ul style="list-style-type: none"> • Organization background and facility description • Overview of SEM goals and objectives • Summary of SEM phases and timeline
Energy Management Team	<ul style="list-style-type: none"> • List of team members and roles • Leadership involvement and support • Summary of team meeting and key decisions
Baseline Energy Analysis and Performance	<ul style="list-style-type: none"> • Baseline methodology and assumptions • Energy consumption and demand trends • Benchmarking values • Key Performance Indicators (KPIs) used • Weather or production normalization factors
Opportunity Identification Summary	<ul style="list-style-type: none"> • Description of walkthroughs and assessments • Total number and type of opportunities identified • Estimated savings and cost ranges by measure category (O&M, behavioral, capital)
Measures Implemented	<ul style="list-style-type: none"> • List of projects and initiatives implemented • Estimated savings and cost by measure • Implementation timeline • Challenges encountered and how they were resolved
Measurement and Verification	<ul style="list-style-type: none"> • Tools and methods used to track performance • Measurement period (dates and durations) • Energy data and key influencing variables collected • Independent variables, static factors and assumptions



Section	Contents
	<ul style="list-style-type: none"> • Summary of site inspection and operational verification activities • Summary of post-implementation performance data • Comparison to baseline and goals • Adjustments made based on findings
Savings Calculations and Methodology	<ul style="list-style-type: none"> • Data analysis and calculation methodology • Assumptions and sources used in calculations • Baseline and post-installation adjustments (routine and non-routine) • Summary of incentives
Training and Engagement Summary	<ul style="list-style-type: none"> • Topics and audience of training sessions • Engagement strategies and outcomes • Staff feedback and ongoing involvement
Continuous Improvement Plan	<ul style="list-style-type: none"> • Summary of ongoing practices adopted • Plans for sustaining momentum and engagement • Recommendations for future improvements
Conclusion and Acknowledgements	<ul style="list-style-type: none"> • Reflections on progress and impact • Recognition of key team members and contributors
Appendices	<ul style="list-style-type: none"> • Appendix A: Energy Data and Analysis Charts • Appendix B: List of Identified and Implemented Measures • Appendix C: Photos or Screenshots • Appendix D: Training Materials • Appendix E: Supporting Documentation (e.g., utility bills, dashboards)

Table 35. Final SEM Report Contents



6 Pre-Study Screening Guidelines

When identifying candidates for energy efficiency projects, Program Allies should apply guidelines and best practices that align with program goals and highlight significant improvement opportunities. This section includes a pre-screening checklist to help Program Allies efficiently evaluate potential projects, identify strong candidates, and maximize energy savings of each project.

6.1 Understand Program Requirements

Before starting a study, confirm that the customer meets all eligibility requirements described in the applicable subprogram section.

6.2 Understand the Facility

To identify energy-saving opportunities, Program Allies should collect and review comprehensive facility information while understanding its operations including:

- Historical utility bills for electricity, gas, and all other fuel use over the past 12–24 months
- Facility layouts detailing design plans and operational flow
- Inventory of equipment with specifications, operating schedules, and performance data
- Operational records such as maintenance logs
- Energy management policies
- Previously completed energy audits
- Detail on recently completed or upcoming projects
- Insights into operating hours to capture seasonal energy demand variations and key process energy usage.
- Behavioral insights, including staffing schedules and occupant behaviors affecting energy consumption

By compiling and analyzing this data, Program Allies can identify energy efficiency opportunities and prioritize measures for maximum impact.

The age of the building should also be considered when evaluating energy efficiency opportunities. Older buildings typically have more potential for energy improvements since they may not have had recent upgrades and are often less energy efficient. In addition to considering the building's age, it's important to assess whether there are opportunities for comprehensive work scopes, such as upgrading HVAC systems, insulation, or lighting. These upgrades can lead to significant energy savings.

6.3 Establish Baseline Metrics

Benchmarking and energy cost assessment are critical initial steps in identifying inefficiencies and areas for improvement in a facility's energy performance. By comparing the facility's energy usage to similar buildings, benchmarking highlights opportunities for increased efficiency, while an energy cost assessment quantifies potential savings and justifies investment in energy-saving upgrades. Establishing baseline metrics, such as total energy consumption, costs, and energy use intensity (EUI), provides a foundation for measuring improvements post-audit and ensures the project delivers



tangible benefits. As part of this process, Program Allies should assess if projects have the potential to meet minimum savings thresholds required by the program.

6.4 Stakeholder Engagement

Equally important is gauging the customer’s willingness to proceed with the project. It’s essential to assess if the decision maker for the customer is committed to implementing energy efficiency measures and if they are aligned with the project’s goals. Financial considerations also play a key role in the project’s success. It’s important to determine if the customer has the capital to invest in the project. If not, alternative financing options or incentives may be necessary to make the project feasible.

Another factor to assess is whether the customer has recently completed any energy efficiency upgrades. If the facility has already undergone improvements, the potential for further savings may be limited. It’s also helpful to check if the facility has a capital improvement plan, as this plan may outline future upgrades or investments that could align with energy efficiency goals.

6.5 Pre-screening Checklist

Program Allies should use the following pre-screening checklist when evaluating projects?

Pre-Screening Checklist	
<input type="checkbox"/>	Is the decision maker for the customer willing to engage in an energy efficiency project?
<input type="checkbox"/>	Does the customer have the capital or financing options to implement the project?
<input type="checkbox"/>	Has the facility undergone significant efficiency upgrades recently?
<input type="checkbox"/>	Are there opportunities for a comprehensive project scope?
<input type="checkbox"/>	What is the age and condition of the building and its systems?
<input type="checkbox"/>	Does the facility have a history of high energy consumption compared to benchmarks?
<input type="checkbox"/>	Does the facility have potential to meet minimum program savings targets?
<input type="checkbox"/>	Is there a capital improvement plan in place that could support the project?
<input type="checkbox"/>	Are there potential measures with significant gas savings?

Table 36. Pre-Screening Checklist



7 Calculation Guidelines

This section outlines the calculation requirements and submission standards including technical guidance on establishing appropriate baselines, applying dual baseline and measure life methodologies, and developing accurate energy savings calculations. The section also includes requirements for modeling, documentation, and technology-specific assumptions to support consistent and transparent energy savings calculations.

7.1 Calculation Submission

The following table provides for calculation submission.

Element	Description
Calculation Methodology	<p>Calculations shall include a detailed explanation of the calculation methods used and use standard engineering methodologies. Aside from inputs used to derive savings, calculations should not contain hard coded values.</p> <p>The analysis shall include energy savings (electricity, gas, and other fuels) as well as peak demand savings for summer peak electric demand (kW) and winter peak natural gas (therms per hour).</p> <p>Vendor-supplied and proprietary tools that were not / cannot be peer-reviewed cannot be used as methods to estimate savings</p> <p>For weather dependent measures, a bin-analysis or hourly analysis (including energy models) shall be provided.</p>
Weather Source	TMY3 or an approved equivalent dataset
Temperature Bins	<p>Minimum of 5°F bin intervals.</p> <p>Must cover the full operating range (e.g., -10°F to 100°F for HVAC applications).</p>
Hourly or Monthly Data	<p>Must include annual bin hours per temperature range.</p> <p>Optionally provide hourly, 15-min, or 5-min intervals for high-resolution analysis.</p>
Format	<p>Excel-based calculations or energy models can be used to estimate savings.</p> <p>Locked workbooks where formulas and references cannot be viewed will not be accepted. Calculations in.pdf format will not be accepted.</p>
Baseline Conditions	<p>Baseline conditions shall describe quantity, manufacturer, model number, capacity, power ratings, flow rates, efficiencies, hours of operation and control settings. Baseline conditions should be supported by site observations, existing equipment schedules and drawings, and specification sheets.</p>
Proposed Conditions	<p>Proposed conditions shall clearly describe how baseline conditions will be modified. Proposed equipment recommendations shall be based on commercially available equipment. Specifications may be requested to justify proposed parameters.</p>



Element	Description
Baseline and Proposed Load Profiles	Load profiles must be provided including (1) equipment operation schedules (hourly, daily, or monthly), (2) load variation by temperature, and (3) system set points, control strategies, and sequences of operation.
Assumptions	Assumptions used in calculations to establish baseline and proposed conditions or used to estimate savings shall be clearly documented. Sources of assumptions shall be provided.
Measure Granularity	Each measure should be clearly defined, including the specific technology or equipment being upgraded or installed. Measures should reflect individual components, systems, and controls. HVAC controls and plant or system upgrades should be treated as separate ECMs, and individual HVAC control strategies should each be reported as distinct ECMs Example: Boiler replacement and outdoor air reset controls are two separate ECMs. Setback controls, demand control ventilation, boiler sequencing, and supply air temperature resets are four separate ECMs.
Measure Interactivity	Individual measures aggregated into a single scope of work will often interact with each other. Measure interactivity shall be integrated into the analysis so that the total project savings account for all interactions among individual measures. Example: If the project scope includes a condensing boiler replacement and R-40 roof insulation, the baseline efficiency used in roof insulation calculations should be based on the new condensing boiler efficiency.
Measure Impact on HVAC Systems	Individual measures may indirectly impact heating and cooling loads. Such interactions shall be integrated into the analysis. Example: A lighting retrofit will likely increase heating load and decrease cooling load. In this case, additional cooling savings and a heating penalty should be included in the analysis.

Table 37. Calculation Submission Table

7.1.1 Energy Modeling

In lieu of spreadsheet calculations, energy modeling software may be used to estimate savings for very comprehensive and complex projects.

Software platforms compliant with ASHRAE 90.1 Appendix G may be used including Carrier HAP, Design Builder, EnergyPlus / OpenStudio, eQuest, IESVE, Trane TRACE 3D Plus, and Trane TRACE 700. Input and output reports are required for the baseline model, proposed model, and each individual ECM.

Required input and output reports are provided in Appendix A.

7.2 Establishing Baselines

7.2.1 Measure Baselines

Measure baseline, against which energy savings should be assessed, shall be determined in accordance with one of the four options defined in [Table 38](#): Normal Replacement, Early Replacement, Extended Life Replacement, or Equipment Add-on (aka “Retrofit”).



All proposed measures must meet or exceed current building codes/appliance standards or common market practice. The applicable building code is New Jersey’s current state energy code, which is ASHRAE 90.1-2019. In cases where ASHRAE 90.1-2019 does not apply, other applicable industry standards will be used, such as the Consortium for Energy Efficiency (CEE), EPA ENERGY STAR, Design Lights Consortium, NEMA, Federal Title 10 or other established resources such as utility/public program experience from other comparable jurisdictions.

If applicable industry standards do not apply, common market practice shall be used as the baseline.

Type	Description and Requirements	Baseline
<p>Normal Replacement / New Construction</p>	<p>Normal replacement is the replacement of equipment that has reached or passed its effective useful life (EUL) and is not classified as extended life replacement.</p> <p>All new construction applications such as new buildings and expansions on existing buildings.</p> <p>New equipment installed in an existing building that is not a retrofit or normal replacement.</p>	<p>ASHRAE 90.1-2019 or common market practice if code does not apply</p>
<p>Early Replacement</p>	<p>Replacement of equipment before it reaches 2/3 of EUL.</p> <p>Equipment must be in good condition and operating generally as intended (i.e., no significant defects or on-going maintenance issues).</p> <p>Documentation such as a nameplate must be provided to confirm equipment age.</p> <p>For HVAC systems, existing equipment may be de-rated due to age as described in Section 4.5.</p> <p>Remaining useful life (RUL) is equal to EUL – age (years).</p>	<p>Existing conditions if they can easily be established and quantified.</p> <p>Otherwise, same as normal replacement</p>
<p>Extended Life Replacement</p>	<p>Existing systems use significantly more energy than current high efficiency models and have a history of significant repair and/or maintenance. To qualify as extended life, the project must also meet both of the following rules:</p> <p>Age Based Rule: Replacement of equipment after it reaches 2/3 of EUL.</p> <p>Energy Based Rule: For chillers replacements, existing chillers must use 35% more energy than high efficiency equipment. For all other systems, the</p>	<p>Existing conditions if they can easily be established and quantified.</p> <p>Otherwise, same as normal replacement</p>



Type	Description and Requirements	Baseline
	<p>existing system must use 20% more energy than high efficiency equipment.²</p> <p>Documentation such as a nameplate must be provided to confirm equipment age.</p> <p>Records and/or invoices for service and/or repair work must indicate that the equipment has been regularly serviced or has undergone significant repairs to maintain useful performance.</p> <p>Other forms of documentation, such as a maintenance schedule / logs, recent inspection reports, preliminary measurements/trend data of existing equipment, statement from the building manager regarding viability and continued intent to use the existing equipment, or a summary of past repairs may be accepted at the Program Manager's discretion.</p> <p>For HVAC systems, existing equipment may be de-rated due to age as described in Section 4.5.</p> <p>Remaining useful life (RUL) is equal to 1/3 of the EUL.</p>	
Equipment Add-on / Retrofit	Equipment add-on (or retrofit) refers to the addition of equipment to an existing system such as HVAC controls or variable frequency drives (VFDs) that enhances performance of existing equipment.	Existing conditions if they can easily be established and quantified. Otherwise, same as normal replacement

Table 38. Measure Baselines

7.2.2 Special Case Scenarios

The following table provides guidance on establishing baselines for special case scenarios. For other scenarios or clarification how to establish baseline on a specific project, please reach out to the program manager for clarification.

Scenario	Baseline Approach
Space Decommissioning	If a space is being decommissioned (e.g., shutting down operations, demolishing a section of a building), energy savings shall not be included in the scope since the energy reduction is not driven by an efficiency improvement but rather by the removal of loads.

² This methodology is adopted from NYS Technical Resource Manual v12, Appendix N, Special Circumstance, with adjustments. In particular, this methodology modifies the age-based rule and requires the Energy-based rule to comply.



Scenario	Baseline Approach
<p>System Decommissioning</p>	<p>The same as space decommissioning, with exceptions.</p> <p>In some cases, system decommissioning may be included in the scope of work if building heating and cooling loads are reduced through energy efficiency measures such as weatherization, building envelope improvements, and ventilation optimization, among other similar measures.</p> <p>Similarly, system decommissioning may be permitted if required to optimize equipment performance, lighting levels, sound levels, comfort levels, and outdoor air.</p> <p>The program manager may require additional documentation or justification to include system decommissioning in the scope of work. In all cases, system decommissioning must be associated with an energy efficiency scope of work rather than non-energy efficiency related drivers.</p>
<p>Space Repurposing / Substantial Renovation</p>	<p>If a space is repurposed such as converting an office to a lab or warehouse to a data center, an adjusted baseline may be required, using code or standard practice for the space.</p> <p>If existing systems will be reused, adjustments may still be required for schedules, set points, and hours of operation.</p>

Table 39. Baseline Approach for Special Case Scenarios

7.2.3 Dual Baselines and Lifetime Savings

A dual baseline approach must be applied in early replacement and extended life scenarios, where a measure has two distinct periods of savings calculation.

- **Step 1 (Early Replacement [ER] or Extended Life [EL] Period):** Calculate energy savings relative to existing energy consumption based on existing conditions and equipment derating, if applicable. Savings can be claimed against existing conditions for the equipment’s remaining useful life [RUL].
- **Step 2 (Normal Replacement [NR] Period):** Calculate energy savings relative to baseline energy consumption using energy code efficiency requirements (or industry standard practice, if energy code is not applicable). Savings are claimed against the baseline for the remainder of the equipment useful life [EUL] or measure life.
- **Step 3 (Lifetime Savings):** Under normal replacement (NR) and add-on scenarios, calculate lifetime savings as:

$$\text{Lifetime Savings (NR and Add – on)} = \text{NR} \times \text{EUL}$$

Under early replacement scenarios, calculate lifetime savings as:

$$\text{Lifetime Savings (ER)} = \text{ER} \times (\text{RUL}) + \text{NR} \times (\text{EUL} - \text{RUL})$$

Under extended life scenarios, calculate lifetime savings as:



$$\text{Lifetime Savings (EL)} = EL \times \left(\frac{1}{3} \times EUL\right) + NR \times \left(\frac{2}{3} \times EUL\right)$$

Exception: If the existing equipment's efficiency is higher than the energy code or standard practice, the existing equipment efficiency should be used in NR calculations.

- **Step 4 (Calculate Adjusted Measure Life):** Under ER and EL scenarios, calculate effective measure life as:

$$\text{Adjusted Measure Life} = \left(\frac{\text{Lifetime Savings}}{\text{First Year Savings}}\right)$$

Internal Check: The effective measure life will always be less than or equal to the EUL.

Example

Consider the following early replacement scenario:

- An existing boiler with 75% efficiency is 10 years old and consumes 1,410 MMBtu/yr.
- A code-compliant boiler with 80% efficiency consumes 1,330 MMBtu/yr
- The proposed condensing boiler with 90% efficiency consumes 1,180 MMBtu/yr
- Energy savings relative to existing conditions is 230 MMBtu/yr (1,410 – 1,180 MMBtu/yr)
- Energy savings relative to code is 150 MMBtu/yr (1,330 – 1,180 MMBtu/yr)
- The EUL is 20 years, which means the RUL is 10 years (20 – 10 years)

Lifetime savings is equal to 3,800 MMBtu using the following formula:

$$\text{Lifetime Savings (ER)} = ER \times (RUL) + NR \times (EUL - RUL)$$

$$\text{Lifetime Savings (ER)} = 230 \frac{\text{MMBtu}}{\text{yr}} \times (10 \text{ years}) + 150 \frac{\text{MMBtu}}{\text{yr}} \times (20 - 10 \text{ years})$$

The effective measure life is equal to 16.5 years (must be less than EUL or 20 years).

$$\text{Effective Measure Life} = \left(\frac{\text{Lifetime Savings}}{\text{First Year Savings}}\right)$$

$$\text{Effective Measure Life} = \left(\frac{3,800 \text{ MMBtu}}{230 \text{ MMBtu}}\right)$$

7.3 Source Energy Savings

The program requires calculation of source energy savings, which will be calculated by TRC or TRC-supplied tools. Source energy consumption and savings in MMBtu will be calculated using the following equation:

$$\begin{aligned} \text{Source Energy Savings (MMBtu)} &= [MMBtu_{FF,B} \times SSR_{Fuel} + MMBtu_{Elec,B} \times SSR_{Elec} + MMBtu_{Renew,B}] \\ &- [MMBtu_{FF,P} \times SSR_{Fuel} + MMBtu_{Elec,P} \times SSR_{Elec} + MMBtu_{Renew,P}] \end{aligned}$$

Where MMBtu is site energy for fossil fuel (FF), electricity (elec), and on-site renewable systems (renew) and the site to source ratio (SSR) is derived from [Table 40](#) and [Table 41](#).



Per NJBPU Board Order 8C, electric site to source ratios (SSR) from the following table shall be used in source energy calculations.³ On-site electricity generation such as solar or wind shall use an SSR of 1.0.

Year	SSR	Year	SSR	Year	SSR	Year	SSR
2022	2.54	2032	2.28	2042	2.02	2052	1.76
2023	2.51	2033	2.25	2043	2	2053	1.74
2024	2.48	2034	2.23	2044	1.97	2054	1.71
2025	2.46	2035	2.2	2045	1.94	2055	1.69
2026	2.43	2036	2.18	2046	1.92	2056	1.66
2027	2.41	2037	2.15	2047	1.89	2057	1.64
2028	2.38	2038	2.12	2048	1.87	2058	1.61
2029	2.36	2039	2.1	2049	1.84	2059	1.58
2030	2.33	2040	2.07	2050	1.82	2060	1.56
2031	2.3	2041	2.05	2051	1.79		

Table 40. Electric Site to Source Ratios

The following SSRs for fossil fuels shall be used in source energy calculations⁴

Fuel	SSR
Natural Gas	1.05
Fuel Oil	1.01
Propane	1.01
Wood / Coal	1.00
Steam	1.20
Chilled Water	1.05

Table 41. Fossil Fuel Site to Source Ratios

³³ <https://www.nj.gov/bpu/pdf/boardorders/2023/20230726/8C%20ORDER%20Second%20Triennium.pdf>

⁴⁴ https://portfoliomanager.energystar.gov/pdf/reference/Source%20Energy.pdf?_gl=1*xmebya*_ga*MTgzNTMyNDM0Ni4xNzQzMDg0ODUy*_ga_S0KJTVVLQ6*MTc0MzA4NDg1MS4xLjAuMTc0MzA4NDg1MS4wLjAuMA..



7.4 Decarbonization

7.4.1 Fuel Switching Methodology

For measures involving fuel switching, decarbonization and energy efficiency savings shall be calculated separately for an individual project. Decarbonization savings will reflect the source energy savings from replacing fossil fuel equipment with code compliant or industry standard electric baseline equipment. Energy efficiency savings will reflect the kWh energy savings from installing high efficiency electric equipment compared to code compliant or industry standard electric baseline equipment.

- **Step 1 (Establish Fossil Fuel Baseline):** Establish the baseline system type per [Section 4.2.1](#), and calculate baseline therms and site MMBtu consumption (e.g., 10 therms = 1 MMBtu). The baseline system type shall be a fossil fuel system. If existing conditions cannot be established, the baseline shall meet state or local energy code requirements. Industry standard fossil fuel systems may be used if energy code is not applicable.
- **Step 2 (Establish Electric Baseline):** Establish the electric baseline system using energy code or industry standard practice corresponding to the proposed electric system. For example, if the proposed case includes variable refrigerant flow or ground source heat pumps, the baseline is an ASHRAE 90.1 code compliant air source heat pump. Calculate electric kWh and site MMBtu consumption of the electric baseline system. For the purposes of converting kWh to Btus, 1 kWh = 3,412 Btu.
- **Step 3 (Calculate Site Energy Savings):** Calculate the net impact on fossil fuel (e.g., therms), electricity (kWh), and site MMBtu. For many measures, the net impact will be positive fossil fuel savings, electric penalty (negative kWh savings), and positive MMBtu savings. Exceptions apply such as a heat pump replacement that results in slightly positive electric savings as well due to exceptional part load cooling performance.
- **Step 4 (Calculate Source Energy Savings):** Calculate source energy savings per the methodology in [Section 4.3](#).
- **Step 5 (Calculate Proposed Electric Consumption):** Calculate proposed kWh of the replacement system.
- **Step 6 (Calculate Energy Efficiency Savings):** Calculate energy savings (kWh) as the difference between baseline electric kWh consumption in [Step 2](#) and proposed electric kWh consumption in [Step 5](#) (identical to a normal replacement scenario).

The following table provides examples of electrification measures that may be included in scopes of work. Energy savings shall be calculated in accordance with the previous section ([4.2.3](#)). Electric resistance heating such as electric baseboards or radiant heating as an alternative to gas heating is not eligible for incentives.

Proposed Equipment Type	Existing Equipment Type(s)
Commercial Food Service	Gas griddles, fryers, and steamers
Electric Chillers including centrifugal, screw scroll, and air-cooled	Steam absorption and turbine chillers Gas-engine driven chiller



Proposed Equipment Type	Existing Equipment Type(s)
	Gas absorption chiller
Electric-powered Manufacturing Equipment	Gas or oil-fired manufacturing equipment
Ground Source Heat Pumps	Fossil fuel heating and/or cooling systems
Heat Pumps Including air-source, water-source, variable refrigerant flow	Fossil fuel heating and/or cooling systems
Heat Pump Dryers	Gas-fired dryers in C&I applications
Heat Pump Water Heaters	Gas or oil-fired water heaters
Induction Cooktops and Electric Ovens	Gas stoves
Industrial Process Cooling Electrification including electric infrared, microwave, or induction heating	Steam absorption and turbine chillers Gas-engine driven chiller Gas absorption chiller Other fossil fuel based cooling systems
Industrial Process Heating Electrification including electric infrared, microwave, or induction heating	Gas or oil-fired process heating
Packaged Terminal Heat Pumps	Packaged terminal air conditioners with fossil fuel heat

Table 42. Electrification Measure Examples

7.5 Whole Building Calibration

7.5.1 Allowed Adjustments to Utility Bills

If one or more utility bills in the baseline period correspond to irregular events (e.g., one-time repairs) or represent faulty or estimated readings, adjustments may be made to utility bill consumption. Any modified or excluded bills must be justified in the audit and are subject to approval by the Program Manager. No more than 25% of the actual billing data can be modified or excluded. Further, adjustments cannot be applied to the first or last monthly billing period of the baseline period. The bill preceding the first and the last bill of the baseline period must be based on actual rather than estimated readings.

- One-Time Events:** If an irregular bill is due to a specific event (e.g., repairs or seasonal equipment use), adjust the bill by normalizing consumption for the impacted period. This could involve applying average consumption patterns from prior or subsequent months as a proxy.



- **Adjust for Irregular Deliveries:** If fuel deliveries are irregular or atypical (e.g., one large delivery in a short period), adjust for this in the utility bill analysis by prorating fuel usage over time. For instance, if a large delivery occurred at the start of the period, break it down into smaller monthly increments based on historical usage patterns. If a delivery has been mistakenly recorded or is inconsistent with typical consumption, correct the data by recalculating expected fuel usage based on past delivery trends or facility demand.

Any adjustments or exclusions made to utility bills should be well-documented in the energy audit report with a clear justification for why a bill was excluded or adjusted and the methodology used. All adjustments and exclusions are subject to approval by the Program Manager.

7.6 New Jersey TRM

Trade allies shall leverage the New Jersey Technical Reference Manual (NJ TRM) corresponding to the program year in which the application for a project is submitted. The NJ TRM shall be used for calculation methodologies and/or assumptions for projects with energy savings measures that are included in the TRM. The New Jersey TRM will take precedence over other jurisdictions' TRMs. If updates to the NJ TRM are issued following publication of these guidelines, the latest version of the NJ TRM shall be used.

7.7 Peak Demand Calculations

Per Section 1.9.1 of the NJ TRM, peak coincident demand savings should be calculated as the average reduction between the hours ending 3pm and 6pm, Monday through Friday, from June 1 through August 31, excluding holidays such as Fourth of July.

If an 8,760 analysis is not performed, baseline and proposed coincident peak demand may be approximated as the average demand per the peak defined above. Alternatively, NJ TRM coincidence factors corresponding to the measure that best aligns with the custom measure may be used.

7.8 Peak Day Natural Gas

For non-weather sensitive measures, peak day natural gas (therms/day) should be calculated as the product of annual therm savings and peak day factor (PDF) from [Table 10-6 \(Peak Day Factors for Commercial and Industrial Buildings Using the Day Per Year Ratio\)](#) of the NJ TRM.

For weather sensitive measures, peak day natural gas (therms/day) should be calculated as the product of annual therm savings and peak day factor (PDF) from one of the two tables:

- **Small Commercial Buildings:** Table 10-9 Small Commercial Building PDFs using the Full Load Hour Method,
- **Large Commercial Buildings:** Table 10-10 Large Commercial Building PDFs using the Full Load Hour Method

7.9 Emerging Technology Evaluation

New and emerging technologies have potential to provide customers with significant energy savings, but there is often a high degree of savings uncertainty due to equipment novelty and lack of available data to



substantiate savings claims. These technologies are defined as commercially available equipment, controls, and technologies that are either new to the market, have low customer adoption rates, and/or have limited acceptance in energy efficiency programs. Due to these risks, additional screening is required when evaluating new and emerging technologies, including pre-installation and/or post-installation measurement and verification (M&V).

For technologies outside the scope of measures described in New Jersey's TRM, TRMs in other jurisdictions, and projects TRC has previously evaluated under Custom C&I programs, trade allies shall submit the following documentation for review:

- Manufacturer product literature including potential energy savings, technology overview, and clear description how the product reduces energy consumption.
- Laboratory test results.
- Third party evaluation studies and results confirming manufacturer claims.
- Documentation confirming the technology does not void equipment warranties.
- Documentation confirming the technology has been incentivized in other jurisdictions (such as other utilities or state energy offices). Documentation should include a complete project file (energy savings analysis, unprocessed and analyzed M&V, report narrative, specification sheets, and approval letter).
- Project case studies with back-up raw trended and analyzed M&V data.

TRC will perform an initial screening of the documentation, and if acceptable, TRC will request details to support M&V of the technology including:

- Proposed M&V plan including details of all metering points and timing/duration of metering.
- For weather-dependent technologies, the M&V plan must include extended pre- and post-metering period over a representative range of weather conditions and loads.
- For weather-independent technologies, the M&V period shall be long enough to confirm the equipment load profile and no shorter than one week.
- Spot measurements will be encouraged to support savings claims but cannot be used as a stand-alone method to confirm energy savings.
- Calculation methodology to determine savings from M&V data.

Following TRC review of the M&V plan, TRC will submit a recommendation and associated documentation for JCP&L and third-party evaluator review and approval prior to pre-installation M&V activities and project pre-approval. The trade ally is responsible for implementing the M&V plan and provided required documentation and data at each project milestone.

7.10 Building Envelope Specific Requirements

7.10.1 Opaque Assemblies

Energy savings from insulating opaque surfaces, such as roofs, walls, floors, and other assemblies separating conditioned from unconditioned or exterior spaces, depend on the following key factors:

- The existing thermal performance of the assembly prior to retrofit
- The rated R-value/in, thickness, framing, and installation method of the new insulation
- The total area of the insulated surface



These three factors must be clearly documented as part of the project documentation. If energy modeling or bin-based analysis is not used, calculations must be developed in accordance with the latest version of the TRM.

For assemblies with varying construction cross-sections (e.g., areas with different framing or cavity materials), the overall effective R-value must be calculated by first determining the U-value of each distinct cross-section and then area-weighting the U-values based on their proportional surface area. Where appropriate, construction libraries from approved simulation tools may be used to support these calculations, provided the assemblies represent combined thermal properties of framing and cavity components.

For metal-framed constructions, effective R-values must be based on **ASHRAE Standard 90.1-2019 Appendix A**. If existing or proposed insulation levels fall between those listed in Appendix A, interpolation between listed values is permitted. For example, if cavity insulation is rated at R-20, but the appendix only lists effective R-values for R-19 and R-21, the average of those two values may be used to estimate the effective R-value for R-20.

If existing roof R-values cannot be established, the following defaults shall be used.

Building Type	Baseline R-value
Hospital	13.5
Hotel	13.5
Large Office	13.5
Light Industrial	12
Multi-family high-rise	13.5
Multi-family low-rise	13.5
Motel	13.5
Multi Story Retail	13.5
Primary School	13.5
Religious	13.5
Secondary School	13.5
Small Office	13.5
Small Retail	13.5
University	13.5
Warehouse	12

Table 43. Default Baseline Roof Insulation R-values



7.10.2 Fenestration

For projects involving window replacement, baseline performance characteristics must be based on **ASHRAE 90.1-2019 Appendix A** unless actual building-specific data (e.g., original specifications, as-built drawings, or verified field observations) are available and well-documented.

The following information must be provided for each window-related measure:

- **Pre- and post-retrofit number of panes** (e.g., single-pane, double-pane, triple-pane, or glass block)
- **Pre- and post-retrofit frame type** (e.g., wood, vinyl, fiberglass, aluminum, thermally broken aluminum, or other)
- Pre- and post-retrofit U-value
- Pre- and post-retrofit Solar Heat Gain Coefficient (SHGC)
- Quantity and size of windows affected, provided in a format sufficient to determine the total improved fenestration area in square feet (e.g., twenty (20) 5' x 3' windows)

All window measures must clearly document both the baseline and proposed conditions. Supporting product specifications, manufacturer data sheets, and NFRC ratings should be included to verify claimed performance values. Area-weighted averages may be used if multiple window types are included in a single measure.

If existing window U-values and SHGC values cannot be established, the following table shall be used.

Frame Type		Unlabeled Vertical Fenestration					
		Clear Glass			Tinted Glass		
		U-Factor	SHGC	VT	U-Factor	SHGC	VT
All frame types	Single glazing	1.25	0.82	0.76	1.25	0.70	0.58
	Glass block	0.60	0.56	0.56	NA	NA	NA
Wood, vinyl, or fiberglass frames	Double glazing	0.60	0.59	0.64	0.60	0.42	0.39
	Triple glazing	0.45	0.52	0.57	0.45	0.34	0.21
Metal and other frame types	Double glazing	0.90	0.68	0.66	0.90	0.50	0.40
	Triple glazing	0.70	0.60	0.59	0.70	0.42	0.22

Table 44. Default Baseline Window U-values and SHGC Values

7.10.3 Airsealing and Infiltration

Component	Requirements
Baseline Infiltration Rate	<ul style="list-style-type: none"> • Site-specific: Use actual results from a blower door test (conducted per ASHRAE 90.1-2019 Section 5.4.3.1.1). • Default: If no test is available, assume 0.40 CFM75/SF (building envelope area).



Component	Requirements
Proposed Infiltration (Post-Retrofit)	<ul style="list-style-type: none"> • Site-specific settings: Use blower door test results following air-sealing work. • Default assumption: If post-retrofit testing isn't available, assume 0.25 CFM75/SF.
Occupied vs. Unoccupied Infiltration Schedule	<p>Apply infiltration schedules reflecting building operation:</p> <ul style="list-style-type: none"> • Occupied periods: 25% of peak infiltration • Unoccupied periods: 100% of peak infiltration <p>This approach aligns with common commercial modeling practices (e.g., EnergyPlus default schedules use 0.25 when HVAC fan is on and 1.0 when off)</p>
Projects Without Air-Sealing Measures	<p>If air-sealing isn't part of the scope, use baseline infiltration values (site-specific or 0.40 CFM75/SF default) for both pre- and post-retrofit.</p>
Air-Sealing Scope of Work Requirements	<p>Provide a detailed, itemized air-sealing scope, including:</p> <ul style="list-style-type: none"> • All affected components (e.g., penetrations, joints, access doors) • Impacted areas and lengths (in linear feet) • Systems or zones involved • Sealing materials and methods • Before-and-after description of envelope continuity

Table 45. Air sealing and Infiltration Requirements

7.11 Domestic Hot Water Specific Requirements

7.11.1 Low Flow Fixtures

Measurements of a representative sample of fixtures may be conducted to establish baseline flow rate. Specification sheets or measurements of installed fixtures may be used to establish proposed rate. If pre- or post-retrofit flow rates are not measured or manufacturer specs are not provided, the following default values must be used:

Fixture Type	Location	GPM _b	GPM _p	T _{operating} (°F)
Faucet aerator	Kitchen	1.8	1.5	93
	Public restroom	0.5	0.5	86
	Private restroom	1.5	1.0	86
Showerhead	Any	2.0	1.5	105



Table 46. Baseline and Proposed Default DHW Fixture Flow Rates

Unless measurements are performed to establish a load profile, energy savings calculations shall comply with the TRM.

7.12 HVAC Specific Requirements

7.12.1 HVAC Equipment Derating

When determining the **existing efficiency** for **existing equipment**, derating may be used to represent the decrease in efficiency of equipment over time. Efficiency of existing equipment affected by retrofit may be de-rated as follows due to age:

$$Efficiency_{Derated} = Efficiency_{Original} \times (1 - M)^{Age}$$

Where:

- Efficiency_{Original} = Existing HVAC or DHW equipment efficiency:
- Nameplate photos or specification sheets shall be used to justify Efficiency_{Original} when possible.
- For equipment in which nameplate or specification sheet efficiency is unavailable, vintage versions of ASHRAE 90.1 shall be used as a proxy. The version of ASHRAE 90.1 must correspond to the energy code in place at the time of equipment manufacture.
- If electrical efficiency is calculated based on nameplate electric specifications (e.g., volts, amps, phase, power factor), assumed power factor shall not exceed 0.75.
- Age = equipment age or the equipment measure life in years per the NJ TRM, whichever is less.
- M = maintenance factor:
- M_a = Maintenance factor for equipment that received annual professional maintenance
- M_b = Maintenance factor for equipment that was seldom or never maintained

HVAC Maintenance Factors	M _a	M _b
Air conditioners and heat pumps	0.0050	0.0100
DHW heaters, <i>electric</i>	0.0050	0.0075
DHW heaters, <i>fossil fuel</i>	0.0025	0.0050
Chillers	0.0025	0.0050
Furnaces and boilers, <i>gas</i>	0.0025	0.0050
Furnaces and boilers, <i>oil</i>	0.0050	0.0075

Table 47. HVAC Maintenance Factors ⁵

Example: A 22-year-old, 10 EER air conditioner received annual professional maintenance.

⁵ Section 4.6.4.7 of New Jersey Board of Public Utilities Pay for Performance Existing Buildings Program Partner Guidelines v4.5 FY21



- $Efficiency_{Derated} = Efficiency_{Original} * (1-M)^{Age} = 10 \text{ EER} * (1 - 0.005)^{\text{minimum of (22 years old, 15-year lifetime)}}$
- $Efficiency_{Derated} = 9.3 \text{ EER}$ (rather than 9.0 EER since measure life [15 years] < equipment age [22 years])

Note that derating should not be applied in cases where the customer or their contractor has provided industry standard performance testing results in support of their equipment’s existing efficiency. Derating can only be applied to early replacement, extended life and add-on scenarios. It shall not be applied to normal replacement and new construction scenarios. $Efficiency_{Derated}$ represents the maximum allowable derating in energy savings calculations. Adjustments may be required to appropriately calibrate calculated baseline energy consumption to utility bills.

7.12.2 Performance Curves

For equipment operating under variable load conditions, energy savings calculations must account for part-load performance. Performance curves should be used to reflect how efficiency or input power varies with load. These curves are essential for accurately estimating energy use and savings, particularly for equipment such as chillers, variable speed pumps and fans, and staged or modulating HVAC units.

Requirements for performance curves include:

- Performance curves must reflect the equipment type and control strategy.
- Curves may be sourced from manufacturer data, approved industry references, or standard libraries such as those provided by ASHRAE or modeling software. Manufacturer curves should be used when possible.
- The selected curve should match the equipment’s type (e.g., air-cooled vs. water-cooled chillers) and configuration (e.g., variable speed vs. constant speed).

Documentation requirements include:

- Clearly identify the curve used, its source, and justify its applicability to the equipment modeled.
- Include a copy of the curve (graph or equation) and any parameters used.
- For custom curves, provide a description of how the curve was derived and any validation steps.

7.12.3 SEER/SEER2, HSPF/HSPF2, and EER/EER2 Conversions

Per Section 8.1 of the NJ TRM, the following table can be used to convert units of efficiency between SEER / SEER2 and HSPF / HSPF2.

SEER2	SEER	HSPF2	HSPF
13.4	14	6.7	8.0
14.3	15	7.1	8.5
15.2	16	7.5	8.8



SEER2	SEER	HSPF2	HSPF
16	17	7.8	9.2
17	18	8	9.5
18	19	8.4	10
19	20	8.5	10.2
20	21	8.9	10.8
21	22	9.1	11
22	23	9.3	11.3
23	24	9.7	11.9
		10	12.4

Table 48. SEER2/SEER and HSPF2/HSPF Conversions

Per Section 8.1 of the NJ TRM, the following table can be used to convert units of efficiency between SEER / SEER2 and EER / EER2.

Equipment Type	SEER	SEER2	EER	EER2	EER2/EER
Split system Air conditioner	14	13.4	11.3	10.8	0.96
Split system heat pump	15	14.3	12.1	11.5	0.95

Table 49. EER/EER 2 Conversions

7.12.4 Extracting Supply Fan Power from Efficiency Ratings

For air-side heating and cooling systems—such as packaged terminal air conditioners (PTACs), rooftop units (RTUs), and packaged heat pumps—electric efficiency must be calculated and modeled separately from AHRI-rated efficiency (e.g., EER, SEER, COP, HSPF) to isolate supply fan power.

This adjustment is required for both baseline and proposed systems in projects where savings are claimed in modeling-based projects and in cases where savings are being claimed for both cooling and ventilation measures, in order to avoid double-counting supply fan energy savings.

- If equipment is derated, the adjusted efficiency must be used in the fan power separation calculations.
- The following equations, adapted from ASHRAE 90.1-2019, are used to extract cooling and heating efficiencies without supply fan power (COP_{nf}) from manufacturer-rated data:

$$COP_{nf,cooling} = 7.84 \times 10^{-8} \times EER \times Q + 0.338 \times EER$$

$$COP_{nf,cooling} = -0.0076 \times SEER^2 + 0.3796 \times SEER$$



$$COP_{nf,heating}^* = 1.48 \times 10^{-7} \times COP47 \times Q + 1.062 \times COP47$$

$$COP_{nf,heating} = -0.0296 \times HSPF^2 + 0.7134 \times HSPF$$

Definitions of variables include

- $COP_{nf,cooling}$ and $COP_{nf,heating}$: Cooling and heating efficiency excluding supply fan power (to be used in modeling).
- EER, SEER, COP47, HSPF: Manufacturer-rated efficiencies at AHRI test conditions.
- Q: AHRI-rated cooling capacity, in Btu/h.

When using eQUEST or similar energy modeling tools, the Energy Input Ratio (EIR) must be based on the adjusted efficiency:

$$EIR = \frac{1}{COP_{nf}}$$

7.12.5 Establishing Existing Fossil Fuel System Efficiency

Calculations should clearly describe existing boiler type, age, and fuel source. Typical efficiencies of various boiler types are provided in the following table for reference:

Boiler Type	Typical Efficiencies
Standard gas-fired boiler (older)	75-80%
Standard gas-fired boiler (newer)	80-85%
Atmospheric gas boiler	75-80%
Condensing boiler	87-95% (if condensing properly)
Oil-fired boiler	80-85%
Gas-fired furnace	78-80%
Oil-fired furnace	78-80%
Gas-fired unit heater	80%
Oil-fired unit heater	80%

Table 50. Typical Fossil Fuel System Efficiencies

Existing fossil fuel system efficiency may be established using one of the following methods

- Combustion tests (boilers only)
- Nameplate data
- Specification sheets
- Vintage code efficiency

With the exception of combustion efficiency test method, efficiency may be derated using the methodology described in [Section 4.12.1](#).

Distribution losses should be excluded from efficiency calculations and accounted for separately.



7.12.6 Condensing Boilers

Condensing boiler performance is dependent on return water temperature and variations in load. In general, the efficiency of a condensing boiler increases as return water temperature and part load ratio decreases. Below is a graph that demonstrates typical condensing boiler efficiencies at various return water temperatures and part load ratios. As depicted below, condensing boiler efficiency drops considerably when return water temperature is greater than 130°F.

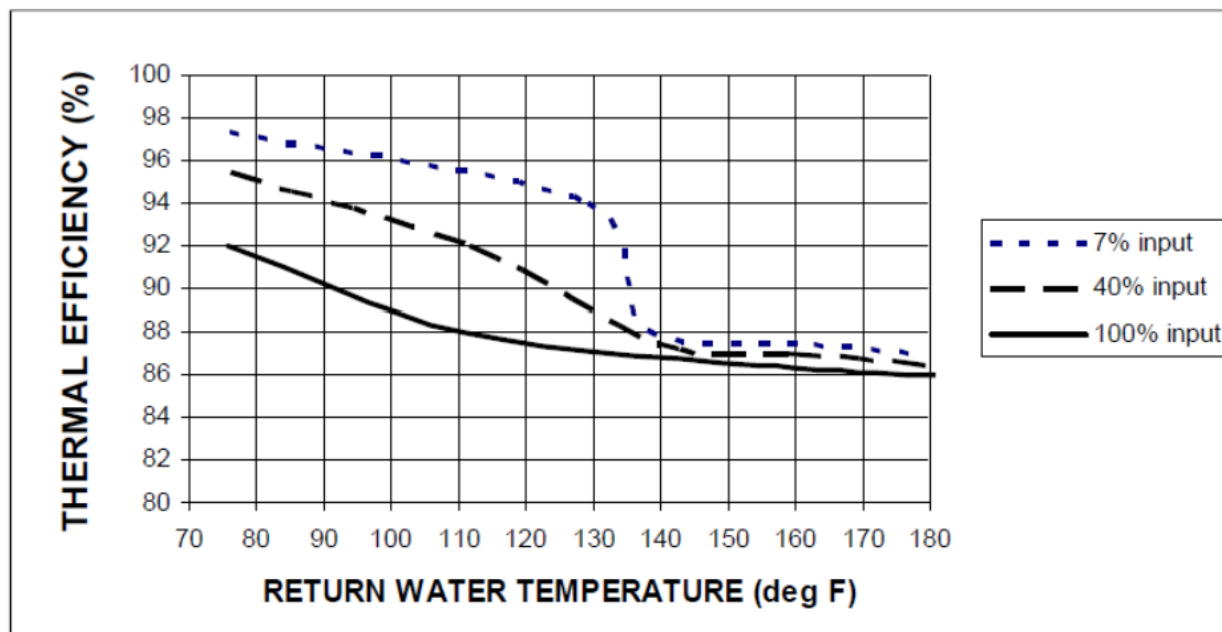


Figure 6. Example Boiler Performance Curve

Condenser boiler efficiency shall be based on verified supply and return water temperature and account for variations in efficiency due to return water temperature and load. Trade Allies should provide supplemental documentation to confirm these temperatures.

If supplemental documentation is not provided, condensing boiler efficiency shall reflect conditions at 150°F (87% efficiency).

7.12.7 Destratification Fans

To model energy savings from destratification fans, the primary method should be to adjust the heating thermostat setpoint to reflect improved air mixing in the space. Savings are based on a reduction in thermal stratification, which should be quantified through temperature measurements taken before the retrofit. These measurements should capture temperatures at both the ceiling and occupant level. If measurements are not performed, the following table shall be used, which assumes an existing stratification rate of 0.4°F per foot above 5 ft.

Ceiling Height (ft)	Estimated ΔT	Assumed Floor Temp	Estimated Ceiling Temp
10	2°F	70°F	72°F
15	4°F	70°F	74°F



Ceiling Height (ft)	Estimated ΔT	Assumed Floor Temp	Estimated Ceiling Temp
20	6°F	70°F	76°F
25	8°F	70°F	78°F
30	10°F	70°F	80°F
35	12°F	70°F	82°F

Table 51. Destratification Assumptions

Stratification of 3°F shall be assumed in the proposed case.

For example, if the pre-retrofit ceiling temperature is 80°F and the floor temperature is 70°F, the average space temperature without destratification is calculated as $(80 + 70) / 2 = 75^\circ\text{F}$, which can be modeled as the average setpoint of the space. If the installed fans reduce the stratification to 3°F, resulting in a 73°F ceiling and 70°F floor, the new average temperature becomes $(73 + 70) / 2 = 71.5^\circ\text{F}$. The adjusted setpoint of 71.5°F can then be used in the post-retrofit model to reflect reduced heating energy requirements.

If other measures impact space temperature set points and setbacks, destratification fan savings shall be calculated after those measures.

In addition, the energy consumed by the destratification fans must be incorporated into calculations. Fan specifications, operating hours, power consumption, and calculation methodology must be provided as part of the model submission.

7.13 HVAC Controls Specific Requirements

7.13.1 General Best Practices

The following table provides best practices when calculating savings from HVAC controls.

Component	Best Practices
Baseline Conditions	<ul style="list-style-type: none"> Establish existing equipment schedules, setpoints, and control strategies. Identify any inefficiencies, like constant volume operation, simultaneous heating and cooling, or lack of setback scheduling. If trend data is available pre-installation, use it to quantify existing conditions. If trend data is not available, compare modeled consumption to utility bill consumption
Proposed Conditions	<ul style="list-style-type: none"> Document specific control strategies being implemented (e.g., optimized start/stop, temperature resets, demand-based ventilation). Clearly define changes to baseline conditions to simulate proposed conditions Include assumptions for improved scheduling and setpoints in the calculations. Where possible, calculate energy savings for each control strategy



Component	Best Practices
	<ul style="list-style-type: none"> individually Account for interactivity among individual control strategies Validate modeled proposed energy consumption using post-installation BMS data Do not use rules of thumb to estimate savings from controls.

Table 52. HVAC Control Calculations Best Practices

7.13.2 Ventilation Schedule

For measures involving ventilation fan shutdown or reduced outdoor air during unoccupied periods, baseline and proposed schedules must be clearly documented. When available, on-site verification of the existing ventilation schedule (e.g., trend data, timeclock settings, or BMS screenshots) should be used to establish baseline operation.

If no site data are provided, assumptions for proposed schedule reductions must follow these limits:

- Weekdays:** No more than 8 hours of ventilation reduction per day
- Weekends:** No more than 16 hours of ventilation reduction per day

Ventilation schedules must remain aligned with space occupancy. Fans may only be assumed to shut off when spaces are unoccupied, and ventilation must resume prior to occupancy as needed to meet indoor air quality standards. Complete elimination of ventilation during the workday or occupied hours is not permitted unless supported by verified controls or occupancy data.

All assumptions must be documented and justified, including any staggered start times, cycling, or reduced flow periods.

7.13.3 Demand Control Ventilation

For measures involving demand control ventilation (DCV), calculations must reflect how outdoor air is reduced in response to real-time occupancy or CO₂ levels. DCV savings should not be based on arbitrary percentage reductions or simplified hourly offsets.

Instead, calculations should reflect:

- Design ventilation rate at full occupancy
- Minimum ventilation rate allowed under DCV (not less than ASHRAE 62.1-2016 requirements)
- Estimated occupancy patterns or CO₂ control setpoints (e.g., modulation between 100% and 30% of design flow based on zone demand)

Acceptable calculation methods include:

- Spreadsheet calculations using weighted average flow rates across time bins or operating hours
- Engineering estimates based on expected occupancy profiles and equipment capabilities
- Manufacturer data showing control logic or minimum turndown ratios



If no site-specific data are available, minimum airflow should not be assumed to drop below 30% of design ventilation during low-occupancy periods. All assumptions, control logic, and supporting references must be clearly documented.

7.13.4 Hot Water Supply Reset

If a hot water supply temperature (HWST) reset schedule has not been established, the following default schedule shall be used based on **outdoor dry-bulb temperature**:

- 150°F at 50°F and above
- 180°F at 20°F and below
- Ramped linearly between 180°F and 150°F at temperatures between 20°F and 50°F

This reset strategy reduces heating system energy use during milder conditions while maintaining occupant comfort. The above schedule may be modified if site-specific data are available, such as measured hot water supply and return temperatures or documented control logic.

7.13.5 Chilled Water Supply Reset

If a chilled water supply temperature (CHWST) reset schedule has not been established, the following default schedule shall be used based on **outdoor dry-bulb temperature**:

- 44°F at 80°F and above
- 54°F at 60°F and below
- Ramped linearly between 44°F and 54°F at temperatures between 80°F and 60°F

This reset strategy reduces overcooling and compressor energy use during mild weather conditions. The above schedule may be modified if site-specific data are available, such as measured chilled water supply and return temperatures or documented control sequences.

7.13.6 Condenser Water Supply Reset

If a condenser water supply temperature (CWST) reset schedule has not been established, the following default schedule shall be used to reset CWST based on the **outdoor wet-bulb temperature**:

- 75°F CWST at 75°F wet-bulb and above
- 65°F CWST at 55°F wet-bulb and below
- Ramp linearly between 75°F and 65°F CWST for wet-bulb temperatures between 75°F and 55°F

This schedule assumes a control strategy that resets CWST downward as outdoor conditions improve, reducing lift on the chiller and improving system efficiency.

The above reset schedule may be modified if site-specific data is available, including:

- Measured condenser water supply and return temperatures
- Documented BMS or plant control sequences
- Manufacturer-recommended reset strategies



7.13.7 Thermostat Nighttime Setbacks

Nighttime temperature setbacks can be applied to heating and cooling systems during unoccupied periods. The following table provides limits on the setbacks that can be claimed in energy savings calculations. Exceptions may be permitted by the Program Manager with appropriate documentation.

Building Type	Heating Setback (°F) Limit	Cooling Setback (°F) Limit	Notes
Grocery	65°F	75°F	Refrigeration loads may limit cooling setback.
Medical – Clinic	70°F	75°F	Limited setbacks due to patient comfort.
Multifamily – Common Areas	65°F	80°F	Depends on resident usage patterns and tenant comfort
Medical - Hospital	No Setback	No Setback	24/7 operation; strict temperature controls.
Multifamily – In-Unit	No Setback	No Setback	Resident preferences vary considerably.
Office – Small	60°F	80°F	Typical unoccupied hours: nights and weekends.
Office – Large	60°F	80°F	Typical unoccupied hours: nights & weekends.
College/University – Cafeteria	65°F	80°F	Kitchens may require separate ventilation controls.
College/University – Classrooms	60°F	80°F	Setbacks applied outside of class hours.
College/University – Dormitory – Common Area	65°F	80°F	Depends on resident usage patterns and tenant comfort
College/University – Dormitory – Living Area	No Setback	No Setback	Resident preferences vary considerably.
Religious Building	55°F	85°F	Often used intermittently, allowing deeper setbacks.
Nursing Home	No Setback	No Setback	No / minimal setbacks to maintain patient comfort.
Retail – Small	60°F	80°F	Setbacks depend on occupancy patterns.
Retail – Large	60°F	80°F	Similar to small retail but may have more 24/7 equipment loads.
School	60°F	80°F	Setbacks applied on nights, weekends, and holidays.
Warehouse – Large C&I	55°F	85°F	Heating setback depends on material storage needs.
Warehouse – Small	55°F	85°F	Heating setback depends on material storage needs.

Table 53. Typical Thermostat Nighttime Setbacks

7.13.8 Thermostat Daytime / Occupied Period Setbacks

Savings may be claimed for measures that reduce space temperatures during occupied periods if on-site measurements of existing temperatures is performed. The post-retrofit temperature during occupied periods may not be less than **72°F** for heating and no higher than **75°F** for cooling. If measurements are not performed to verify existing space temperatures, credit cannot be claimed for this measure and schedule adjustments should be limited to nighttime setbacks.



7.13.9 Supply Air Temperature Reset

If the supply air temperature reset schedule has not been established, the air temperature for cooling shall be set no higher than 5°F under the minimum cooling load conditions.

7.14 Lighting Specific Requirements

7.14.1 Hours of Operation

The following table provides equivalent full load lighting hours (EFLH) for various C&I building types. Supplemental documentation such as site measurements or documentation that actual hours of operation exceed NJ TRM prototype hours of operation must be provided if calculated EFLH exceeds EFLH in the table by more than 15%.

Building Type	Hours	Building Type	Hours
Grocery	7,134	Parking Garage	8,678
Medical – Clinic	3,909	Multifamily – Common Areas	5,950
Medical - Hospital	8,760	Multifamily – In-Unit	679
Office – Small	2,969	Multifamily –Exterior	3,338
Office – Large	2,950	College/University – Cafeteria	2,713
Other	See below	College/University – Classes	2,586
Retail – Small	4,920	College/University – Dormitory	3,066
Retail – Large	4,926	Religious Building	1,955
School	2,575	Nursing Home	5,840
Warehouse – Large C&I	4,116	Restaurant - Dine-In	4,182
Warehouse – Small	3,799	Restaurant - Fast food	6,456
Outside/Outdoor Area	3,604	Museum	3,748

Table 54. Lighting Hours of Operation

7.14.2 Hours of Operation – “Other” Building Type

For building types outside the scope of [Table 54](#) annual lighting hours, excluding impact of lighting controls, shall not exceed the sum of the following:

- (Weekday hours per week open) x 50.6 weeks x 90%
- (Weekday hours per week closed) x 50.6 weeks x 5% + 9.6 hours
- (Weekend hours per week open) x 52 weeks x 90%
- (Weekend hours per week closed) x 52 weeks x 5%



For example, if a library is open 9-6pm Monday through Friday, open 9-1pm on Saturday, and closed on Sunday, annual lighting hours shall not exceed 2,550, which is calculated as the sum of the following:

- (45 hours per week open on weekdays) x 50.6 weeks x 90% = 2,049 hours
- (75 hours per week closed on Weekdays) x 50.6 weeks x 5% + 9.6 = 200 hours
- (4 hours per week open on weekends) x 52 weeks x 90% = 187 hours
- (44 hours per week closed on weekends) x 52 weeks x 5% = 114 hours

7.14.3 Lighting Control Savings Factors

The following lighting control factors (SVG) may be used to account for adjustments to hours of operation due to lighting controls. If existing lighting is served by lighting controls, lighting control factors shall be applied to baseline hours of operation.

For example, if existing hours of lighting operation of an office space is 2,950 and daylighting controls are present, 2,124 hours should be used in the analysis (2,950 hours x [1 – 0.28 LCF]).

Control Type	Lighting Control Factor (SVG)
Networked lighting controls (NLC)	0.49
Luminaire-level lighting controls (LLLC) – Networked & Commissioned	0.49
Integrated fixture with room-based controls	0.38
Dual occupancy and daylight sensors	0.38
Combination of high-end trim and daylight dimming	0.35
Combination of high-end trim and occupancy sensors	0.33
Daylight dimming	0.28
Occupancy sensors	0.24
No lighting controls	0.00

Table 55. Lighting Control Factors

7.14.4 Energy Code Trigger for Lighting Retrofits

Projects that include comprehensive interior lighting retrofits in the scope of work must install lighting controls per ASHRAE 90.1-2019 Section 9 requirements to comply the New Jersey Administrative Code and its Uniform Construction Code. Depending on the nature of the retrofit, mandatory lighting control requirements will vary.

Similarly, projects that include exterior lighting retrofits in the scope of work must install lighting controls per ASHRAE 90.1-2019 Section 9 requirements

It is the responsibility of the Trade Ally to verify that all projects enrolled in the program comply with all local, state, and federal codes.



7.15 Motors and Drives Specific Requirements

7.15.1 Fan Performance Curves

The following fan performance table should be used to estimate fan power at various part load ratios. **For example**, for a VFD with duct SP controls operating at 50% of full design air flow, the fan power should be equal to 21% of the design fan power.

VFD performance accounts for VFD efficiency. Therefore, calculations should not include an additional penalty to account for VFD efficiency (such as increasing power consumption by 1 / VFD eff).

Fan Performance (Fan Power as a Function of Part Load Ratio)

Fan Type	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
No Control or Bypass Damper	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Discharge Dampers	46%	55%	63%	70%	77%	83%	88%	93%	97%	100%
Outlet Damper, BI & Airfoil Fans	53%	53%	57%	64%	72%	80%	89%	96%	102%	105%
Inlet Damper Box	56%	60%	62%	64%	66%	69%	74%	81%	92%	107%
Inlet Guide Vane, BI & Airfoil Fans	53%	56%	57%	59%	60%	62%	67%	74%	85%	100%
Inlet Vane Dampers	38%	40%	42%	44%	48%	53%	60%	70%	83%	99%
Outlet Damper, FC Fans	22%	26%	30%	37%	45%	54%	65%	77%	91%	106%
Eddy Current Drives	17%	20%	25%	32%	41%	51%	63%	76%	90%	104%
Inlet Guide Vane, FC Fans	21%	22%	23%	26%	31%	39%	49%	63%	81%	104%
VFD with duct SP controls	10%	11%	12%	16%	21%	30%	42%	58%	78%	103%
VFD with low/no duct SP	6%	7%	10%	13%	19%	28%	40%	56%	77%	102%

Table 56. Fan Performance (Fan Power as a Function of Part Load Ratio)

Using the values in the above table, the following table provides fan curve coefficients to streamline energy savings calculations. The coefficients shall be used in the following equation

$$FPLR = A + B \times PLR + C \times PLR^2 + D \times PLR^3$$

Where:

- PLR is the ratio of operating flow to design flow rate (i.e., part load ratio)
- FPLR is the ratio of fan power to design fan power
- Design fan power x FPLR is equivalent to the actual fan power at a specific part load ratio

Fan Performance Curve Coefficients

Fan Type	A	B	C	D
No Control or Bypass Damper	1	0	0	0.0000
Discharge Dampers	0.3670	0.9750	-0.3409	0.0000
Outlet Damper, BI & Airfoil Fans	0.5627	-0.5893	2.5093	-1.4336
Inlet Damper Box	0.5010	0.7303	-1.4883	1.3267
Inlet Guide Vane, BI & Airfoil Fans	0.4797	0.6371	-1.4779	1.3617
Inlet Vane Dampers	0.3587	0.2589	-0.4499	0.8236
Outlet Damper, FC Fans	0.2013	0.1241	0.7407	-0.0058
Eddy Current Drives	0.1673	-0.0953	1.3427	-0.3730
Inlet Guide Vane, FC Fans	0.2090	0.0168	-0.0629	0.8761
VFD with duct SP controls	0.1072	-0.0705	0.1413	0.8518
VFD with low/no duct SP	0.0475	0.0804	-0.0707	0.9637



Table 57. Fan Performance Curve Coefficients

7.15.2 Pump Performance Curves

the following table provides pump curve coefficients to streamline energy savings calculations. The coefficients shall be used in the following equation

$$FPLR = A + B \times PLR + C \times PLR^2 + D \times PLR^3$$

Where:

- PLR is the ratio of operating flow to design flow rate (i.e., part load ratio)
- FPLR is the ratio of fan power to design fan power
- Design fan power x FPLR is equivalent to the actual fan power at a specific part load ratio

Control Type	A	B	C	D
One-Speed	1	0	0	0
Throttle Valve	0.55218	0.63701	-0.18996	0
Variable Speed	0.219762	-0.874784	1.652597	0
DP Reset	0	0.0205	0.4101	0.5753

Table 58. Pump Curve Coefficients

7.15.3 Affinity Law Factor

For simple fan applications or all pump applications, for measures involving variable frequency drives, if performance curves are not used, the affinity law exponent, η , in the equation below shall not exceed 2.3.

$$kW_{new} = kW_{old} \times \left(\frac{Flow_{new}}{Flow_{old}}\right)^\eta$$

7.15.4 Motor Load Factor

Unless supported by site observations and supplemental documentation, motor load factor assumed in calculations shall be equal to 0.75 for motors \geq 1 HP and 0.90 for motors $<$ 1 HP.

7.15.5 Motor Efficiency

Unless supported by site observations such as photos of equipment nameplates, the analysis shall assume NEMA premium efficiencies as described in ASHRAE 90.1-2019 Tables 10.8.1 through 10.8.5.

7.15.6 Minimum Speed Ratios

If unknown, the following minimum turndown speed ratios shall be used in fan and pump power calculations.



Control Type	Minimum Turndown Speed
No Control or Bypass Damper	100%
Two-Speed	50%
Discharge Dampers	50%
Outlet Damper, BI & Airfoil Fans	50%
Inlet Damper Box	50%
Inlet Guide Vane, BI & Airfoil Fans	30%
Inlet Vane Dampers	30%
Outlet Damper, FC Fans	20%
Eddy Current Drives	20%
Inlet Guide Vane, FC Fans	20%
VFD with Duct SP controls	20%
VFD with Low/No Duct SP	20%

Table 59. Minimum Turndown Speeds, Fans

Control Type	Minimum Turndown Speed
One-Speed	100%
Two-Speed	50%
Throttle Valve	20%
Variable Speed	20%
Differential Pressure Reset	20%

Table 60. Minimum Turndown Speeds, Pumps



7.16 Plug and Process Load Specific Requirements

7.16.1 Plug Load Control Savings Factors

Plug load controls can eliminate or reduce idle or standby power consumption of connected equipment. Plug load control types include:

- **Load sensing controls** monitors a specific devices power state and de-energizes connected auxiliary units when the monitored devise enters a low power state.
- **Occupancy sensing controls** automatically de-energize devices when no user is present for a set period of time.
- **Scheduled timer controls** allow users to set a schedule to energize and de-energize devices based on the devices' usage pattern and space schedule.

The following energy savings factors (ESFs) may be used to claim savings for plug load controls. ESFs may only be applied to equipment that is directly impacted by the plug load control.

Control Type	Energy Savings Factor
Load sensing control, workstations	0.04
Load sensing control, print rooms	0.32
Schedule timer control, workstations	0.25
Schedule timer control, print rooms	0.50
Schedule timer control, break rooms	0.46
Occupancy sensor controls, all	0.21
All other controls	0.10

Table 61. Plug Load Control Factors



8 Measurement and Verification Guidelines

Measurement & Verification (M&V) is the process of accurately quantifying the savings achieved through energy efficiency projects by collecting and analyzing data. It involves comparing energy usage before and after the implementation of efficiency measures, while accounting for external factors to ensure precise and reliable results. M&V plays a critical role in validating reported savings, often adhering to established protocols such as the International Performance Measurement and Verification Protocol (IPMVP) to ensure consistency and credibility.

8.1 M&V Experience

A qualified M&V professional plays a key role in verifying energy savings and supporting program success. This individual or firm should have demonstrated experience in developing and implementing M&V plans using recognized industry standards, such as IPMVP.

Key qualifications and responsibilities include:

- Experience establishing baseline energy use and tracking savings over time
- Familiarity with tools such as Building Management Systems (BMS), utility meters, and data loggers
- Ability to apply weather normalization, energy modeling, and statistical analysis techniques
- Proven track record preparing M&V reports that meet utility, contractual, or regulatory requirements

8.2 IPMVP Options

Table 62 provides descriptions, calculation methodologies, and example applications for each option described in the International Performance Measurement and Verification Protocols (IPMVP).

IPMVP Option	Description	Calculation Methodology	Example Applications
Option A (Partially Measured Retrofit Isolation)	Savings are predicted using engineering or statistical methods that involve short-term to continuous measurement frequencies, depending on the expected variations in the measured parameter and length of the performance period. Parameters that are not directly measured are estimated using manufacturer specifications, historical data, TRMs, or engineering judgement. Documentation of the source or justification is required and subject to program approval.	Combination of short-term or continuous measurements of key parameters and deemed values. Routine and non-routine adjustments as required.	Lighting retrofit where lighting power is calculated using DLC certifications and hours of operation are measured for a two-four week period.
Option B (Retrofit Isolation)	Savings are predicted using engineering or statistical methods that involve short-term to continuous measurement frequencies, depending on the expected	Short-term or continuous measurements of key parameters for the baseline and reporting period.	Variable frequency drives serving a chilled water pump. In the baseline, a kW meter confirms constant



IPMVP Option	Description	Calculation Methodology	Example Applications
	variations in the measured parameter and length of the performance period. All key parameters are directly measured.		loading over a one-week period. In the reporting period, the kW meter confirms variations in power over a three week period.
Option C (Whole Facility)	Savings are calculated by (1) comparing monthly billing data recorded for the whole building or project site by a utility meter or sub-meters, before and after project installation, and (2) analyzing that data to account for any variables, such as weather or occupancy levels.	Analysis of whole facility baseline and reporting period utility data. Routine and non-routine adjustments as required, using techniques such as simple comparison or regression analysis.	Comprehensive energy savings project with multiple measures that interact with one another. Typical whole building energy savings exceed 10% of the annual consumption.
Option D (Calibrated Simulation)	Savings are calculated using modeling software to create a simulated model of a building based on drawings and site surveys. The model is calibrated using utility data and metered equipment data. Models are constructed for (1) the existing baseline case OR post-installation case, and (2) each efficiency measure.	Energy simulation, calibrated with hourly or monthly utility billing data using a tool compliant with ASHRAE 90.1 Appendix G. Supplemental equipment metering is used to refine model inputs.	Comprehensive energy savings project with multiple measures that interact with one another. Utility data is unavailable or unreliable for the baseline or reporting period.

Table 62. IPMVP Options

8.3 M&V Plan Requirements

Program participants should complete TRC’s M&V plan template in its entirety. Alternatively, participants may provide their own M&V plan as long as the M&V plan:

- Reflects the entire scope of a project.
- Minimally includes all data included in TRC’s M&V plan template.
- Clearly identifies and justifies IPMVP option
- Describes baseline data collection procedures and energy consumption calculation methodology.
- Describes reporting period data collection procedures and energy consumption calculation methodology
- Describes the relationship between baseline and reporting period consumption.
- Incorporates factors and variables that impact consumption under baseline / pre-retrofit and reporting period / post-retrofit conditions such as outside and indoor air temperature, humidity, occupancy, and operating hours.
- Describes how these factors and variables will be measured and used to normalize consumption due to changes in weather, occupancy, and other factors unrelated to the energy efficiency project.



- Includes details of the calculation methodology used to calculate and extrapolate annual energy savings.
- Provides documentation of all assumptions, sources of data, anticipated routine and non-routine and routine adjustments.

All M&V plans must comply with these guidelines and the International Performance Measurement and Verification Protocols. The IPMVP option selected should be appropriate based on unique project characteristics. [Table 63](#) provides guidance for determining the most appropriate option based on these characteristics.

Project Characteristics	A	B	C	D
Only one measure is included in the scope	X	X		
The project includes multiple measures with little or no interaction	X	X		
The project includes multiple measures with easily estimated interaction impacts	X			X
The project has a comprehensive work scope that impacts most energy end-uses			X	X
The stipulation of parameters is less costly than measurement	X			X
Interaction impacts are difficult to estimate or measure			X	X
The project includes behavioral, operations, or maintenance-type measures			X	
The cost to assess measures individually is inexpensive	X	X		
The cost to assess measures individually is expensive				X
Total facility performance needs to be addressed			X	X
Expect savings are <10% of the utility meter	X	X		
The significance of some energy-driving variables is unclear		X		
Correlations exist between energy use and independent variables			X	
A long-term performance assessment is needed	X		X	
Baseline or post-retrofit data is not available or is unreliable				X
Stipulated parameters will not significantly impact overall savings	X			
Submeters exist to isolate the energy use of systems		X		

Table 63. IPMVP Option Selection Criteria



8.4 Additional M&V Plan Requirements

These additional M&V plan requirements shall be addressed if the following options are selected.

8.4.1 Option A

- **Justification of Estimates:** The M&V Plan should identify estimated variables in savings calculations, their sources, and their impact on uncertainty. Best practice includes reporting the range of possible savings based on parameter variations. Additionally, the plan should outline periodic inspections during the reporting period to verify equipment functionality and validate estimated values.
- **Periodic Inspections:** The plan should outline periodic inspections during the reporting period to confirm that equipment remains in place and operates as expected. These inspections may include measuring key parameters and validating estimated values to ensure their accuracy.

8.4.2 Option C

- **Meters:** All fuel sources within the measurement boundary must be accounted for in the analysis. Any exclusions should be justified.
- **Software Identification:** The M&V Plan should specify the name and version of any software or data analysis tool used for savings calculations.
- **Energy and independent variable data:** The plan must detail the sources of all energy and independent variable data, along with the processes for data collection and management. All relevant data should be reported, with raw data archived and available as needed. This includes interval data, utility invoices, weather data, and other independent variables. Additionally, the plan and report should provide copies of energy, weather, and independent variable data, including input/output files and reports. Any post-processing methods, analytical tools, and calculations should also be documented.
- **Model Fit Metrics:** The plan should include key goodness-of-fit statistics for the selected model, such as confidence level, standard error, CV(RMSE), R^2 , net mean bias error, and t-statistics for independent variables. It should also specify the criteria required for the baseline energy model to be considered valid based on expected savings. Additionally, the range of independent variables covered by the model should be defined, along with the acceptable range for its validity during the reporting period. M&V Reports should similarly present goodness-of-fit metrics for reporting period models. While not mandatory, best practice includes calculating uncertainty in savings and reporting the possible range of savings values.

8.4.3 Option D

- **Software Identification:** The M&V Plan must specify the name and version of the simulation software used for savings calculations.
- **Input/Output Data:** The plan should provide copies of all input files, output files, reports, and weather files (or weather file identification) used in the simulation. It should also detail any post-processing methods or calculations used for data presentation and analysis.
- **Measured Data:** The M&V Plan should outline the process for obtaining measured data,



specifying which input parameters were directly measured and which were estimated. The actual measured data should be reported, with raw data archived and available as needed. This may include interval data or utility-provided bills.

- **Model Calibration:** The plan should define the energy and operating data used for calibration, including the required accuracy levels (e.g., CV(RMSE), MBE) and how well the simulation results must align with actual facility conditions. Supporting data should be provided at intervals of at least one billing cycle (monthly), though higher resolution is preferred. A description of the calibration steps taken should also be included. M&V Reports must present model calibration results, as outlined in Section 9.4.2.
- **Justification of Estimates:** The M&V Plan must identify all estimated variables used in savings calculations and assess their impact on uncertainty. This includes reporting actual values, sources of estimates, and, when possible, the range of potential savings based on plausible variations in these estimates.

8.5 Sampling Requirements

M&V plans that address multiple systems and components should describe equipment sampling that will be conducted. Sample size should meet the following requirements:

- The sample size must meet the confidence and precision required by the program (e.g., 80% confidence with +/-20% precision).
- Equipment or systems that operate similarly should be grouped together.
- The sample size must consider the operation of *all* equipment, even if that equipment is similar. Similar systems with different operating schedules should be grouped separately.
- Sampling should focus on the systems that contribute to the largest amount of energy savings and/or incentives.

Table 64 provides general guidance for sampling requirements based on 80% confidence with +/-20% precision. If M&V plans cannot meet desired sample sizes, please discuss an alternate plan with the program manager.

Number of Components or Systems	Minimum Sample Size (#)	Minimum Sample Size (%)
1	1	100%
2	2	100%
3	3	100%
4 – 6	4	67%
6 – 10	5	50%
11 – 15	6	40%
16 – 20	7	35%
21 – 40	8	20%
41 – 99	9	9%
100+	10	5%



Table 64. M&V Sample Size

8.6 Weather-normalization Assumptions

Performance of many efficiency measures are weather-dependent. M&V plans must detail the weather normalization methodology used including all weather-normalization assumptions including:

- Weather station (name and ID)
- Weather data source (name of source and link)
- HDD and/or CDD reference temperature(s)
- Weather normalization time period, including specific years included in analysis
- Discussion of how inaccuracies and/or inconsistencies in weather data will be handled.

8.7 Expected Accuracy and Uncertainty

The M&V Plan should clearly define the expected accuracy of the reported energy savings and outline the potential sources of uncertainty, including measurement, data capture, sampling, modeling, and data analysis. It should also describe the uncertainty assessment methodology that will be applied in the planned savings report.

The assessment should incorporate both qualitative and, where feasible, quantitative evaluations of uncertainty levels. All sources of uncertainty must be identified, along with details on their origin, the anticipated direction of influence, and the estimated magnitude of their impact on the reported savings. In some cases, providing specific estimates of uncertainty in the savings may be necessary.

8.8 Analysis Methods

M&V plans must detail the analysis method that will be used to calculate energy savings. Degree day analyses based on heating and/or cooling degree data are appropriate for residential, multifamily, and small commercial projects where there is strong correlation between outdoor air temperature, cooling loads, heating loads, and overall building energy consumption. For other projects, participants should outdoor air temperature bins (bin analysis) or average hourly temperatures (hourly analysis) in M&V calculations.

8.9 M&V Duration

The metering and monitoring period must be long enough to accurately represent the annual amount of energy consumed by the affected equipment. Each period will be dependent on measure type, controls, and overall complexity of project. For example, projects involving cooling systems such as chillers must be metered during the cooling season for a long enough period to capture performance over a wide range of outdoor air temperatures. In many cases, chiller projects undergo metering and monitoring from May through September.

8.10 Facility Baseline Variables

In many cases, energy use and/or demand depend on factors unrelated to building components. The most common example is outdoor temperature, which affects the energy used for heating and cooling and is captured by Program tools. Other examples include:



- Building occupancy (e.g., number of guests in a hotel, types of tenants)
- Production volumes (e.g., number of items produced at an industrial facility)
- Hours of operation (e.g., number of shifts, hours open)

These key baseline variables may vary between the baseline and post-retrofit periods and must be recorded in as much detail as possible. Any changes in these variables will need to be adjusted for in consultation with the Program Manager. Changes in these parameters during the post-installation period compared to the pre-retrofit stage must be reported.

The following are examples of why and how baselines could be adjusted:

- **Changes in occupancy:** Baseline occupancy levels must be documented. If significant changes in future occupancy are expected and predictable (e.g., hotel, multifamily, etc.), details of these changes should be included, along with defined procedures for addressing them.
- **Changes in hours of operation:** Similar to occupancy changes, baseline hours of operation must be documented, along with any known or predictable future changes.
- **Tenant changes/improvements:** While tenant modifications may be predictable, they often involve numerous unknowns. Program Allies do not need to provide detailed calculation methods for every possible scenario, but the baseline should include information on each tenant, including business type, hours of operation, and major energy-consuming equipment. Since program savings should reflect energy reductions that would not have occurred without participation, changes in operating hours, conditioned space, or equipment outside the approved scope will not be counted toward savings and must be adjusted for during post-retrofit verification.
- **Changes in process loads:** For some facility types, such as wastewater treatment plants and manufacturing facilities, energy consumption is primarily influenced by process loads rather than weather. The baseline should detail the type of process load and its unit of measurement (e.g., an industrial laundry facility may measure loads in pounds of laundry). Procedures for addressing process changes should be defined to account for them in post-retrofit savings verification.
- **New/unexpected addition of loads:** This includes changes such as the addition or removal of equipment outside the project scope, unexpected construction, and other modifications. Since these changes are unpredictable, they are often difficult to plan for at the baseline stage. Adjustments should be made where possible, leveraging information from site representatives, including details on the change, its timing, and a list of added or reduced loads.

8.11 Additional M&V Resources

In addition to these guidelines, the following resources best practices, templates, examples, and technical information related to the M&V process. These materials can support M&V professionals in developing and implementing effective M&V plans. This list is provided for reference only and does not imply endorsement of any specific organization, standard, or publication. Other references may available beyond those listed here. Users should evaluate each resource based on the specific project needs and applicable program requirement. References in purple contain hyperlinks

- [IPMVP Core Concepts](#)



- IPMVP – Application Guide for Non-Routine Events & Adjustments
- IPMVP Application Guide – Energy Efficiency, Renewable Energy, and Water Efficiency Projects
- IPMVP Statistical Uncertainty Guide
- IPMVP Volume I – Concepts and Options for Determining Energy and Water Savings
- IPMVP Volume II – Concepts and Practices for Improved Indoor Environmental Quality
- IPMVP Volume III, Part I – Concepts and Options for Determining Energy Savings in New Construction
- IPMVP Volume III, Part II – Concepts and Practices for Determining Energy Savings in Renewable Energy Technologies Applications
- ASHRAE Guideline 14
- Federal Energy Management Program (FEMP) M&V Guidelines
- ISO 50015:2014 – Energy Management – Measurement and Verification of Energy Performance



9 Appendix A Energy Model Input and Output Reports

For projects involving modeling, the following input and output reports are required.

Software	Input and Output Reports	
Carrier HAP	<ul style="list-style-type: none"> A. Building-Level Output Reports <ul style="list-style-type: none"> • A1. LEED Summary Report • A2. Energy Budget by System Component • A3. Energy Budget by Energy Type • A4. Monthly Energy Use by System Component Report • A5. Billing Details Report B. Plant-Level Output Reports <ul style="list-style-type: none"> • B1. (Plant) Monthly Simulation Results C. Air-Side HVAC System-Level Output Reports <ul style="list-style-type: none"> • C1. (Air System) Monthly Simulation Results Report • C2. (Air System) Hourly Simulation Results, CSV Version • C3. Air System Sizing Summary Report • C4. Zone Sizing Summary Report • C5. Ventilation Sizing Summary Report • C6. Air System Design Load Summary Report D. Input Data Reports <ul style="list-style-type: none"> • D1. Building Input Data Report • D2. Plant Input Data Report • D3. Air System Input Data Report • D4. Simulation Weather Summary Report, • D5. Space Input Data • D6. Wall Constructions Report • D7. Roof Constructions Report • D8. Window Constructions Report • D9. Chiller Input Data Report • D10. Cooling Tower Input Data Report • D11. Boiler Input Data Report • D12. Electric Rate Input Data Report • D13. Fuel Rate Input Data Report 	
	Design Builder / OpenStudio / EnergyPlus	EnergyPlus summary output document (.html) EnergyPlus input (.idf) files EnergyPlus simulated results file (.eso).
	eQuest	Input files (.inp) Parametric run files (.prd) eQuest interface files (.pd2) Output files (.sim)



Software	Input and Output Reports
<p>IESVE</p>	<p>Room Loads Report Zone Loads Report Space Loads & Ventilation Report Thermal Template Report ASHRAE 62.1 Report Plant Loops & Equipment Report System Loads Report Energy Model Output Report Model Orientation and Rotation Check Report ASHRAE 90.1 PRM/ECB Compliance Report ModelIT Model Report BPRM Report Unmet Hours Report Detailed Simulation Report IECC Compliance Report Florida Energy Code Compliance Report ASHRAE 90.1-2016 PCI Report (Performance Cost Index - Proposed vs Baseline)</p>
<p>Trane TRACE 700</p>	<p>Title Page Project Information Entered Values Energy Cost Budget/PRM Summary Monthly Energy Consumption Monthly Utility Costs Library Members Entered Values Building U-Values Building Areas Walls by Direction Entered Values Walls by Cardinal Direction Entered Values Room Information Entered Values Building Envelope Cooling Loads at Coil Peak Building Envelope Heating Loads at Coil Peak Plant Information Entered Values Equipment Energy Consumption System Entered Values System Checksums Report Building Cool/Heat Demand report from the Visualizer</p>
<p>Trane TRACE 3D Plus</p>	<p>Climatic Summary Space Summary Site Consumption Summary Monthly Energy End Use Monthly Utility Details Opaque Exterior Fenestration</p>



Software	Input and Output Reports
	System Cooling Checksums
	Room Cooling Loads by Component
	System Heating Checksums
	Room Heating Loads by Component
	Interior Lighting
	Utility Peak Demand Summary
	System Component Selection Summary
	Plant Equipment
	Outside Air
	Cooling Plant Summary
	Heating Plant Summary

Table 65. Energy Model Input and Output Reports



10 Appendix B Technology Specific M&V

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adapt to new possibilities.

