PAY FOR PERFORMANCE PROGRAM

NEW CONSTRUCTION

PARTNER GUIDELINES

VERSION 4.~~7~~8

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Limitations

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1 Introduction

New Jersey's Clean Energy Pay for Performance **New Construction** Program (Program) comprehensively addresses the energy efficiency needs of the Commercial and Industrial (C&I) sector by working with building owners and their representatives (Participants) to improve the energy efficiency of new construction and major renovation of commercial, industrial and select multifamily buildings with 50,000 square feet or more of planned conditioned space.

This Program relies on a network of contractors who have demonstrated their experience and expertise in comprehensive commercial and industrial energy efficiency projects. These entities are identified as Pay for Performance Partners (Partner) and are afforded the privileges outlined in the Partnership Agreement and its Attachments. The Program will work to achieve the following goals:

- Create a market-based network of energy efficiency professionals capable of delivering comprehensive services to developers, building owners and their representatives;
- Facilitate access to capital for comprehensive energy and energy-related improvements;
- Reach significant numbers of commercial and industrial customers with comprehensive, cost effective scopes of work;
- Reduce the C&I sector's contribution to the system peak demand;
- Package energy efficiency improvements and improve the profitability of Participants by implementing cost effective energy efficiency measures which lower energy consumption and costs.

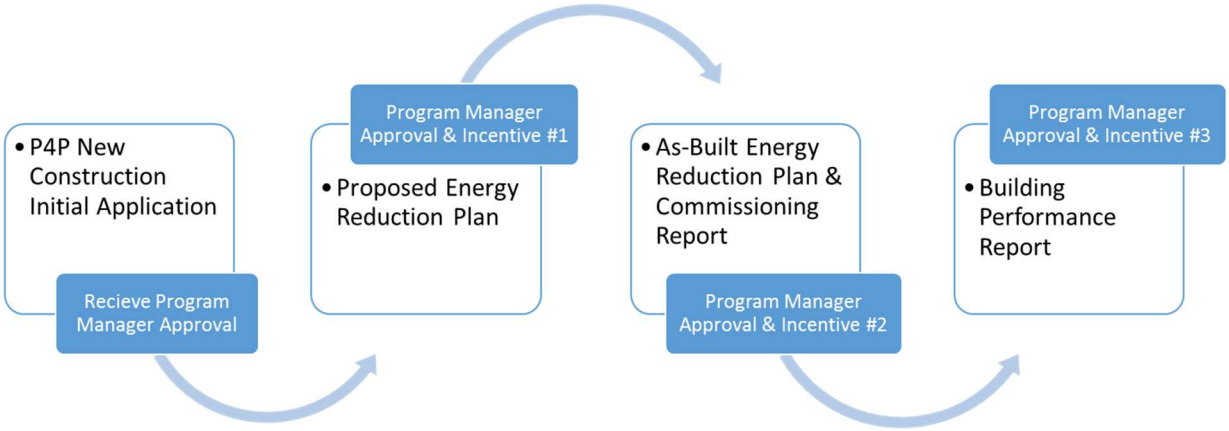
Participants will be required to work with an approved Pay for Performance Partner to develop an Energy Reduction Plan (ERP) and facilitate the incorporation of the recommended energy efficient design features. In order to receive incentives offered through the Program, the submitted ERP must include a package of energy efficiency measures that achieve the minimum performance target of 5% energy costs or source energy below the current energy code requirements for C&I projects, and 15% for select multifamily. In addition, the ERP must include a comprehensive mix of measures. Projects that cannot identify efficiency improvements that meet this minimum performance level will be referred to the appropriate NJ SmartStart Buildings Program(s).

2 General Requirements

2.1 Program Overview

The Program has four main deliverables that are submitted in the order shown in Figure 2-1 below:

Figure 2-1. Program Process



1. **Application:** Initial application form must be submitted and approved by Program Manager prior to beginning work on the Proposed Energy Reduction Plan. This is to ensure the facility is eligible to participate. Please refer to Instructions on the Application, which can be downloaded from the New Jersey's Clean Energy website.
2. **Proposed Energy Reduction Plan (Section 3):** Summary report of proposed building design that achieves the Minimum Performance Target. Submitted at the onset of the project, preferably at the Design Development stage, or well enough before construction to allow for review and approval by the Program Manager. Projects earlier in the design process may be eligible for a pre-design bonus (Section 3.2).
3. **As-Built Energy Reduction Plan & Commissioning Report (Section 5 & 6):** Proposed Energy Reduction Plan that is updated to incorporate all changes that occurred during construction. Accompanied by a Commissioning Report completed by pre-approved Commissioning Authority. Submitted once construction is completed and ensures that all energy-efficiency measures are installed and operating as outlined in the approved Proposed Energy Reduction Plan (or as modified in the approved As-Built Energy Reduction Plan).
4. **Building Performance Report (Section 7):** Assess the energy performance of the project building based on its first year of operation, and promote quality construction and energy

efficient operation and maintenance practices.

2.2 Tools and Resources

In addition to the Partner Guidelines, the following tools must be used when completing program deliverables:

1. Energy Reduction Plan Excel tables
2. ASHRAE 90.1 Performance-based Compliance Form workbook
3. Commissioning Plan template

These documents, as well as other helpful resources, such as instructions on uploading documents to the FTP site, modeling help sites, etc. can be downloaded from the *Partner Portal:*

URL: http://www.njcleanenergy.com/p4p-portal-login
Case sensitive password is: **tRP47px**

2.3 Eligibility Requirements

Participation in the Program is based on the following criteria:

- Societal Benefits Charge – Participants will be electric and/or gas customers of the following investor-owned New Jersey utilities (IOU) and pay a monthly Societal Benefits Charge (SBC), which can be found as a line item on their utility bills:
    - Atlantic City Electric
    - Elizabethtown Gas
    - Jersey Central Power & Light
    - New Jersey Natural Gas
    - PSE&G
    - Rockland Electric Company
    - South Jersey Gas
- Project Size – The project must have 50,000 square feet or more of planned conditioned space. The Program Manager has the discretion to approve projects that are within 10% of the minimum 50,000 square foot threshold. Projects are limited to a single building meeting square footage requirement. Multiple buildings may be considered as a single project with prior approval from Program Manager.
- Construction Type – The new construction component will accept both new construction

and substantial renovation, or gut rehabilitation, as defined below:

- *New Construction:* Defined as a new building.
- *Substantial Renovations (Gut Rehab):* Defined as one of the following types of projects:
  - Change of use and reconstruction of an existing building;
  - Construction work of a nature requiring that the building or portion of the building -within be out of service for at least 30 consecutive days;
  - Reconstruction of a vacant structure or a portion of the building within.

- Scope of Work – Project must be comprehensive in nature and meet the following minimum scope of work criteria:
  - Proposed design must meet or exceed the Minimum Performance Target of 5% energy cost or source energy savings for commercial and industrial buildings and 15% for multifamily buildings compared to ASHRAE 90.1-~~2016~~ 2019 baseline[12]. See Section 3.3.
  - The Minimum Performance Target is based on reducing the total energy cost or source energy for the facility where electricity and/or natural gas is purchased and/or delivered by a New Jersey Investor-Owned Utility (IOU). For projects with non-IOU fuel sources at least 50% of the energy cost or source energy reduction must come from an IOU, or 100,000 kWh or 2,000 Therms whichever is greater.
  - Project must have at least one measure addressing *each* of the following building components: envelope, heating, cooling, and lighting (e.g. increased insulation, improved HVAC efficiency, lighting power density below code requirements, etc.). Buildings that are not heated (e.g. refrigerated warehouse) or not cooled (e.g. warehouse) will not be required to have a measure addressing the missing building component. Measures are defined as components that exceed ASHRAE 90.1-~~2016~~ 2019 requirements and must not be procured prior to Application receipt by the program.
  - Equipment for which Participants previously received incentives through other

[1] Performance Target is rounded down to two significant figures, e.g. 0.1487 is rounded to 0.14 or 14%.

[2] Projects that can provide proof of permit received under the prior energy code, i.e. ASHRAE 90.1-~~2013~~2016, will be able to measure their savings from this baseline.

NJCEP programs or other Programs offered by any of the New Jersey investor-owned utilities may not be eligible for incentives through this Program. Further, the project site may not participate or apply for incentives for energy efficient measures through other NJCEP Programs while participating in this Program except as noted in Section 2.3.1, or otherwise approved by Program Manager.

2.3.1 Core and Shell vs. Tenant Fit-Out

The P4P NC program is unique in that the incentive is calculated based on conditioned square footage. Although there is a minimum energy savings threshold, by design, the P4P NC program is meant to cover all energy efficiency measures within an assigned area/building(s). Therefore, P4P NC projects are required to evaluate the whole building design. Further, if a P4P NC Application is submitted to the program, that same building(s) cannot also submit applications to other programs. An exception to this rule may apply to eligible projects pursuing Core & Shell separate from Tenant fit-out improvements as described below and shown in **Figure 2-2.**

2.3.1.1 Definitions

- ***Tenant fit-out*** is defined as an area that has components specifically designed for that area based on tenant ~~needs, and~~needs and is funded by the tenant. For some Tenant fit-outs, components may be limited to lighting and equipment loads if the entire building is served by a central HVAC system (e.g. central plant). For others, equipment may include dedicated HVAC systems that serve the tenant space.

- ***Core & Shell*** is defined as the systems and parts of the building that are not Tenant fit-out related, and are funded by the developer (or entity other than tenant, such as building owner, land owner, or landlord).

2.3.1.2 Project Scenario 1- Core & Shell and Tenant Fit-out are Combined

In this scenario, all aspects of the design (whole building) must be included under a single P4P NC Application and treated as a single project. This may apply where:

- Developer is funding and constructing both Core & Shell and Tenant fit-out.
- High performance systems are specified and funded for the Tenant space separate from Core & Shell, but the building owner and tenant come to an agreement to include both scopes of work under a single project.

Projects under this scenario will follow all Partner Guidelines as typical.

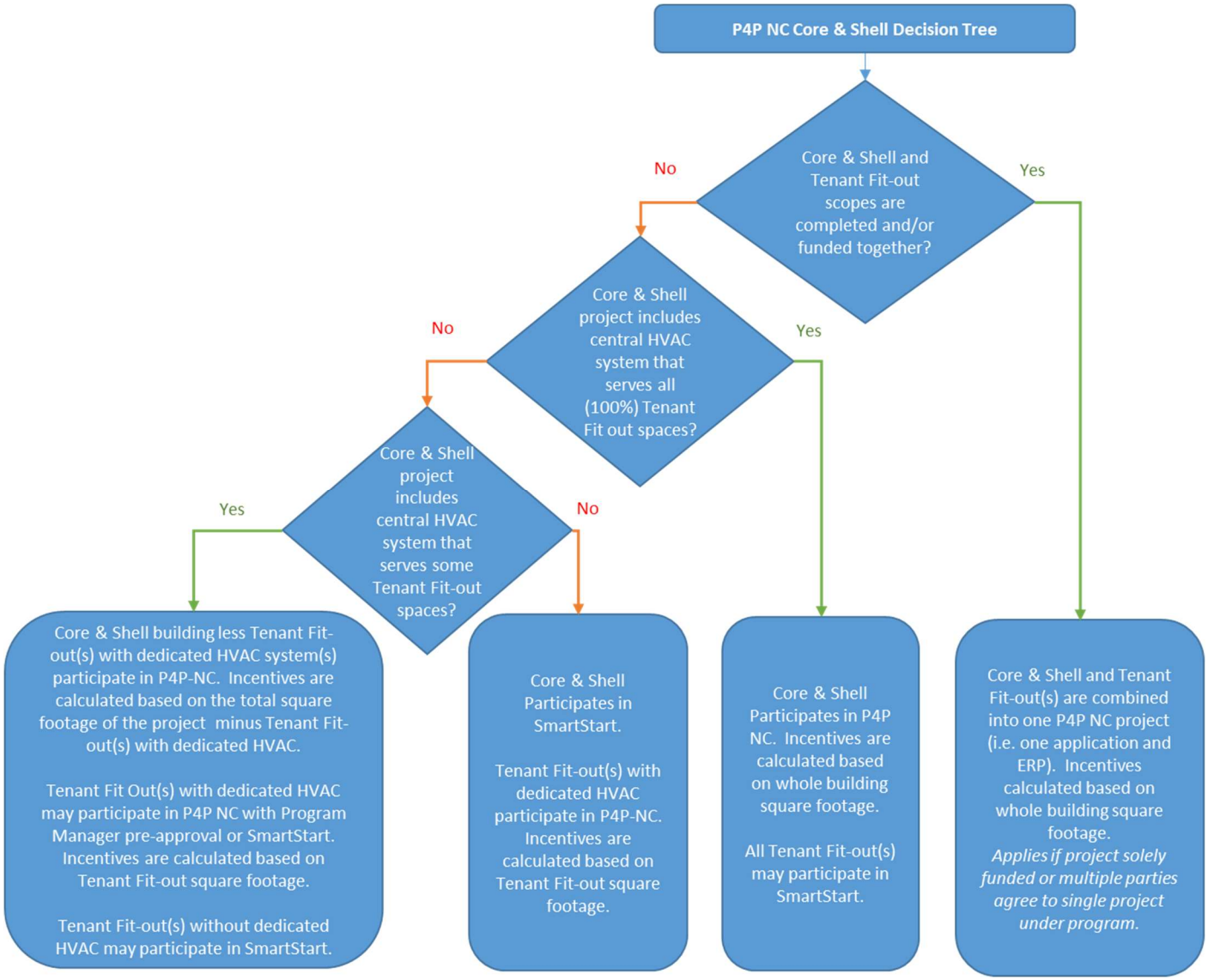
2.3.1.3 Project Scenario 2- Core & Shell Separate from Tenant Fit-out

This scenario applies when the Core & Shell work is known but the tenant space development is unknown and/or is funded separately. Therefore, the Core & Shell is treated as a separate project from the Tenant fit-out.

A building may apply for P4P NC for either Core & Shell or Tenant fit-out(s), not both, except as discussed in Section 4.5.27, Example 3. The determining factor depends on which scope will include design and construction of the central HVAC system. For example, if the Core & Shell scope includes building envelope, common area and exterior lighting, and central HVAC systems, this project may be eligible to apply for incentives under P4P NC, in which case:

- P4P NC incentives will apply to all conditioned square footage of the building serviced by the central HVAC in the project's scope of work.
- The Proposed Energy Reduction Plan should clearly describe Core & Shell and Tenant spaces. The space types and areas listed should only reflect the areas associated with the project, per above, to calculate incentives correctly.
- The project scope applying for P4P NC (e.g. Core & Shell OR Tenant Fit-out) must be able to meet all requirements for P4P NC on its own.
- Any Tenant fit-out or Core & Shell work not included in P4P NC, (and connected to a non-residential electric/gas account paying into the SBC), may seek incentives through the NJCEP SmartStart Program for eligible equipment.
- ~~ASHRAE bEQ Path does not support projects pursuing Core & Shell or Tenant Fit-Out only (rather this Path applies to complete buildings), and Appendix G Path must be followed. Reference Section 4.5.27 for additional modeling considerations.~~

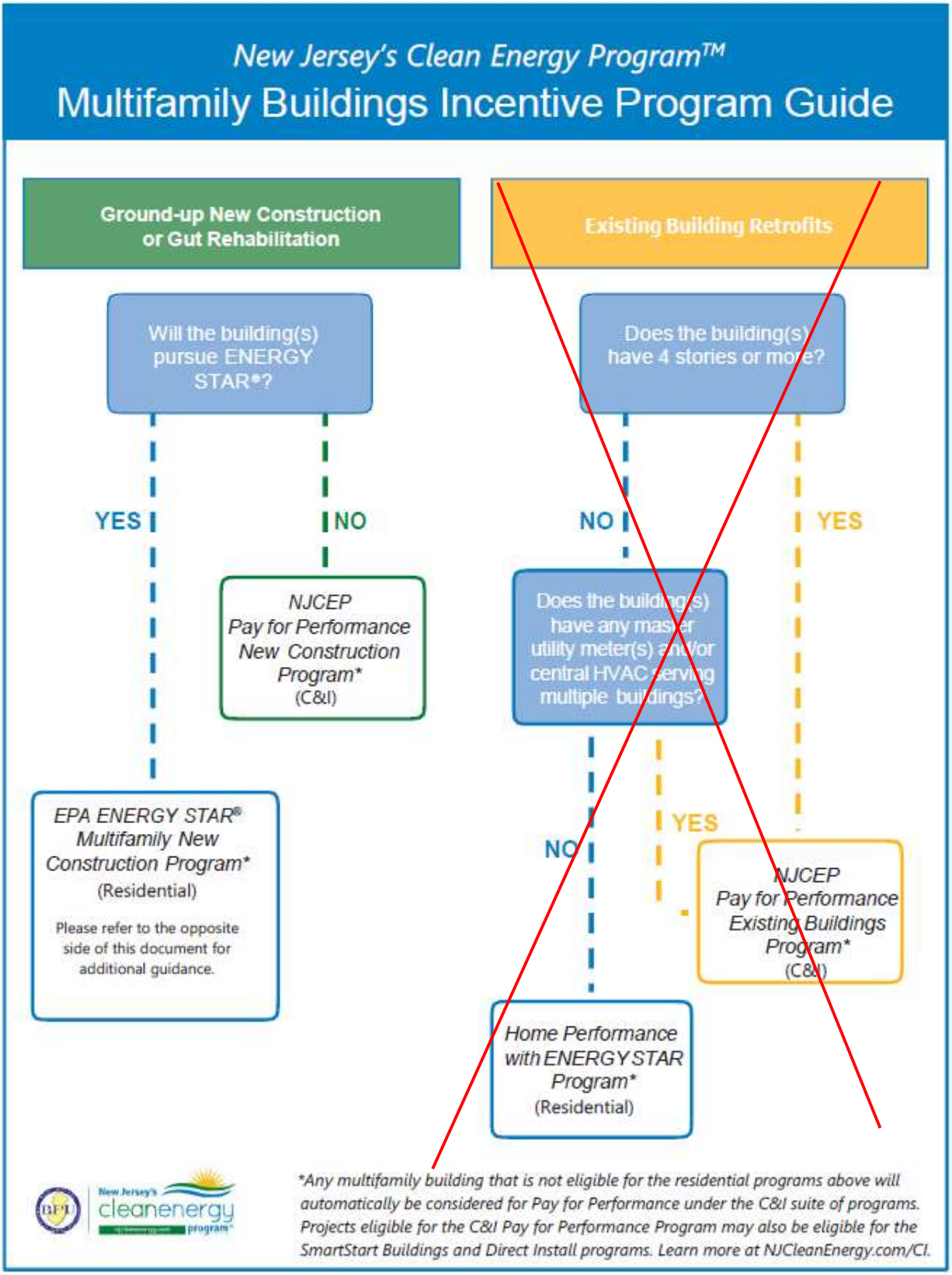
Figure 2-2. Core & Shell vs. Tenant Fit-Out Logic Tree



2.3.2 Multifamily Buildings

The Program will serve Multifamily Buildings that are not pursuing ENERGY STAR, or that otherwise do not meet the qualifications of ENERGY STAR Homes Program® and/or ENERGY STAR Multifamily New Construction~~High Rise~~ Program®. Please reference **Figure 2-3** on the following pages.

Figure 2-3. Multifamily Decision Tree


New Jersey's Clean Energy Program™
Multifamily Buildings Incentive Program Guide
Ground-up New Construction or Gut Rehabilitation
Existing Building Retrofits
Will the building(s) pursue ENERGY STAR®?
Does the building(s) have 4 stories or more?
YES
NO
NO
YES
NJCEP Pay for Performance New Construction Program* (C&I)
Does the building(s) have any master utility meter(s) and/or central HVAC serving multiple buildings?
EPA ENERGY STAR® Multifamily New Construction Program* (Residential)
Please refer to the opposite side of this document for additional guidance.
NO
YES
NJCEP Pay for Performance Existing Buildings Program* (C&I)
Home Performance with ENERGY STAR Program* (Residential)
*Any multifamily building that is not eligible for the residential programs above will automatically be considered for Pay for Performance under the C&I suite of programs. Projects eligible for the C&I Pay for Performance Program may also be eligible for the SmartStart Buildings and Direct Install programs. Learn more at NJCleanEnergy.com/CI.

2.4 Program Incentives

2.4.1 Definitions

- ***Ratepayer*** is the entity whose name will be on the project facility's future utility bill(s) and will be contributing to the Societal Benefits Charge (SBC), and which is therefore eligible for incentives. Depending on the circumstance of each project, the Ratepayer may be the developer, building owner, or tenant.

- ***Participant***, for program purposes, is the Ratepayer that is funding the project/improvements except as described in Assignment of Incentives section below. Participant information must be listed consistently on P4P NC Application and all supporting documentation (e.g. Request for Incentives, etc.). All Program Incentives are paid directly to the Participant but can be assigned to the Partner if the Participant wishes to do so.

2.4.2 Incentive Assignment

In New Construction, it is common that the project is funded by an entity other than the Ratepayer. For example, the future tenant will be the Ratepayer, but the developer is building and funding the project. In this case the entity that pays for the project (in this example the developer) may be listed as the Participant on the Application. In such cases, a supplemental, formal memorandum from the Ratepayer (in this example the future tenant) must also be supplied and include the following information:

1. Identify Participant as listed on the Application and their relationship to the project (e.g. building owner, developer, etc.);
2. Identify Ratepayer and their relationship to the project (e.g. tenant);
3. Acknowledgement that the Ratepayer is technically eligible for the incentives through this program;
4. Acknowledgement that Ratepayer is not funding this project;
5. Approval to "sign over" all P4P incentives to the Participant for the purpose of this project; and
6. Must be signed by appropriate authority at both Participant and Ratepayer firms and include their title/role.

This memo should be provided with the Initial Application if all information is known, otherwise it must be provided no later than with the Proposed Energy Reduction Plan.

2.4.3 Incentive Structure

Table 2-1. P4P New Construction Incentive Structure

Minimum Cost or Source Energy Reduction Over ASHRAE 90.1-~~2016~~ 2019 Baseline	Incentive by Building Type, Per Square Foot	
	Industrial/High Energy Use Intensity	Commercial and Multifamily
Incentive #1: Proposed Energy Reduction Plan		
Tier 1 C&I: 5% to < 7% Multifamily: 15% to < 17% ~~bEQ Path (all): 61 < score ≤ 63~~	$0.10	$0.08
Tier 2 C&I: 7% to < 10% Multifamily: 17% to < 20% ~~bEQ Path (all): 59 < score ≤ 61~~	$0.12	$0.10
Tier 3 C&I: 10% or greater Multifamily: 20% or greater ~~bEQ Path (all): Score ≤ 59~~	$0.14	$0.12
Maximum 1st Incentive	$50,000.00	
Pre-Design Bonus	$0.04	
Maximum Bonus	$20,000.00	
This incentive is designed to offset some or all of the cost of services associated with the Proposed Energy Reduction Plan (ERP) and is payable upon approval of the Proposed ERP. Incentive #1 is contingent upon moving forward with installation. If installation does not commence within the required timeframe, Incentive #1 may be required to be returned to the program. In the event the project is cancelled and Incentive #1is not returned, the project may reapply to the program in the future but another Incentive #1 will not be paid. Projects that are in pre-design or schematic design may be eligible for a pre-design bonus; see Section 3.2.		
Incentive #2: Installation and Commissioning of Measures		
Tier 1	$1.00	$0.80
Tier 2	$1.20	$1.00
Tier 3	$1.40	$1.20
This incentive is based on the successful installation and commissioning of the energy efficiency measures as outlined in the approved Proposed Energy Reduction Plan and is used to offset the costs associated with the implementation of recommended energy-efficiency measures. Incentive #2 is payable upon approval of As-Built ERP and associated Commissioning Report, completed by a certified Commissioning Authority.		
Incentive #3: Building Performance		
Flat	$0.40	$0.35
This incentive is paid for projects demonstrating superior energy performance based on its first year of operation. Buildings that qualify as high intensity users may receive an additional incentive up to $0.05/SqFt.		

2.4.4 High Energy-Intensity Facilities

High energy intensity facilities are defined as those where manufacturing and/or processing load use is equal to or greater than 50% of the total energy cost or source energy at the building/site. They may include manufacturing, pharmaceutical, chemical, refinery, packaging, food/beverage, data center, transportation, mining/mineral, paper/pulp, and biotechnology. Hospitals may also fall into this category if 50% or more of the gross floor area is used for general medical and surgical services and 50% or more of the licensed beds provide acute care services.

2.4.5 Incentive Caps

Incentives will be capped at the lesser of:

1. Project Cap- The total of Incentives #1, #2, and #3 combined shall not exceed $2 million per project, assuming both electric and natural gas measures are recommended and implemented. Should only electric measures, or only gas measures, be recommended and implemented then the total of Incentive #1, #2, and #3 combined shall not exceed $1 million per project. The latter applies to electric-only facilities as well.
2. Entity Cap- The participating customer's entity will be subject to an Entity Cap of $4 million per calendar year (Definition of an Entity can be found in the Board Order Docket No. EO07030203).

If total project incentive exceeds any of the above caps, Program Manager will manually adjust incentive down to comply with above incentive caps while maintaining the distribution of Incentive #1, #2, and #3 as shown in **Table 2-1.**

In addition to the specific caps outlined above, no project shall receive incentives from one or more NJCEP programs and/or Board-approved utility programs in an amount that exceeds the total cost[3] of measures installed or performed.

[3] Total cost is usually determined by reference to a sales invoice. It is not, for example, impacted by federal tax credits that will become available to the applicant on its next tax return or grants from sources other than NJCEP or Board-approved utility programs.

2.5 Submission Guidelines and Timelines

2.5.1 Submittal Procedure

- All new submittals must be submitted to the P4P@njcleanenergy.com email;
- This also includes submittals uploaded to FTP or TRCNET. Please send an email to P4P@njcleanenergy.com notifying Program Manager of the upload and/or providing FTP access;
- All emails must contain Application Number (except new applications), Project Name, and Revision Number in the subject line;
- Partners may email resubmittals/revisions directly to assigned reviewer but must CC P4P@njcleanenergy.com;
- Sub-consultants must CC Partner of record on all email correspondence;
- Revisions must be submitted within thirty (30) days from the date Program Manager provides comments. Extensions may be available, otherwise if a response is not received by this date the application will be considered abandoned and thereby cancelled.
- Partners may request a conference call with the Program Manager's review team to discuss reviews comments; the request should include a list of discussion questions or topics.
- Unless the Program Manager in advance approves a Partner's request to provide an incomplete or partial submittal, the Program Manager will not review such submittals and will instead notify the Partner of same. Examples of situations in which the Program Manager will consider approving the provision of an incomplete submittal include the submission of incomplete ERP Tables or draft models to facilitate an upcoming discussion between the Partner and the Program Manager.
- Similarly, if responses to the Program Manager's comments are incomplete or significantly unresponsive, the Program Manager will not review such "responses" and will instead notify the Partner of same.
- If Partner does not satisfactorily resolve the Program Manager's comments by the third iteration (i.e., rev3), the Program Manager will adjust measure-level savings to reflect the impact of unresolved comments, which in many cases will result in a decreased incentive. In cases in which the Program Manager adjusts incentives, it will notify the Partner of the adjustments. If the unresolved comments are sufficiently significant to undermine the entire application, the Program Manager will reject the application.

Initial submittal documents, as listed in **Table 2-2** below, should be submitted to the Program Manager at the very beginning of the project to verify that project meets minimum eligibility criteria. Projects may apply to the program at any point up to and during the Design Development phase. Projects that are in the Construction Document phase and/or have begun construction may still apply to the program so long as the recommended design components have not been procured prior to receipt of the Initial Application with the understanding that any measures installed prior to approval of the Proposed ERP are done so at the project's own risk. In the event that the equipment selected does not qualify for an incentive, it will be removed from the Proposed ERP and no incentives will be paid for that equipment. In addition, projects in the Construction Document phase will not be eligible for pre-design bonus incentives associated with Incentive #1.

Incentive #1 submittal documents, including the Proposed ERP should be submitted within six (6) months of Application approval.

- *Pre-Design Bonus:* In order to qualify for the Pre-Design Incentive #1 bonus, the Pre-Design submittal shall be submitted after Application approval but prior to the Proposed Energy Reduction Plan. Pre-inspections are generally not performed, although the Program Manager reserves the right to inspect projects applying for the Pre-Design bonus. Projects in the construction document phase are not eligible for Pre-Design bonus incentives.

Each Appendix of the Proposed ERP shall be submitted as a single file and labeled appropriately. For example, *"01234 - <Project Name> - Appendix A – Cx Plan.pdf"* shall be submitted separately from the ERP Excel Tables. Other Appendices and ancillary documents shall be submitted in a similar format. The most recent versions of tools and templates must be used.

Incentive #2 submittal documents, including the As-Built ERP and Commissioning Report should be submitted within twelve (12) months of Proposed ERP approval or upon construction completion, whichever comes first. Same rules regarding Appendices above apply. The most recent versions of tools and templates must be used.

Incentive #3 submittal documents should be submitted within fifteen (15) months of As-Built ERP and Commissioning Report approval. In cases where the building has been complete for some time prior to As-Built ERP and Commissioning Report approval, the submittal may be sent in earlier with prior permission from Program Manager.

2.5.2 Extensions

Incentive #1 Submittal: The Program Manager may grant an extension of up to SIX months past the Proposed ERP submittal deadline provided there is sufficient justification.

Incentive #2 Submittal: The Program Manager may grant a project a *first extension*, not to exceed SIX months past the As-Built submittal deadline, and a *second extension* up to an additional SIX months, provided there has been significant progress toward completion of the projects, and where the delay was unavoidable and unforeseeable at the time of the upfront incentive application.

Incentive #3 Submittal: The Program Manager may grant a project a *first extension*, not to exceed SIX months past the Building Performance submittal deadline, and a *second extension* up to an additional SIX months, provided one of the following conditions are met:

- Partner must provide building performance results and demonstrate that they are not meeting program requirements, as well as a plan to address potential issues to try and meet program requirements.
- Partner must provide documentation that building has not been fully occupied for the previous twelve months, and thus actual annual consumption data (i.e. utility bills) required for Incentive #3 are not yet available.

The following steps must be followed to request an extension to the above deadlines:

1. Partner must submit the request for an extension in writing (email is acceptable) prior to the expiration date.
2. Request must identify the reason for the request, progress to date, and a schedule that identifies how much extra time is needed to complete the submittal.
3. Approval of a request for extension will not change or modify any other program terms and conditions.

In addition, the Program Administrator, with the approval of Board Staff, may approve up to two extensions, each of a length set by the Program Administrator with the approval of Board Staff, beyond the extensions the Program Manager is authorized to approve above.

Table 2-2. P4P Program Submission Guidelines and File Naming Conventions

Initial Submittal	**P4P New Construction Application:** Submit online or as a PDF file (*.pdf). Include all attachments as outlined on the Application Instructions.
Incentive #1 Submittals	**Proposed Energy Reduction Plan (ERP) Package:** The Energy Reduction Plan Package consists of two workbooks – the **ERP Tables** and the~~-~~ **90.1 Performance-based Compliance Form**. The ERP Tables includes information specific to P4P such as the project description, construction schedule, financing plan, individual energy efficiency measure (EEM) savings, EEM descriptions, and project incentives. ~~The 90.1 Performance-based Compliance Form workbook is based on~~The *DOE/PNNL ASHRAE Standard 90.1 Performance Based Compliance Form*[4] ~~and~~ includes the detailed descriptions of the baseline and proposed designs, simulation inputs, and results of the baseline and proposed design models. Submit both workbooks as Excel files (*.xlsx). Each **Appendix** of the Proposed ERP (e.g. modeling files, commissioning plan, signed Partner-Participant contract, etc.) shall be submitted as its own file in an appropriate format and labeled appropriately. Reference ERP Tables Instructions for requisite Appendices.
	Request for Incentive #1: Submit as PDF file (*.pdf)
Incentive #2 Submittals	**As-Built Energy Reduction Plan Package:** Submit the revised ERP Tables and the 90.1 Performance-based Compliance Form (Energy Reduction Plan Package) workbooks as Excel files (*.xls). Each Appendix of the As-Built ERP (e.g. Commissioning Report, modeling files, etc.) shall be submitted as its own file in an appropriate format and labeled appropriately. Reference ERP Tables Instructions for requisite Appendices.
	Request for Incentive #2: Submit as PDF file (*.pdf)
Incentive #3 Submittals	**ENERGY STAR Portfolio Manager Benchmark Report & Certification:** Submit as PDF file (*.pdf).* See Section 7.2 for alternative option for ineligible building types.
	Request for Incentive #3: Submit as PDF file (*.pdf)

[4] https://www.energycodes.gov/ashrae-standard-901-performance-based-compliance-form

2.6 Miscellaneous

2.6.1 Business Clearance Certificate

A valid Business Assistance Tax Clearance Certificate from the State of New Jersey, Division of Taxation is required before any incentives can be released. Participants are required to use the State's Premier Business Services (PBS) portal online to file for Tax Clearance Certificates. Please visit the NJ Clean Energy website for complete instructions: www.njcleanenergy.com/TCC

2.6.2 Payment and Check Process

The Program Manager will submit Incentive Invoices to the State of New Jersey twice each month for payment of approved incentives. Upon receipt of wire transfer of payment from NJ Treasury Department, the Program Manager will issue incentive checks to Participants and/or their designated payee within approximately five business days. It can take approximately 45-60 days for checks to be mailed from the time Program Manager submits Incentive Invoices to the State.

2.6.3 Prevailing Wage Requirements

Participating projects with a contract at or above current prevailing wage contract threshold amount set pursuant to the New Jersey Prevailing Wage Act (N.J.S.A. 34:11-56.25 et seq.) are required to pay no less than prevailing wage rate to workers employed in the performance of any construction undertaken in connection with Board of Public Utilities financial assistance, or undertaken to fulfill any condition of receiving Board of Public Utilities financial assistance, including the performance of any contract to construct, renovate or otherwise prepare a facility, the operations of which are necessary for the receipt of Board of Public Utilities financial assistance. By submitting an application, or accepting program incentives, applicant agrees to adhere to New Jersey Prevailing Wage requirements, if and to the extent that Act may apply to the work covered by the application. More information can be found at https://www.nj.gov/labor/wagehour/regperm/public_contracts_general.html

2.6.4 Dispute Resolution Process

Disputes, concerns, or complaints that arise will be addressed initially by the Program Manager or Program Staff at the point of contact. If resolution for whatever reason is not possible, there is a dispute resolution process backed by the NJ Board of Public Utilities. https://njcleanenergy.com/main/board-public-utilities/board-public-utilities-0

Appeals and disputes must be presented to the Program Administrator within **45 days** of the Program Manager's determination regarding the subject of the appeal or dispute.

For contractual disputes between a system owner and installer or registrant, the NJ Division of Consumer Affairs (DCA) is the point of contact and the agency has an online complaint form.

The program is designed to allow for participation by pre-approved third party contractors that meet program requirements. One of the primary responsibilities of the program is to oversee the level of performance of the contractors that participate in the program. There are BPU approved contractor remediation procedures that will be followed if a contractor is found to violate program procedures and rules or consistently violates program requirements which may include being barred from participating in the program.

3 Proposed Energy Reduction Plan Development

3.1 Overview

The proposed ERP provides a roadmap for developing and implementing a comprehensive energy efficient work scope in new C&I projects. The process of creating an ERP involves assisting the design team in developing an energy efficient design and evaluating potential energy and cost savings of the proposed design. The ERP includes simulation results, a financing plan, a construction schedule, and a commissioning plan. The ERP must be developed in consultation with the Participant and must be adhered to closely throughout construction in order to ensure that the energy efficiency measures are installed in such a way as to realize the intended energy savings.

The proposed ERP shall include the following necessary components:

- Project Description
- Recommended Energy Efficiency Measures, including:
    - Description of measures (Section 3.4)
    - Estimated energy savings (Section 4)
    - Simulation Results (Section 4)
- Financing Plan (Section 3.5)
- Plan Implementation and Schedules (Section 3.6)
- Commissioning Plan (Section 3.7)

In addition, the requisite appendices shall include additional documentation, model simulation reports and assumptions, as well as any other analyses completed for the energy efficiency measures.

3.2 Pre-Design Bonus

Projects that are in pre-design or schematic design may be eligible for a higher Incentive #1. The goal is to incentivize applicants to critically think about their building design from an energy efficiency standpoint early in the design process when changes are easier to make, thereby

supporting high-performance, cost-effective project outcomes[5].

ASHRAE 209-2018 Energy Simulation Aided Design for Buildings Except Low-Rise Buildings defines modeling requirements, modeling goals, and best practices for modeling cycles during design, construction, and operation of new construction buildings and is a useful resource for design teams to implement an integrated design process. Note that P4P does not require compliance with Section 4.2 of ASHRAE 209-2018 to be eligible for pre-design bonus incentives.

3.2.1 General Requirements

To qualify for pre-design bonus incentives, the Partner will need to work with the applicant beginning in pre-design (see below) and develop at least one design support energy modeling report.

The Partner shall submit the following deliverables after Initial Application approval but prior to the Proposed Energy Reduction Plan:

- Energy Charrette Materials (Section 3.2.2): The submittal must include the Owner Project Requirements (OPR) report and the P4P ERP Tables with the "P4P – General Info" and "P4P – Energy Charrette" tabs completed.
- Design Support Energy Modeling Report (Section 3.2.3): Partners must complete either the *Load Reduction Modeling* (section 3.2.3.1) or *HVAC System Selection Modeling* (3.2.3.2) and submit reports that comply with the requirements of those respective sections.

Although pre-construction inspections are not routinely performed in this program, the Program Manager may inspect projects applying for this bonus.

3.2.2 Energy Charrette

3.2.2.1 Prepare for the Energy Charrette

The following steps must be followed to prepare for the energy charrette:

1. Complete the "P4P – General Info" tab including the "Project Information," "Utility Information," and "Project Team Information" tables
2. ***Schedule the energy charrette:*** The energy charrette must be conducted prior to initiating energy modeling and attended in-person or remotely by the following team members:

[5] Aligned with LEED New Construction v4 Integrative Process credit.
http://www.usgbc.org/node/2613097?return=/credits/all/all/integrative-process-credits

owner or owner's representative, architect, engineer, P4P Partner and the energy modeler or individual supervising energy modeler's work.

3.2.2.2 Prepare the Draft Owner Project Requirements (OPR) Report

The draft OPR must include the following sections:

1. General project information ("P4P – General Info" tab including the "Project Information" and "Utility Information" tables)
2. Anticipated building use including space functions, operating hours, etc. If the project-specific values are unknown, use typical values such as EPA Target Finder defaults.
3. Benchmarking results: the project must be entered into the EPA Target Finder. The report must include the Target Finder median source energy use intensity (EUI), and the source EUI necessary to meet ENERGY STAR requirements.
4. Overall Energy Goals (Project Energy Goals section of "P4P – Energy Charrette" tab of the ERP Tables)
5. Suggested modeling cycles: Projects must complete the Load Reduction Modeling Cycle (Section 3.2.3.1) or HVAC System Selection Modeling (Section 3.2.3.2)
6. Performance goals: The suggested performance goals of individual building systems and components and the related 90.1-~~2016~~ 2019 prescriptive requirements.

3.2.2.3 Conduct the Energy Charrette

The energy charrette must be conducted prior to initiating energy modeling. During the energy charrette, the P4P Partner must introduce the draft OPR report, and discuss the following:

1. Anticipated building operating conditions used in conjunction with the EPA Target Finder. Get input from the owner and design team whether assumptions reflect the expected building use.
2. EPA Target Finder results
3. Typical relative magnitude of different end-uses (heating, cooling, lighting, etc.) for the building type. Suggested presentation of end uses is included in "P4P – Energy Charrette End Uses" tab of the ERP Tables.
4. Project Energy Goals: Get input from the owner and design team on the suggested project energy goals. Discuss P4P incentives and how they relate to the achieved energy performance.
5. Planned modeling cycles: Discuss how modeling may be used to inform design and P4P Pre-design Bonus incentives. Get input on the modeling cycles that projects will pursue.
6. Set performance goals for individual building systems and components, such as target thermal and solar properties of envelope components, HVAC system type and efficiency,

etc. The system performance targets must support the established project energy goals (e.g., the target EUI and incentive tier) and may be based on sources such as *ASHRAE 50 Percent Advanced Energy Design Guides (AEDG)*[6] and *Zero Energy AEDG*[7] for the appropriate building types and *NYStretch Energy Code – 2020*[8], New York's stretch energy code.

3.2.2.4 Develop the OPR report

The following process should be used to develop the final energy performance goals report:

1. Share energy charrette minutes with the participants
2. Revise the draft OPR report incorporating items discussed at the energy charrette, and distribute to the energy charrette attendees to solicit input
3. Distribute the final OPR report to the owner and design team.

3.2.3 Design Support Energy Modeling Report

The Partner must perform design support modeling cycle(s) as agreed at the energy charrette. At least one of the modeling cycles described below must be completed to qualify for pre-design bonus incentive.

3.2.3.1 Load Reduction Modeling (Simple Box / Conceptual Design)

Purpose:

1. Identify the distribution of energy by end-use.
2. Identify energy improvements that are tied to the form and architecture of the building.
3. Evaluate strategies that will reduce annual energy use and heating and cooling peak loads.

Timing: Prior to or during Schematic Design

Scope: Create building energy models to estimate annual building energy by end-use and peak heating and cooling loads. Use simplified perimeter/core zoning. The modeled HVAC system type may reflect the 90.1 Appendix G baseline or expected proposed HVAC system type. The base case should have envelope, HVAC and service water heating efficiencies and lighting minimally

[6] https://www.ashrae.org/technical-resources/aedgs/50-percent-aedg-free-download

[7] https://www.ashrae.org/technical-resources/aedgs/zero-energy-aedg-free-download

[8] https://www.nyserda.ny.gov/All-Programs/Programs/Energy-Code-Training/NYStretch-Energy-Code-2020

compliant with the state energy code. Evaluate design alternatives related to the following building characteristics within the range of options acceptable to the owner and design team:

1. Building geometry
2. Window-to-wall ratio, by orientation, and shading options (if applicable)
3. Orientation
4. Building envelope performance including but not limited to insulation level, glazing U-value and SHGC, infiltration, and thermal mass
5. Lighting and daylighting
6. Internal equipment loads
7. Outdoor air (including, but not limited to, outdoor airflow, exhaust air, and energy recovery)
8. Passive conditioning and natural ventilation

Reporting: The analysis must be documented in the report and cover the following:

1. Energy consumption by end use and peak cooling and heating loads
2. Recommendations to improve the energy performance based on the completed analysis, including at least five load reduction strategies selected from items 1-8 above. For projects with the high internal loads, at least two recommended strategies must be related to the equipment loads.

3.2.3.2 HVAC System Selection Modeling

Purpose: Estimate the annual energy and demand impacts of HVAC system options.

Timing: Before HVAC system type selection is finalized, prior to or during Design Development

Scope: Create building energy models to calculate annual building energy by end-use and peak heating and cooling loads. Evaluate at least two HVAC system type options relative to the 90.1 Appendix G baseline. The following modeling approach can be used:

1. Use simplified perimeter/core zoning representative of the building design
2. Model envelope, service water heating efficiency and lighting to be minimally compliant with the state code or based on the performance targets accepted by the owner and design team.

3. Use efficiency levels and controls minimally required by 90.1-~~2016~~ 2019 for each HVAC system type option.
4. Address ventilation strategies including dedicated make-up air system, outdoor air flow, exhaust air energy recovery, and demand control ventilation

Reporting:

1. Energy consumption by end use and peak cooling and heating loads.
2. Recommendations to improve the energy performance based on the completed analysis, including alternatives evaluated, recommended system types and ventilation strategies.

3.3 Minimum Performance Target

The Proposed ERP details the proposed design and specific energy efficiency measures that will be implemented to achieve the Minimum Performance Target.

~~-~~The Minimum Performance Target is 5% energy cost or source energy savings for commercial and industrial buildings and 15% for multifamily buildings compared to ASHRAE 90.1-201~~9~~6 based on 90.1 Appendix G method. ~~For projects following the ASHRAE Building Energy Quotient (bEQ) As-designed path, the equivalent targets are expressed using bEQ As-Designed scores (see Section 4.3.1). **Note on ASHRAE bEQ:** *ASHRAE bEQ As-Designed* has recently been updated and now requires that two models be developed. References in this guide are based on the prior bEQ program, which required only a single model to be developed.~~

Projects that can provide proof of permit received under the prior energy code, i.e. ASHRAE 90.1-~~2013~~2016, will be able to measure their savings from this baseline. ~~The 90.1 Performance-based Compliance Form will not have an option to select this baseline code,. therefore, 2013 requirements will need to be looked up and referenced independently for projects using the older code. A 2013 drop-down option will be available in the ERP workbook and performance will be calculated within this workbook.~~

Projects that cannot identify efficiency improvements that meet this minimum target will be referred to the appropriate NJ SmartStart Buildings Program(s).

The Minimum Performance Target is based on reducing the total energy use for the facility where electricity and/or natural gas is purchased and/or delivered by a New Jersey Investor-Owned Utility (IOU). For projects with non-IOU fuel sources at least 50% of the energy cost or source energy reduction must come from an IOU, or 100,000 kWh or 2,000 Therms whichever is greater.

3.4 Measure Requirements

Regardless of compliance path selected, each project must have at least one measure addressing

each of the following building components: envelope, heating, cooling, and lighting. Buildings that are not heated (e.g. refrigerated warehouse) or not cooled (e.g. warehouse) will not be required to have a measure addressing the missing building component(s). Further, gut rehab/renovation projects will not be required to propose building envelope improvements.

The calculation of energy savings must follow the Simulation Guidelines (Section 4).

For each proposed measure, a narrative description of the measure and the baseline component is required.

The ~~appropriate~~ lifetime for each measure ~~must comply with~~used to determine lifetime savings for program reporting purposes is provided ~~are shown~~ in Appendix A.

3.4.1 Minimum Performance Standards

Measures are defined as components that exceed ASHRAE 90.1-~~2016~~ 2019 requirements and comply with Appendix B, where applicable. Proposed HVAC system types that differ from ASHRAE 90.1-~~2016~~ 2019 Appendix G system type may be considered a measure, assuming that the proposed system type is an improvement over the baseline system type (e.g., proposed energy efficient chiller vs. baseline DX cooling) and is not otherwise an energy penalty. In such cases, the proposed HVAC system type must still demonstrate efficiencies that exceed ASHRAE 90.1-~~2016~~ 2019 requirements in order to qualify.

3.4.2 Demand Reduction or Shifting

Energy cost savings due to decrease or shift in peak demand in the proposed design compared to the baseline may contribute to the Minimum Performance Target if local utility rates include demand and/or time of use charges and the measure can be modeled in the simulation software. Qualified measures that reduce peak demand include efficiency improvements such as high-performance lighting or cooling systems, and demand shifting measures such as thermal storage. The Partner must provide justification for rates used.

3.4.3 Non-Eligible measures

The Pay for Performance program will only provide incentives for eligible energy-efficiency equipment. Renewable energy technologies that generate power cannot be included in the Energy Reduction Plan, such as:

- Solar panels
- Wind turbines

- Biogas
- Hydro power

Power generating technologies may be included as part of the project, as long as they are not included in the ERP. In which case, they must be separately metered so that they can be separated from the savings figures claimed under the Pay for Performance program. The following technologies are not considered to be power generating, and may be included in the ERP work scope:

- Geothermal heat pumps
- Thermal storage
- Solar water heaters

The following measures are not permitted:

- Sub-metering
- Monitoring software
- Power factor correction equipment
- Permafrost or similar refrigerant additives
- Removal of miscellaneous plug loads or other similar non-permanent measures
- Emerging technologies, unless supported by third party evaluation/study which will be reviewed and permitted at Program Manager's discretion.
- Operations and maintenance-type measures
- Energy cost savings due to demand control or demand shifting agreements with utility
- Any measures where energy savings are dependent on manual response/operation.

Most energy-efficient technologies will qualify under the Pay for Performance Program. If the scope of work recommends new or emerging technologies, please contact the Program Manager first to verify eligibility. When in doubt, please contact the Program Manager for clarification.

3.4.4 Combined Heat and Power & Fuel Cells

Combined Heat and Power (CHP) and Fuel Cell Systems cannot contribute to the Minimum Performance Target. A separate program for CHP and fuel cell incentives is provided by the New Jersey Clean Energy Program. Please visit www.njcleanenergy.com/chp for more information.

3.4.5 Materials and Installation Standards / Specifications

It is the responsibility of the Partner to ensure that all performance assumptions reflected in the ERP are translated into bid and design documents. A work scope should contain performance specifications or references to the specifications for the materials and equipment to be installed. Additionally, the work scope should include enough information about installation standards to ensure that competitive bidding is fair in scope and pricing and that potential contractors understand the importance of following the performance specifications. The project work scope, proper measure selection, and successful project implementation are the Partner's sole responsibility.

3.5 Financing Plan

The scope of the financing plan will vary in complexity depending on the anticipated sources of funding for the energy efficiency work scope. For Participants who have sufficient funds in reserve to cover the construction costs of the project, the financial plan will be very simple. Conversely,

for Participants who are planning to include public funding, the financing plan will be more complex.

The objective of the financing plan is to clearly present a detailed description of how the proposed energy efficiency work scope is intended to be financed. The plan is seen as a critical component of a well-prepared project and illustrates that the Participant, in collaboration with the Partner, as necessary, has considered how the proposed construction project will be financed. The plan should provide enough detail to ensure that all parties (Participant, Partner, and the Program Manager) are aware of the intended sources of funding for the energy efficiency project.

The Financing Plan table contains total construction costs, including the recommended EEMs, as well as the total Partner fees for the project. The table must delineate all sources of financing for the project, including the Pay for Performance Program Incentives.

3.6 Implementation Plan

The implementation schedule should include a detailed description of the proposed construction schedule for the project, including a timeline for regulatory approvals, system design, and bid document preparation, as applicable. The plan should provide enough detail to ensure that all parties (Participant, Partner, and the Program Manager) are aware of construction schedule. Estimated Construction Start and Completion Date should be within the program allowances, as described in Section 2.5.

3.7 Commissioning Plan

A detailed Cx Plan, utilizing the Cx Plan template, must be submitted as part of the proposed ERP and shall include the following items:

1. Identification of the CxA and documentation of experience;
2. A narrative describing the activities to be accomplished during each phase of Cx, including identification of the responsible party and how they will be completed;
2. Proposed operation of control systems;
3. Equipment and systems to be tested, including the extent of tests;
4. Functions to be tested (calibration, economizer control, etc.);
5. Conditions under which the test shall be performed (winter and summer design conditions, full outside air, etc.);
6. Measurable criteria for acceptable performance;
7. Method for reporting and resolving any deficiencies discovered;
8. Timeline/Schedule for commissioning activities;

9. Owner's Project Requirements (OPR);
10. Basis of Design (BOD);

The Partner and CxA should work together in developing the Cx Plan to ensure key performance assumptions used in energy savings calculations are translated into the Cx Plan as parameters for acceptable performance. Details of the Cx Plan must be clearly documented in the proposed ERP. For more information on Commissioning requirements, please see Section 6.

4 Simulation Guidelines

4.1 Overview

For projects to qualify for incentives under this Program, the Partner must calculate the project's Performance Rating (or Performance Score), which must meet or exceed the Minimum Performance Target.

The Minimum Performance Target is 5% energy cost or source energy savings for commercial and industrial buildings and 15% for multifamily buildings compared to ASHRAE 90.1-201~~6~~9[9] based on 90.1 Appendix G method. ~~For projects following the ASHRAE Building Energy Quotient (bEQ) As-designed path, the equivalent targets are expressed using bEQ As-Designed scores.~~

The Simulation Guidelines are intended to assist the Partner in developing their energy models and are meant to:

1. Facilitate consistent modeling among different modelers
2. Establish modeling protocols for measures
3. Ensure that modeling results are used to drive the energy-efficient design process

Each project shall submit a single energy model. If project involved multiple buildings (with prior program approval), they must be captured in a single energy model.

For any energy efficiency measure (EEM) included in the model that is not addressed in the Simulation Guidelines, or for any calculations performed outside the modeling software and not specified in the Simulation Guidelines, Partners must submit for Program Manager approval.

4.2 Software Requirements

Modeling software must satisfy the requirements outlined in ASHRAE 90.1-~~2016~~ 2019 Appendix G Section G2.2, as modified in these Simulation Guidelines. Examples of allowed tools include eQUEST, HAP, EnergyPlus, and Trane Trace. Approval for use in LEED and Federal Tax Deductions for Commercial Buildings program may serve as the proxy to demonstrate compliance with the requirement.

Partners or software vendors who believe that they have an analytical tool that satisfies the

[9] Projects that can provide proof of permit received under the prior energy code, i.e. ASHRAE 90.1-~~2013~~2016, will be able to measure their savings from this baseline.

requirements above but that is not yet approved for use in the program should discuss with the Program Manager and describe the tool's capabilities and how the tool complies with the listed program requirements. Particular emphasis must be placed on how the tool meets ASHRAE 90.1 Appendix G Section G2.2 requirements and EEM modeling. Based on the Program Manager's review, the tool may be accepted for use on one or several pre-approved pilot projects. After successful completion of the pilot project(s), the tool will be included in the list of approved software.

Energy Reduction Plans for projects that are not identified as pilot projects prior to preparing the comprehensive energy assessment and that utilize software not approved for use in the program will not be accepted.

4.2.1 External Calculations[10]

If the approved simulation tool used for the project cannot adequately model a design, material, or device, then the energy savings associated with this component may be calculated using an external calculation such as custom spreadsheets. Exceptional calculations for systems and components that may be modeled directly in the simulation tool will not be accepted. *If unsure whether a measure can be included through exceptional calculations, please check with the Program Manager prior to ERP submittal.* The resulting savings may then be subtracted from the usage projected by the proposed design model. Spreadsheets may also be used to support simulation inputs. Unless approved by the Program Manager, at no time shall the total exceptional savings constitute more than 3% of the modeled energy cost or source energy of the proposed design. RETScreen may be used for modeling savings from solar water heating measures and other renewable energy technologies if these systems are not supported by the simulation tool used for the proposed design. RETScreen is a free tool developed and maintained by Natural Resources Canada. This software can be downloaded at http://www.retscreen.net/ang/home.php. The results must then be integrated into the compliant simulation tool.

Vendor-supplied and proprietary tools that were not / cannot be peer-reviewed cannot be used as external calculations to estimate EEM savings.

Documentation for Exceptional Calculation Methods must include:

1. Copies of all spreadsheets used to perform the calculations labeled as an Appendix to the ERP. *.PDF calculations will not be accepted.

[10] Approach adopted by ASHRAE 90.1-201~~6~~9 and modified for this document.

2. Theoretical or empirical information supporting the method used based on peer review references.
3. The predicted energy savings by energy type, the energy cost savings, a narrative explaining the exceptional calculation method, and theoretical or empirical information supporting the accuracy of the method.
4. The calculations shall be performed on a time step basis consistent with the simulation program used.
5. When using exceptional calculation methods, please select 'Custom Calcs' in ERP Excel Tables, Measure Simulation tab (*Savings Calculation Method)*. In the *Changes Made to Previous Model Run*, the description should include the exact name of the supplemental spreadsheet submitted.

4.3 General Simulation Requirements

~~4.3.1 ASHRAE Building Energy Quotient (bEQ) As-Designed[11] Path~~

~~The ASHRAE bEQ compliance path may be used to demonstrate that the proposed design is meeting or exceeding the Minimum Performance Target. Under this path, the Partner shall develop a single energy model representing the proposed project design using the ASHRAE 90.1-2016 Appendix G protocol and the schedules and plug and process loads specified by building space type in the COMNET Appendices B and C[12].~~

> ~~Exception: Multifamily projects must use miscellaneous plug load density and schedules prescribed by *ENERGY STAR Multifamily Program Guidelines – Appendix G 90.1-2016 v1.0*[13].~~

~~The program calculates the project's bEQ Score within the ERP by comparing the modeled EUI of the proposed design and the Median EUI as determined by ZeroTool[14]. This is aligned with the methodology used by ASHRAE bEQ Portal.[15]~~

~~[11] https://www.ashrae.org/technical-resources/building-eq~~

~~[12] https://www.comnet.org/reference-appendices~~

~~[13] https://www.energystar.gov/sites/default/files/asset/document/ENERGY_STAR_MFNC_Simulation_Guidelines_AppG2016_Version_1_Rev01.pdf~~

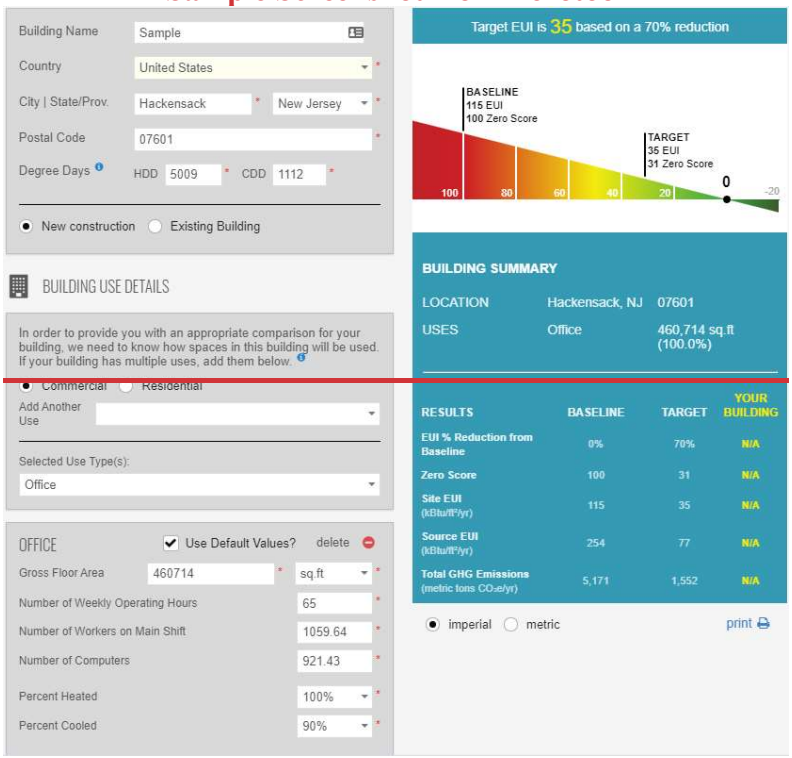
~~[14] https://zerotool.org/zerotool/~~

~~[15] https://buildingeq.ashrae.org/~~

~~The Partner shall complete and provide the following documentation in the Energy Reduction Plan Package:~~

1. ~~**ERP Tables** with all tabs completed.~~
2. ~~**90.1 Performance-based Compliance Form**~~
3. ~~Screenshot or pdf of **Zerotool,** inputs and results. A sample is shown below for reference. Refer to Zerotool's Guide[16] for instructions for populating Zerotool.~~

~~**Sample Screenshot from Zerotool**~~



~~In addition to the guidance provided in the 'Instructions' tab of the ERP tables, the following instructions apply to the *90.1 Performance-based Compliance Form* for ASHRAE bEQ projects:~~

- ~~"General Information" tab: select "ASHRAE 90.1-2016 Appendix G" compliance path~~
- ~~"Results from eQuest" tab: This tab does not have to be filled out as the project performance outcome can only be determined in the ERP for bEQ projects.~~
- ~~"Compliance Calculations" tab: This tab does not have to be filled out as the project~~

~~[16] https://www.zerotool.org/user-guide/~~

~~performance outcome can only be determined in the ERP for bEQ projects.~~

- ~~All other tables and tabs: Fill out only the Proposed Design columns and tabs, but not the baseline columns and tabs.~~

~~4.3.1.1 bEQ Score Structure~~

~~Proposed design simulation results are used to determine the project's Energy Use Intensity ($EUI_{standard}$) which is compared to the Median EUI for the building type (EUI_{median}) to determine the project's Performance Score.~~

$$\text{~~Performance Score} = (EUI_{standard} / EUI_{median}) \times 100$$

~~EUI_{median} is based on the Energy Information Administration's Commercial Building Energy Consumption Survey (CBECS) 2003 and determined by filling out Architecture 2030's Zerotool (new construction). The EUI_{median} must be manually entered into 'P4P – Measure Simulation' tab of the ERP Tables to determine the project's performance score and incentive tier. Projects earn incentives by achieving a bEQ Score that is less than or equal to 63. ASHRAE bEQ incentive tiers are as follows:~~

- ~~Tier 1: 61 < score ≤ 63~~
- ~~Tier 2: 59 < score ≤ 61~~
- ~~Tier 3: ≤ 59~~

~~4.3.1.2 Building Use Type Selection~~

~~The 'Building Use Details' section of ZeroTool contains a list of building use types eligible for this path including sub-categories of building. Partners should refer to the EPA Portfolio Manager Glossary[17] for a description of each use type and associated space use characteristic input. With the exception of hospitals, the ASHRAE bEQ Path cannot be used for projects classified as 'high intensity users.'~~

~~Select the primary building use in Zerotool and specify any additional building uses by selecting, one-by-one, options under the 'Add Another Use' drop-down menu. If the building contains only one primary function, no additional building use types should be added. The total area of all building uses should equal the total gross floor area of the building. Support spaces (e.g., corridors, storage, etc.) do not need to be entered separately. Space uses that are significantly~~

[17] ~~https://portfoliomanager.energystar.gov/pm/glossary~~

~~different in occupancy and/or use patterns must be entered separately. For example, a parking garage should be entered as an additional building use.~~

~~Complete the 'Building Use Detail' using values consistent with the proposed model.~~

~~4.3.1.3 Gut Rehab/Renovation Projects~~

~~The proposed model must reflect the project's design parameters, whether the components are new, renovated/improved, or existing left as-is (Exception: existing systems and components that are left as-is AND exceed 90.1-2016 must be modeled as minimally complying with 90.1-2016).~~

~~ASHRAE 90.1-2016 has several exceptions allowing renovated components to be less efficient than new construction (e.g., 90.1-2016 Section 5.1.3 – Envelope Alternations). Retrofitting envelope to meet or exceed requirements of the current code for new components presents a special challenge and may be cost prohibitive. To account for these factors, the target bEQ score for major renovation projects is adjusted as follows:~~

- ~~Tier 1: 64 < score ≤ 66~~
- ~~Tier 2: 62 < score ≤ 64~~
- ~~Tier 3: score ≤ 62~~

~~This adjustment is incorporated into the incentive tier calculations in the ERP Tables when conditioned area is indicated as a major renovation. For projects that include both new construction and major renovations, target scores will be calculated using an area-weighted average.~~

~~Refer to Section 4.3.2.6 for additional information and requirements on gut renovation projects.~~

~~4.3.2~~4.3.1 ASHRAE 90.1-201~~6~~9 Appendix G ~~Path~~

~~4.3.2.1~~4.3.1.1 General Description

~~Under this option, the~~The Partner shall model a baseline and proposed building using ASHRAE 90.1-~~2016~~ 2019 Appendix G (Appendix G). Additional addenda may be used but must be explicitly listed in the submittals. In addition to the ASHRAE Standard 90.1, the ANSI/ASHRAE/IES Standard 90.1-2016 (or 2019 once it is published) Performance Rating

Method Reference Manual[18] ~~-~~and 90.1 User's Manual are useful references for interpretation of the Standard.

Appendix G uses a baseline that~~,~~ ~~will~~ starting with ASHRAE 90.1 2016, will remain the same for ~~ASHRAE 90.1-2016 and~~ all future iterations of ASHRAE 90.1 and is roughly equivalent to ASHRAE 90.1-2004.

Baseline Design

- Shall be modeled as described in ASHRAE 90.1-~~2016~~ 2019 Appendix G;
- Shall not include end uses that do not exist in the proposed design. For example, if the parking lot in the proposed design is not lit, then the parking lot lighting power allowance cannot be added to the baseline energy consumption.

  Exception: Cooling must be modeled in some conditioned spaces with no cooling specified, as required by Appendix G Table G3.1 #1b.

Proposed Design

- Must reflect the actual building design components specified;
- Must comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 9.4 and 10.4) in ASHRAE Standard 90.1-~~2016~~2019, and Table G3.7 or G3.8 in the Appendix G. Compliance with 8.4 is not required by NJ State Energy Code (N.J.A.C 5:23-3.18) and will not be required by this program with the exception of Section 8.4.4 Transformers, which is required by EPAct 2005. Receptacle controls required by Section 8.4.2 may be treated as a measure if included in the scope of work.
- Must include all end-use load components including, but not limited to exhaust fans, parking garage ventilation fans, snow-melt, and freeze-protection equipment, façade lighting, swimming pool heaters and pumps, elevators and escalators, refrigeration and cooling.
- Where the space classification for a space is unknown in buildings in which energy-related features have yet to be designed, the space shall be categorized as an office space.

The Partner shall complete the following workbooks in the ERP Tables Package:

1. **ERP Tables**
2. **90.1 Performance-based Compliance Form**

[18] ANSI/ASHRAE/IES Standard 90.1-2016 Performance Rating Method Reference Manual, S Goel, M Rosenberg, C Eley, PNNL 2016

~~4.3.2.2~~4.3.1.2 Performance Targets and the Performance Cost Index

The program allows establishing the incentive tier based on the percent improvement of the proposed design over code using either units of energy cost or source energy.

$$\text{Performance Rating} = 100 * (PCIt - PCI)/PCIt$$

PCIt = (BBUEC + (BPF x BBREC))/BBP

PCI = PBP/BBP

where:

PCI = Performance Cost Index. A project with a PCI=1.0 is as efficient as the baseline (i.e. meets ASHRAE 90.1-2004). A project with a PCI= 0.0 is a net zero building.

PCIt= Performance Cost Index Target

BBP = Baseline Building Performance

PBP= Proposed Building Performance

BBREC = Baseline Building Regulated Energy Cost (or Source Energy Consumption). The portion of the annual energy cost (or source energy consumption) of a *baseline building design* that is due to *regulated energy use*, calculated by multiplying the total energy cost (or source energy consumption) by the ratio of *regulated energy use* to total energy use for each fuel type.

BBUEC = Baseline Building Unregulated Energy Cost (or Source Energy Consumption). The portion of the annual energy cost (or source energy consumption) of a *baseline building design* that is due to *unregulated energy use*, calculated by subtracting regulated energy cost (or source energy consumption) from total energy cost (or source energy consumption).

BPF= Building Performance Factor accounts for the difference in stringency between the modeled baseline compliant with ~90.1-2004 and the requirements in 90.1-201~~6~~39[19]. For mixed use buildings, the BPF is calculated as an area-weighted average of the building area types, as described in.

Cost Option

Both the baseline and proposed building performance are expressed as *energy cost*. If performance credit is claimed for demand reduction (Section 3.4.2), its impact on energy cost must be calculated

hourly within the simulation tool. The blended energy rates for the baseline and proposed design based on the simulation outputs must be entered in the 'P4P – General' tab of the ERP Tables to claim credit for this reduction.

Source Energy Option

Both the baseline and proposed building performance are expressed as source energy based on the EPA Portfolio Manager Site-to-source conversion factors[20] shown in the table below that are also incorporated into the ERP. This option does not allow credit for demand reduction but better supports projects with high performance electric heating systems such as VRF heat pumps in the proposed design and gas heating in the baseline.

Source-Site Ratios for all Portfolio Manager Energy Meter Types

Energy Type	U.S. Ratio	Canadian Ratio
Electricity (Grid Purchase)	2.80	1.96
Electricity (On-Site Solar or Wind, RECs Retained)	1.00	1.00
Electricity (On-Site Solar or Wind, RECs Sold/Arbitraged)	2.80	1.96
Natural Gas	1.05	1.01
Fuel Oil (Nos. 1,2,4,5,6, Diesel, Kerosene)	1.01	1.01
Propane & Liquid Propane	1.01	1.04
Steam	1.20	1.33
Hot Water	1.20	1.33
Chilled Water	0.91	0.57
Wood	1.00	1.00
Coal/Coke	1.00	1.00
Other	1.00	1.00

The ERP Tables will calculate a PCI that is equivalent to ASHRAE 90.1-~~2016~~2019, as well as PCI values corresponding to three tiers that are equivalent to exceeding ASHRAE 90.1-~~2016~~ 2019 by 5%, 7%, and 10%, respectively, for commercial buildings and 15%, 17%, and 20%, respectively, for multifamily buildings.

~~4.3.2.3~~4.3.1.3 Building Type Selection

The ERP Tables allows for eight (8) building types to be selected. Based on the building type

[20] https://portfoliomanager.zendesk.com/hc/en-us/articles/216670148-What-are-the-Site-to-Source-Conversion-Factors-

selected, the ERP Tables will calculate the minimum Performance Cost Index (PCI) value necessary to comply with ASHRAE 90.1-201~~6~~9 and meet or exceed the Minimum Performance Target to align with the incentive structure (as noted above).

- Multifamily: Includes all mid-rise and high-rise apartment buildings. Also includes senior living, assisted living, and nursing assuming the below two criteria are met, otherwise these should be classified as "All Others".
    - ***dwelling unit:*** a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.
    - ***nontransient:*** occupancy of a dwelling unit or sleeping unit for more than 30 days.
- Healthcare/Hospital: Includes outpatient health care and hospitals.
- Hotel/Motel: Includes small and large hotels and motels as well as dormitories.
- Office: Includes administrative, financial, government, and medical buildings as well as data centers ("high intensity users" only).
- Restaurant: Includes fast food and sit-down restaurants.
- Retail: Includes stand-alone retail (non-food), strip malls, malls, and supermarkets.
- School: Includes preschool/day care, primary schools, secondary schools, colleges, and universities.
- Warehouse: Includes non-refrigerated and refrigerated warehouses ("high intensity users" only) as well as distribution centers.
- All Others: Includes manufacturing and process facilities as well as any building type that does not fit into the above categories.

Partners should discuss with the Program Manager if unsure how to classify a building type.
For projects that are mixed use such as a building that contains a school, retail store, and a multifamily building, each building type and associated area shall be entered in the 'P4P General Info' tab. If the project has more than three distinct building types, Partners should discuss with the Program Manager on how to proceed.

~~4.3.2.4~~4.3.1.4 Unregulated Energy

For 90.1 Appendix G compliance, energy use must be separated into regulated and un-regulated components as described below.

Regulated energy use: energy used by building systems and components with requirements prescribed in 90.1 Sections 5 through 10. This includes energy used for HVAC, lighting, service water heating, motors, transformers, vertical transportation, select refrigeration equipment, computer-room cooling equipment, and other building systems, components, and processes.

Unregulated energy use: energy used by building systems and components that are not regulated in Section 5 through 10 including the following:

1. Lighting subject to the exceptions 90.1 Section 9.1.1 including emergency lighting that is automatically off during normal building operation, lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation and decorative gas lighting systems.
2. Transformers, except low-voltage dry-type transformers included in Section 8.4.4.
3. Plug-in equipment including but not limited to residential kitchen appliances, consumer and office electronic systems.
4. Industrial process equipment and custom refrigeration systems with no requirements in 90.1.

Miscellaneous plug load density (W/SqFt) shall be determined using COMNET Commercial Buildings Energy Modeling Guidelines and Procedures Appendix C. Plug load hourly schedules shall be determined using COMNET Commercial Buildings Energy Modeling Guidelines and Procedures Appendix B.

> Exception: Multifamily projects must use miscellaneous plug load density and schedules prescribed by *ENERGY STAR Multifamily Program Guidelines – Appendix G 90.1-2016 Version 1, Revision 03.~~v1.0~~*

All unregulated and process energy must be included in the simulation. Unregulated and process energy must be the same in both the Baseline and Proposed models *unless savings are documented by the Partner with justification for all assumptions and submitted to the Program Manager for approval (e.g. claiming savings for ENERGY STAR appliances, versus standard-efficiency appliances*).

For Appendix G projects, unregulated and regulated lighting, refrigeration, and miscellaneous energy must be calculated and entered into the ERP Tables and the 90.1 Performance-based Compliance Form separately in order to calculate the PCI target correctly.

~~4.3.2.5~~4.3.1.5 Modeling Energy Neutral Systems and Components

If performance credit will not be claimed for a system or component included in the proposed design (e.g., in cases where systems do not meet the Minimum Performance Standards or design is not specified), such systems shall be modeled as energy neutral as follows:

a. Energy neutral Unregulated systems and components must be modeled the same in the baseline and proposed design.

b. Energy neutral Regulated systems and components must be modeled as follows:
   - Baseline must be modeled based on the applicable requirements of 90.1 Appendix G and as described in these guidelines. If not prescribed, the baseline must reflect requirements in Section 5 to 10 of 90.1-~~2016~~2019.
   - Proposed Design must be modeled as meeting the applicable requirements of 90.1-~~2016~~2019.

~~4.3.2.6~~4.3.1.6 Gut Rehab/Renovation Projects

The program is open to both ground-up new construction and major renovation (gut rehabilitation) projects.

Renovation projects typically remove and replace all equipment within the space, but sometimes a project may elect to leave and repurpose certain components, such as envelope or portions of the HVAC. This creates a "hybrid" project that is part new construction and part retrofit. This section outlines the special rules that apply to such projects.

~~4.3.2.6.1~~4.3.1.6.1 Performance Target Adjustment

Starting from 2013 edition, Standard 90.1 Appendix G Performance Rating Method (PRM) does not differentiate between new construction (NC) and major renovation (MR) projects, measuring performance of the proposed design relative to the same baseline irrespective of the project type.

ASHRAE 90.1-~~2016~~ 2019 has several exceptions allowing renovated components to be less efficient than new construction (e.g., 90.1-~~2016~~ 2019 Section 5.1.3 - Envelope Alternations). Thus, the new PRM approach is more stringent for renovation projects than the prescriptive path of compliance with energy code. Retrofitting envelope to meet or exceed requirements of the current code for new components presents a special challenge and may be cost prohibitive.

To account for these factors, the Building Performance Factor (BPF) that determines the improvement in the regulated energy cost or source energy of the proposed design relative to 90.1-2004 baseline that is required to meet 90.1-~~2016~~ 2019 is reduced by 6%, which translates into a corresponding reduction in the stringency of the P4P performance target for such projects. This adjustment is incorporated into the incentive tier calculations in the ERP Tables. For projects that include both new construction and major renovations, target PCIs will be calculated using an area-weighted average.

~~4.3.2.6.2~~4.3.1.6.2 Component Modeling

The table below summarizes the program approach for modeling systems and components in major renovation projects. In summary:

- The baseline model must be the same as for the new construction projects, except as described in Table G3.1. (e.g., fenestration area).
- The proposed model must reflect the project's design parameters, whether the components are new, renovated/improved, or existing left as-is, EXCEPT the existing systems and components that are left as-is AND exceed 90.1-~~2016~~ 2019 must be modeled as minimally complying with 90.1-~~2016~~2019.

Table 4-1. New Construction vs Gut Rehab Component Modeling

Component Type	Project and Incentive Impact	Baseline Component Modeling ~~(Appendix G path only)~~	Proposed Components Modeling	Is Component a Measure?	Examples
New Construction	May be energy penalty or credit, depending on proposed design.	ASHRAE 90.1-~~2016~~2019 Appendix G (= ~ ASHRAE 90.1-2004) and as described in Section 4 of these guidelines.	As specified by design	Yes, if it exceeds 90.1-201~~6~~9 prescriptive requirements. S*ee Section 3.4 for full measure requirements.*	Ground-up new construction project, addition to existing building
Existing Components Being Replaced	Same as New Construction	Same as New Construction	Same as New Construction	Same as New Construction Exception: May use subsections that apply to "Alterations" of existing building, which may be less stringent (e.g. 90.1-201~~6~~9, section 5.1.3).	Gut-renovation project with some improvements to existing envelope
Existing Components Being Left As-Is	Energy neutral if existing component is *better than or equal* to code. Penalty if *worse* than code.	Same as New Construction	If Energy neutral: model as meeting corresponding prescriptive requirements of 90.1-~~2016~~2019. If penalty: model as-is	No	Gut-renovation project, but existing chiller to be repurposed. Existing chiller has a rated COP greater than the prescriptive requirements of 90.1-~~2016~~2019 but must be modeled as minimally compliant with 90.1- 201~~6~~9.

4.4 Simulating Measure-Level Savings

4.4.1 General Approach

Energy-efficiency measures must be modeled incrementally. For example, in eQuest the "parametric runs" function must be used to model all energy reduction measures where possible. In TRACE 700, the "Alternatives" function must be used. Note that TRACE 700 only allows up to four (4) Alternatives; therefore, if modeling more than three (3) measures, Alternative-4 should be 'saved as' Alternative-1 and additional measures modeled as subsequent Alternatives. Model submissions that do not incorporate parametric runs [eQuest], alternatives [TRACE], or an equivalent process will not be accepted.

To account for interactive effects and to allocate them among measures, the measures must first be ranked. The order may be based on the cost-effectiveness of each measure, or the sequence in which measures would likely have been implemented had they been implemented individually. The measures are then added sequentially based on the established ranking and compliance path chosen, as described in the following sections. ~~However, only the measures that exceed ASHRAE 90.1-2016 requirements can contribute toward the incentive (see Section 4.4.5).~~

The model files submitted to Program Manager must allow review of savings projected from individual measures as described above.

4.4.2 Measure Modeling for Appendix G Path

All differences between Appendix G baseline and Proposed Design, including energy penalties (see Section 4.5.28), shall be simulated as measures based on the following steps:

Step 1 Add the highest ranking measure (M1) to the Baseline design to calculate usage of the Baseline with Measure #1. HVAC measures shall be modeled first.

Step 2 The savings associated with Measure #1 are calculated by comparing the usage of the Baseline Design to the Baseline + M1 Model from the previous step.

Step 3 The Baseline+M1 model is then modified to include the measure that was ranked the second (Measure #2) to obtain the Baseline+M1+M2

Step 4 The savings associated with Measure #2 are estimated by comparing the Baseline +M1 model to Baseline+M1+M2 model.

Step 5 Repeat with the remaining measures until the model includes all the measures and is equivalent to the Proposed Design.

Appendix G baseline is roughly equivalent to ASHRAE 90.1-2004. ~~Building components that~~

~~exceed Appendix G baseline, but do not exceed ASHRAE 90.1-2016 requirements, are not eligible to receive incentives (see Section 4.4.5).~~ In the 'P4P – Measure Info' tab of the ERP Tables, "Measure Exceeds 90.1-~~2016~~ 2019 Prescriptive or Additional Compliance Requirements" must be set to "Yes" or "No" depending on whether the measure exceeds the minimum mandatory/prescriptive requirements of 90.1 2019. This field ~~to make this measure eligible for incentives~~is used for program reporting purposes.

~~**4.4.3 Measure Modeling for ASHRAE Building Energy Quotient (bEQ) As-Designed Path**~~

~~All eligible energy efficiency measures shall be modeled relative to the proposed design energy model, as parametric runs or alternatives downgraded to code compliant parameters, and as described in Section 4.4.5, based on the following steps:~~

~~Step 1 "Remove" the highest ranking measure (M1) from the Proposed design to calculate usage of the Proposed Design without Measure #1. Note that the savings will be negative due to measures being simulated by derating design components to ASHRAE 90.1-2016 baseline equivalents. In the 'P4P – Measure Info' tab of the ERP Tables, "Measure Exceeds 90.1-2016 Prescriptive or Additional Compliance Requirements" must be set to "Yes" to trigger incentives. HVAC measures shall be modeled *last*.~~

~~Step 2 The savings associated with Measure #1 are estimated by comparing the usage of the Proposed Design to the Proposed - M1 Model from the previous step.~~

~~Step 3 The Proposed-M1 model is then modified to include the measure that was ranked second to last (Measure #2) to obtain the Proposed-M1-M2~~

~~Step 4 The savings associated with Measure #2 are estimated by comparing the Propsoed-M1 model to Proposed-M1-M2 model.~~

~~Step 5 Repeat with the remaining measures until the model includes all the measures that exceed mandatory or prescriptive requirements of 90.1-2016.~~

~~4.4.4~~4.4.3 Measure Granularity

Multiple components or systems may be grouped and reported as a single measure provided that these components/systems belong to the same end use. Distinct energy efficiency measures should not be combined if individual components have separate baselines OR if individual components improve efficiency, reduce flow rates, and/or reduce hours of operation. For example, different types of lighting fixtures may be modeled and reported as a single measure, but lighting fixtures and occupancy sensors cannot be combined. Similarly, lighting and HVAC system upgrades

cannot be combined. Measure granularity is defined by the available measures in the ERP template.

~~4.4.5~~4.4.4 Measures ~~Eligible for Incentives~~Classification

~~Only measures that exceed ASHRAE 90.1-2016 mandatory requirements in Section 5.4, 6.4, 7.4, 8.4.4, 9.4, 10.4 or prescriptive requirements in Sections 5.5, 6.5, 7.5, 8.5, 9.5, and 9.6 are eligible for incentives.~~ In the 'P4P – Measure Info' tab of the ERP Tables, Partners must identify if~~whether~~ a measure exceeds ASHRAE 90.1-2019 mandatory requirements in Section 5.4, 6.4, 7.4, 8.4.4, 9.4, 10.4 or prescriptive requirements in Sections 5.5, 6.5, 7.5, 8.5, 9.5, and 9.6 ~~the eligible measures~~ by selecting 'Yes' in the 'Measure Exceeds 90.1-~~2016~~ 2019 Prescriptive or Additional Compliance Requirements?' column. ~~With bEQ path, only measures eligible for incentives shall be modeled, and thus all measures will have "Yes" selected. For Appendix G path, s~~Select "No" for the following:

- Measures that exceed Appendix G baseline, but do not exceed ASHRAE 90.1-~~2016~~ 2019 requirements.
- Measures that result in negative source energy or energy cost savings

4.5 Component Modeling

4.5.1 High-rise Multifamily Buildings

For high-rise multifamily buildings, the ENERGY STAR Multifamily Program Simulation Guidelines must be used as an addendum to the P4P New Construction Simulation Guidelines if performance credit is claimed for measures that are outside the scope of Appendix G ~~or ASHRAE bEQ~~, such as ENERGY STAR appliances, low flow fixtures, or in-unit lighting.

Partners must use the calculations provided in the 90.1 Performance-based Compliance Form. See Section 4.2.1 for external calculations requirements.

4.5.2 Schedules ~~(Appendix G Path Only)~~

Operating and occupancy schedules from one of the following sources shall be used:

- ASHRAE 90.1-2019 ~~2016~~ User Manual Tables G-5~~D~~ through G-14~~N~~
- ~~ASHRAE 90.1 Section C3.5.5.3 Schedules and Internal Loads~~
- COMNET Commercial Buildings Energy Modeling Guidelines and Procedures Appendix C, except for multifamily
- ENERGY STAR Multifamily Simulation Guidelines for multifamily projects

Schedules must be identical in the baseline and proposed models. Exceptions include:

- Setpoints and schedules for HVAC systems that automatically provide occupant thermal comfort via means other than directly controlling air dry-bulb and wet-bulb temperatures.
- Modeling non-standard energy efficiency measures such as automatic lighting controls, automatic natural ventilation controls, automatic demand control ventilation controls, and automatic controls that reduce service water heating loads. In such cases, documentation including sources must be provided in the ERP justifying the assumptions.

Simulated hourly schedule distribution must be realistic as the Program requires reporting demand savings.

4.5.3 Building Envelope: Opaque Assemblies

4.5.3.1 Proposed Design

Proposed building envelope must be modeled as shown on architectural drawings, except uninsulated assemblies which can be averaged with larger adjacent assemblies. Thermal properties (U-value) of the proposed assemblies shall be calculated in accordance to 90.1 Appendix A. Careful attention must be placed on effective R-values for cavity insulation. For example, the effective R-value for R-21 cavity insulation may be as low as R-7.4 due to frame type, spacing, and depth.

To determine ~~To demonstrate that~~that opaque envelopment ~~-~~components exceed ASHRAE 90.1-~~2016~~2019 requirements, proposed opaque assemblies shall exceed the performance listed in Table 5.5-4 and Table 5.5-5. The prescriptive component can be determined as follows:

- Same assembly type as Appendix G (light-weight assemblies)
- Same assembly type as the proposed design. For example, if the proposed design includes a mass wall in climate zone 4a for a residential building, the proposed mass wall U-value must be less than U-0.090 (R-11.4 ci).

For major renovation projects, proposed design must exceed requirements of 90.1-~~2016~~2019 Section 5.1.3.

4.5.3.2 Baseline ~~(Appendix G Path Only)~~

Baseline building envelope must be modeled using light-weight assembly types for all above-grade walls, roofs, and floor assemblies using the maximum U-factors in Tables G3.4-1 through G3.4-8 for the building's climate and space type (residential, non-residential, semi-heated).

Gut rehab projects are treated identically to new construction projects. Baseline building envelope shall not be modeled as the existing condition, with the exception of existing fenestration area.

4.5.4 Building Envelope: Exterior Roof Surfaces

4.5.4.1 Proposed Design

Performance credit may be claimed for variances in solar reflectance and thermal emittance as long as the proposed performance is clearly documented and tested in accordance to CRRC-1 Standard, Solar Reflectance Index method in ASTM E1890, or equivalent. To ~~demonstrate~~ determine that the roof surface exceeds ASHRAE 90.1-~~2016~~ 2019 requirements, the same values as the Appendix G baseline may be used.

4.5.4.2 Baseline ~~(Appendix G Path Only)~~

Baseline exterior roof surfaces shall be modeled using a solar reflectance of 0.30 and thermal emittance of 0.90. The solar reflectance and thermal emittance values may be used to show compliance with ASHRAE 90.1-~~2016~~ 2019 as well.

4.5.5 Vertical Fenestration

4.5.5.1 Proposed Design

Proposed fenestration must be modeled as specified and include the whole window assembly (i.e. frames and glazing). Sources for proposed U-value include the window's NFRC rating and ASHRAE 2014 Fundamentals. If both summer and winter fenestration U-value is available, winter U-value must be used as it reflects the NFRC rating conditions. If software is capable of explicitly modeling framing and glazing separately, this approach may be used if these properties are known. Actual Visible Transmittance (VT) of the specified windows must be modeled to capture interaction with daylighting controls.

To ~~demonstrate~~ determine that components exceed ASHRAE 90.1-~~2016~~ 2019 requirements, proposed vertical fenestration shall exceed the performance listed in 90.1-~~2016~~ 2019 Table 5.5-4 and Table 5.5-5, as applicable based on the project's climate zone. For major renovation projects, proposed design must exceed requirements of 90.1-~~2016~~ 2019 Section 5.1.3.

Exception: For Appendix G projects, if the proposed window area exceeds Table G3.1.1-4 allowances, the additional window area shall be modeled as an energy penalty and separate from the EEM.

4.5.5.2 Baseline ~~(Appendix G Path Only)~~

Per ASHRAE 90.1-~~2016~~ 2019 Appendix G Table G3.1, vertical fenestration areas for new buildings and additions shall equal that in Table G3.1.1-4 based on gross above-grade exterior wall area. For building with multiple building area types, each type shall use the values in the table.

For building areas not shown in Table G3.1.1-4, such as multifamily buildings, vertical fenestration areas for new buildings and additions shall equal that in the proposed design or 40% window-to-wall ratio, whichever is less, and shall be distributed on each face of the building in the same proportions as the proposed design.

For gut rehab projects, the fenestration area shall be equal to the existing fenestration area prior to proposed work and shall be distributed on each face of the building in the same proportions as the existing building.

4.5.6 Skylights and Glazed Smoke Vents

4.5.6.1 Proposed Design

To ~~demonstrate~~ determine that components exceed ASHRAE 90.1-~~2016~~ 2019 requirements, proposed skylights shall exceed the performance listed in Table 5.5-4 and Table 5.5-5. For major renovation projects, proposed design must exceed requirements of 90.1-~~2016~~ 2019 Section 5.1.3.

4.5.6.2 Baseline ~~(Appendix G Path Only)~~

Per ASHRAE 90.1-~~2016~~ 2019 Appendix G Table G3.1, skylight area shall be equal to that in the proposed design or 3%, whichever is smaller. If the skylight area of the proposed design is greater than 3%, baseline skylight area shall be decreased by an identical percentage in all roof components in which skylights are located to reach 3%.

4.5.7 Interior Lighting

4.5.7.1 Proposed Design

Lighting in the proposed design must include all task and ambient lighting and a 'Space-by-Space Method' must be employed. Lighting energy savings credit may be claimed only for lighting fixtures compliant with Appendix B of this document.

For in-unit lighting in multifamily buildings, proposed lighting shall be modeled as described in the *ENERGY STAR Multifamily Program Guidelines – Appendix G 90.1-2016 Version 1, Revision 03~~v1.0~~*.

To ~~demonstrate~~ determine that components exceed ASHRAE 90.1-~~2016~~ 2019 requirements for all other lighting, proposed interior lighting power density shall exceed the performance listed in Table 9.5.1 or Table 9.6.1. The prescriptive requirement can be determined as follows:

- Using the Building Area Method, demonstrate that the whole building LPD is less than the values specified in Table 9.5.1. The ERP Tables shall include the total building area LPD

in the 'Measure Description' tab.

- Using the Space-by-Space Method, to ~~demonstrate~~ determine that the total lighting power in the proposed design is less than the total allowance calculated in ASHRAE 90.1-~~2016~~ 2019 Section 9.6. This approach may not be used to isolate spaces and ~~demonstrate~~ determine compliance for a portion of the spaces in the building. The building as a whole must exceed ASHRAE 90.1-~~2016~~ 2019 requirements.
- For multifamily buildings, in-unit LPD shall be excluded from this calculation and modeled separately. ~~-~~To demonstrate that in-unit LPD exceeds ASHRAE 90.1-201~~6~~9 requirements, the proposed LPD shall be less than 0.~~91~~ 6 W/SqFt.

4.5.7.2 Baseline Except In-Unit Multifamily ~~(Appendix G Path Only)~~

Interior lighting power in the baseline shall be determined using values in Table G3.7 and the methodology described in Sections 9.6.1 and 9.6.2 of ASHRAE 90.1-~~2016~~2019. Building Area Method shall not be used.

4.5.7.3 Baseline, In-Unit Multifamily ~~(Appendix G Path Only)~~

The lighting schedule used in the baseline and proposed designs shall be equal to 2.34 hr/day. Performance credit may only be claimed for hard-wired fixtures located in apartments. Portions of apartments with no lighting specified must be modeled ~~identically in the baseline and proposed designs~~with a lighting power density of 0.6 W/ SqFt.

For multifamily buildings following the Appendix G Path, the baseline lighting power density in apartments shall be modeled as 1.~~1~~ 07 W/SqFt.

4.5.8 Exterior Lighting

4.5.8.1 Proposed Design

Performance credit for exterior lighting is only permitted for tradable surfaces based on 90.1-~~2016~~ 2019 Table 9.4.2-2. Proposed exterior lighting power shall not exceed the baseline allowance prescribed in table 9.4.2-2, as these requirements are mandatory.

4.5.8.2 Baseline ~~(Appendix G Path Only)~~

Non-tradable exterior lighting shall be modeled identically in the baseline and proposed design.

4.5.8.3 Exterior Lighting Runtime

Exterior lighting schedules used in the model shall account for the mandatory lighting controls and their schedules as required in ASHRAE 90.1-~~2016~~ 2019 Section 9.4.1.4. Alternatively, exterior

lighting runtime shall not exceed 8 hours per day. Per the baseline column of ASHRAE 90.1-~~2016~~ 2019 Table G3.1 #4, exterior lighting schedules shall be modeled identically in the baseline and proposed designs. No performance credit shall be claimed for reducing exterior lighting runtime.

4.5.9 Lighting That Does Not Comply with Minimum Performance Standards

To achieve aggressive targets required by ASHRAE 90.1-~~2016~~2019, Partners should encourage design teams to specify fixtures that meet the Minimum Performance Standards. The following summarizes how to handle scenarios in which spaces or portions of spaces have fixtures that do not meet Program requirements.

a. For entire spaces that do not have lighting fixtures that comply with the Minimum Performance Standards, the lighting shall be modeled as follows:

   i. The baseline lighting power density (LPD) shall be modeled as described in Sections 4.5.7.2 and 4.5.7.3.

   ii. The proposed lighting must be based on the maximum LPD in ASHRAE 90.1-~~2016~~ 2019 Table 9.6.1 complying with Sections 9.6.1, 9.6.2, and 9.6.4, or the specified lighting, whichever is greater. Proposed lighting that does not qualify shall not be modeled as being equal to Appendix G baseline.

b. For portions of spaces that do not have lighting fixtures that comply with the Minimum Performance Standards, the following approach may be used:
   i. (A) Calculate total area of the space, [SqFt]
   ii. (B) Calculate total wattage of the space, [Watts]
   iii. (C) Calculate wattage that does not qualify, [Watts]
   iv. (D) Calculate wattage that does qualify, [Watts]
   v. (E) Calculate the percentage of lighting power that does not qualify as (C) / (B), [%]
   vi. (F) Calculate the area of the space associated with non-qualifying lighting as (A) x (E), [SqFt]
   vii. (G) Calculate the lighting power to be used in the proposed design for the portion of the space with non-compliant lighting by using the greater of the value in (C) and the code lighting power density allowance for this area calculated as described in Section 4.5.9.a.ii. above x (F) [Watts].
   viii. (H) Calculated weighted average proposed LPD as [(G) + (D)] / (A), [W/SqFt]
   ix. (I) Calculate baseline LPD as described in 4.5.9.a.i. above.

Example: A 1,000 SqFt office space has a lighting design consisting of 200 W of non-qualified lighting and 400 W of qualified lighting. The space Room Cavity Ratio (RCR) of the space is 9 and is calculated as defined in ASHRAE 90.1 Section 9.6.2. The baseline and proposed lighting for the space should be modeled as follows:

- (A) Area of Space: 1,000 SqFt
- (B) Total Wattage: 600 W
- (C) Wattage that does not qualify: 200 W
- (D) Wattage that does qualify: 400 W
- (E) Percentage of lighting power that does not qualify: 33.3% (200 W / 600 W)
- (F) Area of space associated with non-qualifying lighting: 333 SqFt (1,000 SqFt x 33.3%)
- (G) Based on 90.1-~~2016~~ 2019 Table 9.6.1, the LPD of an enclosed office over 250 SqFt is ~~1.11~~0.66 W/SqFt. Since the space RCR>8, the allowance is increased to ~~1.11~~0.66*1.20 =~~1.33~~0.792 W/SqFt following 90.1 Section 9.6.2.4, and is 333 [SqFt] x ~~1.33~~0.792 [W/SqFt] = ~~443~~ 263.7 [W]. This is greater than 200 W specified non-qualifying wattage, thus ~~443~~ 263.7 [W] must be used for this portion of the space in the proposed design model.
- (H) The proposed lighting must be modeled as 400 [W] + ~~443~~ 263.7 [W] = ~~843~~ 663.7 [W], or ~~0.84~~0.66 [W/SqFt].
- (I) The baseline LPD is 1.1 W/SqFt per Appendix G Table G3.7

The Program will also allow similar calculations using lumens of qualifying and non-qualifying lighting fixtures in lieu of Watts.

4.5.10 Lighting Controls

4.5.10.1 Proposed Design – Controls Other than Daylighting

Lighting controls other than daylighting must be modeled by reducing proposed LPD by the control credit percentages ~~specified in the 'Automatic Lighting Controls' column of the 'bEQ' tab of COMNET Appendix B. For Appendix G projects, these percentages and proposed lighting power densities with lighting control credit~~that are automatically calculated in the~~–~~ 90.1 Performance-based Compliance Form based on 90.1-~~2016~~ 2019 Table G3.7 Occupancy Sensor Reduction column.

For manual-on or partial-auto-on occupancy sensors, the occupancy sensor reduction factor shall be multiplied by 1.25. For occupancy sensors controlling individual workstation lighting, occupancy sensor reduction factor shall be 30%. These are included in the automated calculations

in the 90.1 Performance-based Compliance Form.

To demonstrate that lighting controls meet ASHRAE 90.1-~~2016~~ 2019 requirements, proposed lighting controls for each space type must:

- Meet all 'REQs' listed in Table 9.6.1
- Include (1) "ADD1" when present in Table 9.6.1
- Include (1) "ADD2" when present in Table 9.6.1

~~Credit may be claimed only for lighting controls that exceed the minimum lighting control requirements of ASHRAE 90.1-2016. For example, credit for 'Automatic Full Off' controls may be claimed if only 'Partial Off' is required by 9.6.1. The following requirements must be met to claim credit for lighting controls:~~

- ~~Additional lighting controls are not prohibited by state or local building or safety code.~~
- ~~Lighting controls, where installed, must control eligible energy efficient lighting fixtures.~~
- ~~All mandatory lighting control requirements mentioned above are met.~~

The Program Manager may request a narrative on how mandatory lighting control requirements of Section 9.4 will be met, including the type of control(s) that will be installed in each space type.

Projects participating in the program may also document credit for the following automatic lighting controls included in the proposed design that are not required by Section 9.4.1 and Table 9.6.1:

• Automatic full off (90.1 Section 9.4.1 [i]) when either automatic full off or scheduled shutoff is allowed in 90.1 Table 9.6.1 (ADD2): the occupancy sensor reduction factor may be increased by 5%. Example: enclosed office >250 ft2

• For high end trim or task tuning, the occupancy sensor reduction factor may be increased by 7.5%. The following must be provided to claim this credit:

a. The lighting designer must provide the anticipated degree of turndown that is to be installed in each space with task tuning. This is the basis of savings to be claimed in the energy model. The submittal must list what tuning factors are applied to the space LPD. The tuning factor is to be considered in addition to control factors for occupancy sensors and lighting schedules.

b. The project construction documents must clearly list the intended light level that the systems are to be tuned to (foot candles as measured below the light at a specific height above the floor).

c. The project construction documents must clearly describe lighting controls

commissioning requirements and methods for implementing task tuning.

• For lighting in dwelling units that have controls meeting all of the following requirements, an occupancy sensor reduction factor of 10% may be used:

a. Each dwelling unit has a main control by the main entrance that turns off all the lights and all switched receptacles in the dwelling unit.

b. The main control may have two controls, one for permanently wired lighting and one for switched receptacles.

c. Where controls are divided the main controls must be clearly identified as "lights master off" and "outlets master off."

4.5.10.2 Proposed Design – Daylighting Controls

Daylighting is required for most building types to comply with ASHRAE 90.1-~~2016~~ 2019 and NJ state energy code. Partners are encouraged to discuss this requirement with design teams as this requirement is often overlooked. Daylighting shall be explicitly modeled in the simulation tool if it has the capability (e.g. eQuest). Otherwise, daylighting software or daylighting tools may be used to support model inputs. The software/tool must incorporate impact of fenestration properties such as visible transmittance (VT). The outputs of the daylighting software/tool shall be used to modify lighting schedules or lighting power density entered in the modeling software tool. The daylighting software tool outputs must be provided and include a discussion how these results were translated into model inputs.

4.5.10.3 Baseline ~~(Appendix G Path Only)~~

Lighting controls shall be modeled as having occupancy sensors in employee lunch and break rooms, conference/meeting rooms, and classrooms (excluding shop classrooms, laboratory classrooms, and preschool through 12th grade classrooms). No other automatic lighting controls shall be modeled in the baseline building design. Additional interior lighting power for non-mandatory controls allowed in ASHRAE 90.1-~~2016~~ 2019 Section 9.6.2~~(c)~~ shall not be modeled.

4.5.11 Domestic Hot Water

4.5.11.1 Proposed Design

To demonstrate that components exceed ASHRAE 90.1-~~2016~~ 2019 requirements, proposed domestic hot water heaters must exceed the performance requirements of Table 7.8. The ~~prescriptive~~ mandatory requirement shall be determined using the same DHW system type as the

proposed design.

When a combination system has been specified to meet both space heating and service water heating loads, the proposed design shall reflect the actual system type using actual component capacities and efficiencies. To demonstrate that components exceed ASHRAE 90.1-~~2016~~ 2019 requirements, combination heating and DHW systems shall exceed requirements for boilers listed in Table 6.8.1.6.

For water heater types that reference USDOE minimum efficiencies, please refer to the minimum requirements in ASHRAE 90.1 2019 Appendix F Table F-2.

4.5.11.2 Baseline ~~(Appendix G Path Only)~~

The baseline hot water system type shall be determined using Table G3.1.1-3 which either requires a natural gas storage water heater or electric resistance storage water heater based on the building type. If buildings do not have domestic hot water loads, no heater shall be modeled. If the building will have domestic hot water loads, but a system has not been specified, it shall be modeled identically in the baseline and proposed designs using Table 7.8 of ASHRAE 90.1-~~2016~~2019.

For C&I buildings, where a complete service water-heating system exists or a new service water-heating system has been specified, one central service water heating system shall be modeled for each building area type in the proposed building.

For multifamily buildings, where a complete service water-heating system exists or a new service water-heating system has been specified, the layout and configuration of the baseline building DHW heaters shall be the same as the proposed design (i.e., the baseline building shall have the same number of water heaters as the proposed design).

Baseline storage water heaters shall be modeled as insulated to R-12.5.

4.5.11.3 Combination Heating and DHW Systems: Modeling Approach

For eQuest projects, to simulate an improvement to a combination system, a process load to the space heating boiler should be added and the baseline DHW system capacity should be set to 0.0001 MMBtu/h. The following equations can be used to convert GPM used as the process flow input of DHW heaters to MMBtu/hr used as the process load input of heating boilers. In eQuest, DHW consumption entered as a HW boiler process load will appear as a misc. equipment end-use. In the 'Results from eQuest' tab of the ERP Tables, the additional misc. equipment end-use compared to the previous run should be subtracted and manually added to the DHW end-use.

$$GPM \times \Delta T \times \frac{lb}{gal} \times \frac{min}{hour} \times \frac{Btu}{lb \cdot °F} \times \frac{MMBtu}{Btu} = MMBtu/hr$$

Where:

$\Delta T = DHW\ outlet\ temp\ (°F) - DHW\ inlet\ temp\ (°F)$ $GPM = Process\ Flow\ (gallons\ per\ minute)$

$\frac{min}{hour} = 60$ $\frac{lb}{gal} = 8.33$ $\frac{Btu}{lb \cdot °F} = 1$ $\frac{MMBtu}{Btu} = 0.000001$

4.5.12 Hot Water Demand

For commercial buildings, hot water demand shall be based on the ~~'Water Heating' column of the 'bEQ' tab of COMNET's Appendix B in conjunction with occupancy from the 'Default Occupant Density' column~~ASHRAE 90.1 User Manual Tables G-C through G-M schedules and loads which are automated in Table 5 on the Service Water Heating tab in the Compliance Form. Alternatively, Table 6 from ASHRAE HVAC Applications Handbook 2019 Chapter 51 can be used. For multifamily buildings, hot water demand shall be calculated using *ENERGY STAR Multifamily Program Guidelines – Appendix G 90.1-2016 Version 1, Revision 03~~v1.0~~*. This calculation is automated in the 90.1 Performance-based Compliance Form.

Performance credit associated with reduction may be claimed for low flow faucets and showerheads as well as ENERGY STAR appliances such as clothes washers and dishwashers that result in reduced hot water consumption.

4.5.12.1 Baseline Design

There are no ASHRAE 90.1-~~2016~~ 2019 requirements that establish baseline flow rates. Therefore, the maximum flow rates allowed by NJ A5160 ~~Plumbing Code~~[21] for faucets and showerheads must be used for both the Appendix G baseline and establishing the ASHRAE 90.1-~~2016~~ 2019 baseline when confirming that component qualifies for incentives. For example~~, 2.2 GPM shall be modeled for the lavatory (Section 7.6.2) and kitchen (Section 7.11) faucets, and 2.5 GPM for showerheads (Sections 7.8 and 7.10).~~:

- Lavatory faucet or a replacement aerator for a lavatory faucet shall not exceed a maximum flow rate of 1.5 gallons per minute at 60 pounds per square inch~~;~~

[21] ~~https://www.state.nj.us/dca/divisions/codes/codreg/~~

- Residential kitchen faucet or replacement aerator for a residential kitchen faucet shall not exceed a maximum flow rate of 1.8 gallons per minute at 60 pounds per square inch, with an optional temporary flow rate of 2.2 gallons per minute, provided the faucet or replacement aerator defaults to a maximum flow rate of 1.8 gallons per minute at 60 pounds per square inch after each use~~;~~
- Public lavatory faucet or a replacement aerator for a public lavatory faucet shall not exceed a maximum flow rate of 0.5 gallons per minute at 60 pounds per square inch~~;~~
- Showerhead shall not exceed a maximum flow rate of 2.0 gallons per minute at 80 pounds per square inch

4.5.13 HVAC

4.5.13.1 Proposed Design

The proposed model shall be consistent with mechanical schedules and drawings included as an Appendix to the ERP.

~~For the ASHRAE bEQ Path, model savings of the proposed HVAC system relative to a system of the same type that minimally meets efficiency requirements in 90.1-2016 Tables 6.8.1-1 through 6.8.1-16.~~

~~*Example:* The proposed design includes centrifugal chillers that exceed minimum efficiency requirements of 90.1-2016. For ASHRAE bEQ, the savings will be modeled relative to a chiller of the same type and capacity, with an efficiency per Table 6.8.1-3.~~

4.5.13.2 Baseline Design ~~(Appendix G Path Only)~~

4.5.13.2.1 Change in Baseline System Type

HVAC system types will often vary between proposed and baseline models. If there are no changes to the HVAC system type, only one model shall be submitted, which incorporates all measure runs. In cases where the HVAC system type changes from the baseline to proposed design, two models may be submitted if necessary. The first model shall reflect the baseline design. The second model shall reflect the change in HVAC system, with each of the measure improvements modeled subsequently as separate parametric runs/alternates. For eQuest projects, the compare documents feature of Microsoft Word or other word processor may be used to compare the *.inp files of the two models to identify any unintended differences.

4.5.13.2.2 Conditioned Spaces without Cooling Specified

Heating and cooling shall be modeled in all conditioned spaces, even if no cooling is specified for the project unless spaces are designed with heating only systems serving storage rooms, stairwells,

vestibules, electrical/mechanical rooms, and restrooms not exhausting or transferring air from mechanically cooled thermal zones. With proper documentation, the requirement to model cooling may be waived for industrial facilities that do not have a specified cooling system and are unlikely to have cooling installed in future.

4.5.13.2.3 Baseline System Type Selection ~~(Appendix G Path Only)~~

All projects in New Jersey are required to use natural gas heating in the baseline. Electric heating shall not be modeled in the baseline design (no exceptions). ASHRAE 90.1--2019 ~~a~~Addendum ab[22] clarified and streamlined the process of determining the baseline HVAC system types. These updated requirements must be followed when documenting performance with the program. Below is a summary of the process based on amended Section G3.1.1.1:

1. Determine the combined gross conditioned and semi-heated floor area for each of the following building area types in the proposed design:
   - residential and residential-associated zones
   -
   - public assembly
   - heating-only storage
   - retail
   - hospitals
   - other nonresidential

2. Classify the nonresidential building area type with the largest combined area as the predominant nonresidential building area type. Add the combined area of any remaining nonresidential building area types with less than 20,000 ft^2 to the combined area of the predominant nonresidential building area type.

3. ~~3.~~ Select a baseline HVAC system type from Table G3.1.1-3 for each of the following building area types included in the proposed design based on the size of the building as a whole and not an individual occupancy: 1. Residential + residential associated 2. Predominant nonresidential 3. Each additional nonresidential building area type with more than 20,000 ft^2 of combined area based on G3.1.1.

[22] https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_ab_20220727.pdf

The amended section G3.1.1.2 includes requirements for determining additional and adjusted baseline HVAC system types.

Example: Baseline System Type for a Mixed-Use Building

~~Q.~~ A n~~N~~ew construction project involves a 5 story 100,000 ft^2 building with a retail store on the first floor (25,000 ft^2) and hotel on floors 2-5. The retail store includes the sales floor, offices, restrooms and heated-only storage space. Hotel floors include guest rooms, corridors, heated only stairwells, conference rooms and management offices. ~~What HVAC systems should be modeled in the baseline?~~
~~A.~~ The baseline HVAC systems are established using a two-step process:

Step 1: Determine the baseline HVAC system types based on building area types following 90.1 addendum ab Section G3.1.1.1

Based on 90.1 2019 Addendum ab definition, any HVAC zone that primarily includes nonresidential spaces designed to serve occupants of residential spaces on a floor where over 75% of the gross conditioned floor area are residential spaces is considered residential-associated. On floors 2-5, hotel guest rooms account for more than 75% of conditioned and semi heated floor area, and all non-residential spaces on these floors are used for the hotel function. Thus, the residential zones on floors 2-5 shall be modeled with baseline System 1 – PTAC following Table G3.1.1-3 and the residential associated spaces on these floors shall be modeled with System 3 – PSZ- AC following 9.1-2019 Addendum ab G3.1.1.2 (f).

The entire area of the first floor is considered retail and would map to baseline System 5 – Packaged VAV with reheat following Table G3.1.1-3 based on the number of floors and floor area of the entire building.

Step 2: Determine additional and adjusted baseline HVAC system types following 90.1 addendum ab Section G3.1.1.2

Heated only stairwells on the hotel floors and heated only storage on the retail floor are subject to addendum ab Section G3.1.1.2 Exception(c) and will be modeled with System 9 – Heating and Ventilation.

~~Baseline system types shall be based on ASHRAE 90.1-2016 Tables G3.1.1-3 and G3.1.1-4, Appendix G exceptions described in Section G3.1.1, and the following order of priority:~~
~~Building type with the largest conditioned floor area~~
~~Number of floors including floors above and below grade~~
~~Gross conditioned floor area~~
~~Climate zone~~
~~In mixed-use projects that are predominantly warehouses, the HVAC system type for the remaining areas must be determined by applying the procedure described above to the total area of such spaces.~~
~~*Example:* One story building includes a 600,000 SqFt warehouse and a 50,000 SqFt office area. Based on Table G3.1.1-1, the warehouse portion is modeled with baseline system 9, and the office portion is modeled with baseline system 5.~~
~~For systems 1, 3, 9, 11, and 12 each thermal block shall be modeled with its own HVAC system and efficiency shall be based on the heating and cooling loads of those thermal blocks. For systems 5 and 7, each floor shall be modeled with its own HVAC system.~~
~~All residentially associated spaces of a multifamily building are considered integral to the function of the multifamily building. Therefore, System 1 – PTAC shall be used for the entire multifamily building. Commercial tenant spaces attached to the multifamily building (e.g. a convenience store on the ground floor that is open to the public) shall be modeled using a different system type if those conditions apply to more than 20,000 SqFt of conditioned floor area.~~

Economizers in Climate ~~Zon~~Zonee 4a:

Economizers are not required in the baseline for projects in Climate Zone 4a. If the proposed design incorporates economizers, this is considered a measure that exceeds code. ~~contributes to the project's incentives.~~

Economizers in Climate ~~Zon~~Zonee 5a:

For systems 3, 5, 7, air-side economizers shall be included in the baseline model for projects unless the system serves a computer room, includes gas-phase air cleaning, or impacts refrigerated casework of a supermarket. The exceptions for the latter two only apply if the proposed design does not contain air-side economizers. For system 11, an integrated waterside economizer is required in the baseline that complies with ASHRAE 90.1-~~2016~~ 2019 Section 6.5.12. ~~In these scenarios, only economizers that exceed ASHRAE 90.1-2016~~ 2019 ~~requirements can contribute to the project's incentives.~~

4.5.13.2.4 Purchased Heat and Chilled Water ~~(Appendix G Path Only)~~

Projects with space heating, cooling or service water heating provided by a district plant in lieu of on-site systems must be modeled following the method below, which is based on ASHRAE 90.1-

2022 Addendum a. The method eliminates the penalty that has previously existed for such projects.

Sections G3.1.1.1, GG3.1.1.2 and G3.1.1.3 shall be eliminated in their entirety. The HVAC systems in the baseline design for projects served by the district systems shall be modeled the same as for projects with on-site systems.

The proposed designs utilizing purchased thermal energy must be modeled with on-site systems providing hot water, steam, or chilled water as follows:

1. Systems in the proposed design that use purchased hot water or purchased steam for space heating shall be modeled with forced draft boiler(s) that comply with but do not exceed the mandatory and prescriptive requirements of Section 6. The number of boilers and boiler controls shall meet the requirements of Sections G3.2.3.2 through G3.2.3.6 f.
2. Systems in the proposed design that use purchased chilled water shall be modeled with the type and number of chillers determined by following Sections G3.2.3.7 through G3.2.3.11 using equipment efficiency and controls that comply with but not exceed the mandatory and prescriptive requirements of Section 6.
3. Systems in the proposed design that use purchased hot water or purchased steam for service water heating shall be modeled with the same service water heating system type as in the baseline design and shall comply with but not exceed the mandatory and prescriptive requirements of Section 7.

Exception: Proposed systems can be modeled as prescribed in ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1-2020[23] Table C1.2 Proposed Building Performance Column #s1-3, 5 if the following criteria are met:

- The district plant is being designed and constructed contemporaneously with the building.
- The district plant is **not** participating and receiving incentives from another New Jersey incentive program.

The modeling methodology is subject to program administrator approval. Documentation must be provided to justify all district plant modeling parameters.

~~For systems with purchased hot water or steam, the heating source shall be modeled as purchased hot water or steam in both the baseline and proposed designs. Similarly, for systems with purchased chilled water, the cooling source shall be purchased chilled water in the baseline and proposed designs. Appendix G modifies the system types listed in tables G3.1.1-3 and G3.1.1-4~~

[23] https://ashrae.iwrapper.com/ASHRAE_PREVIEW_ONLY_STANDARDS/STD_189.1_2020

~~for buildings with purchased heat and purchased chilled water. Systems served by purchased heat do not need to be modeled with hot water supply temperature reset per Appendix G3.1.3.4. Similarly, systems served by purchased chilled water do not need to be modeled with chilled water supply temperature reset per Appendix G3.1.3.9.~~

Example: A dormitory with proposed purchased chilled water and hot water systems served by an existing district plant would be modeled with System 1, which consists of PTACs with DX cooling served by hot water boilers in the baseline. The baseline hot-water pump distribution power would be modeled as 19 W/GPM as consistent with Appendix G requirements for on-site systems. The number of boilers and boiler controls shall be modeled per the requirements of Sections G3.2.3.2 through G3.2.3.6.

The proposed would be modeled with as-designed systems except that instead of modeling purchased hot and chilled water, the systems would be modeled as served by on-site chilled and hot water systems with the chiller and boiler plants minimally compliant with Section 6. The number of boilers and boiler controls shall meet the requirements of Sections G3.2.3.2 through G3.2.3.6 f and the type and number of chillers shall be determined following Sections G3.2.3.7 through G3.2.3.11.~~A dormitory with purchased chilled water and hot water would be modeled using a modified System 1 consisting of constant volume fan coils instead of PTACs and boilers. The baseline hot-water pump distribution power would be modeled as 14 W/GPM instead of 19 W/GPM. The baseline chilled-water pump distribution power purchased chilled water shall be modeled as 16 W/GPM with variable speed drives and a minimum flow of 25% of the design flow rate.~~

4.5.13.3 Baseline System Sizing

The baseline systems may be sized based on the peak loads in the annual simulation or design day conditions. If design day sizing method is used in the residential occupancies, the cooling sizing runs must be based on the infiltration, occupants, lighting, and equipment hourly schedules reflecting the typical weekday schedule from the annual simulation.

4.5.13.4 Fan System Operation

Schedules for HVAC fans that provide outdoor air for ventilation shall run continuously whenever spaces are occupied and shall be cycled on and off to meet heating and cooling loads during unoccupied hours. Exceptions include:

- Where no heating and/or cooling system is to be installed. In this scenario, fans shall cycle on and off to meet heating and cooling loads for all hours.
- Mandated minimum ventilation requirements during unoccupied hours for health and

safety.

- HVAC fans serving computer rooms.

~~In the proposed design, if supply fans are modeled as cycling and the fan energy is included in the energy efficiency rating of the equipment, fan energy shall not be modeled explicitly.~~

4.5.13.5 Baseline Fan Power ~~(Appendix G Path Only)~~

For multifamily buildings, baseline fan power shall be modeled as 0.3 W/CFM based on baseline system maximum design supply air. An additional allowance shall not be modeled for any exhaust fans. Instead, the calculated allowance shall be distributed between supply and exhaust fans in the same proportion as the proposed design. Alternatively, exhaust fans may be excluded from the baseline design and only supply fans shall be modeled at 0.3 W/CFM.

Baseline fan power for systems 3, 5, 7, 11, and 12 shall be calculated using Table G3.1.2.10 and associated allowances from Section 6.5.3.1.1 of ASHRAE 90.1-~~2016~~2019. Baseline fan motor efficiency shall be calculated using Table G3.9.1. Proposed fan power shall be determined using either the mechanical schedule or manufacturer specifications.

For System 9, baseline fan power shall be modeled as 0.054 W/CFM only if the proposed design includes fans sized and controlled to provide non-mechanical cooling.

Regardless of system type, the fan power allowance calculated reflects the total fan power allowance for supply, return, exhaust, and relief fans (excluding VAV boxes). The calculated fan power must be distributed to the supply, return, exhaust, and relief fans in the same proportion in the proposed design.

Fan power associated with dedicated make-up air systems shall not be included in the baseline even if it's included in the proposed design.

Improvements in fan power in the proposed design may be grouped with air-side HVAC or cooling EEMs.

4.5.13.6 Pump Power and Heat-Rejection ~~(Appendix G Path Only)~~

Baseline hot water pumps, chilled water pumps, and condenser water pumps shall be modeled per ASHRAE 90.1-~~2016~~ 2019 Sections G3.1.3.5, 3.1.3.10, and 3.1.3.11, respectively.

ASHRAE 90.1-~~2016~~ 2019 includes ~~new requirements~~the following requirements for chilled water pumps, condenser water pumps, and heat rejection.

- Chilled-water systems shall be modeled as primary/secondary systems with constant-flow primary loop and a variable flow secondary loop. The baseline constant-volume primary pump power shall be modeled as 9 W/GPM, and the variable flow secondary pump power

shall be modeled as 13 W/GPM.

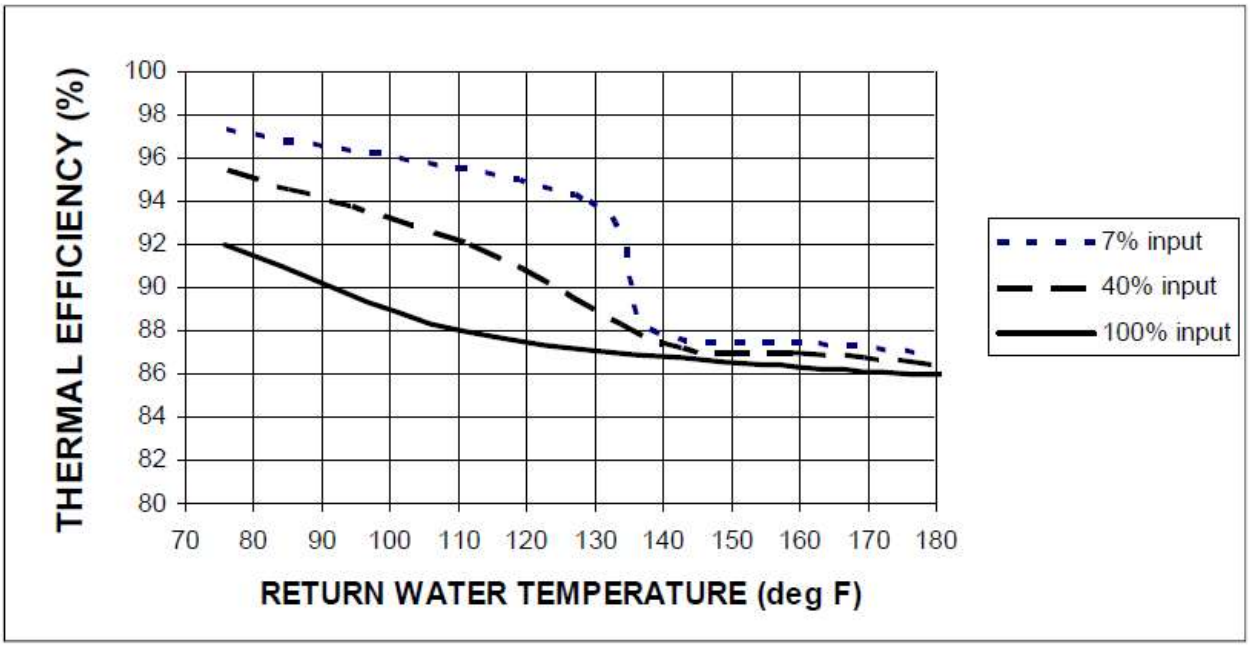
- Baseline condenser-water pumps shall be modeled as constant volume.
- Baseline leaving water temperature for heat-rejection systems shall be equal to 75 °F in climate zone 4A and 70 °F in climate zone 5A.

Improvements in pump power in the proposed design may be grouped with pump control measures such as variable speed drives.

4.5.13.7 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 4-1. Condensing Boiler Performance Curves



180°F supply and 130°F return water temperature must be modeled in the baseline per Appendix G, if boilers are a baseline requirement. The proposed design must reflect mechanical drawings and should not be modeled identically to the Appendix G baseline.

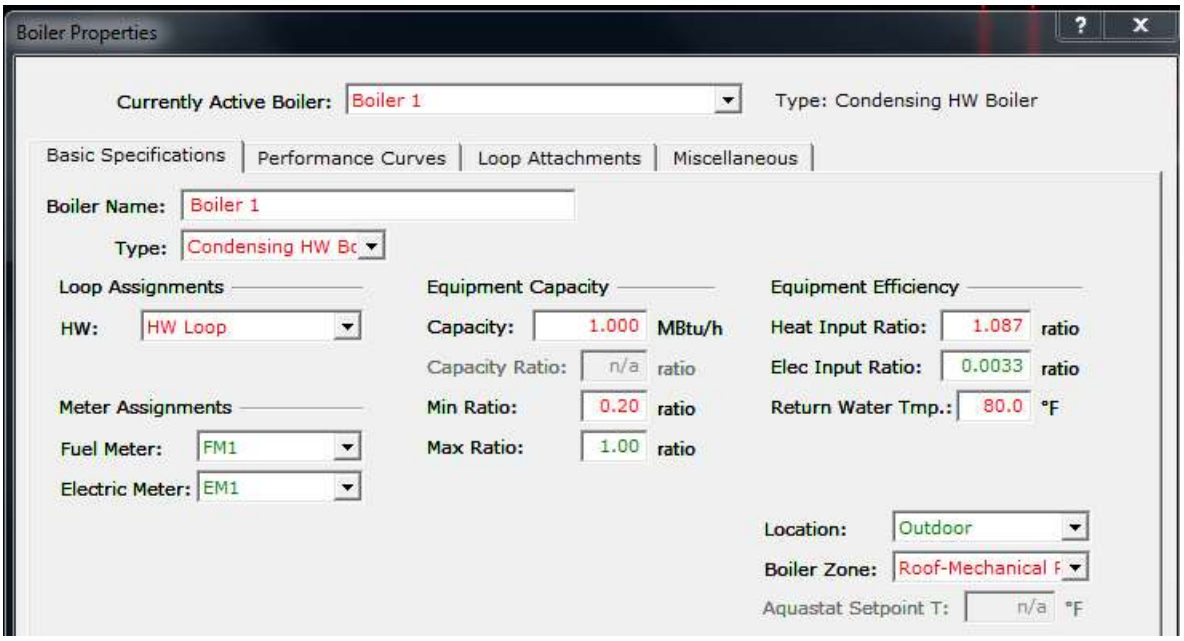
Design supply and return water temperatures must be explicitly entered into the simulation tool if the tool can automatically capture their impact on boiler efficiency (such as eQUEST). If the tool is not capable of automatically adjusting efficiency based on entered loop temperatures (such as TRACE), efficiency entered into the simulation tool must be adjusted manually to reflect manufacturer's performance data for the boiler at actual operating conditions.

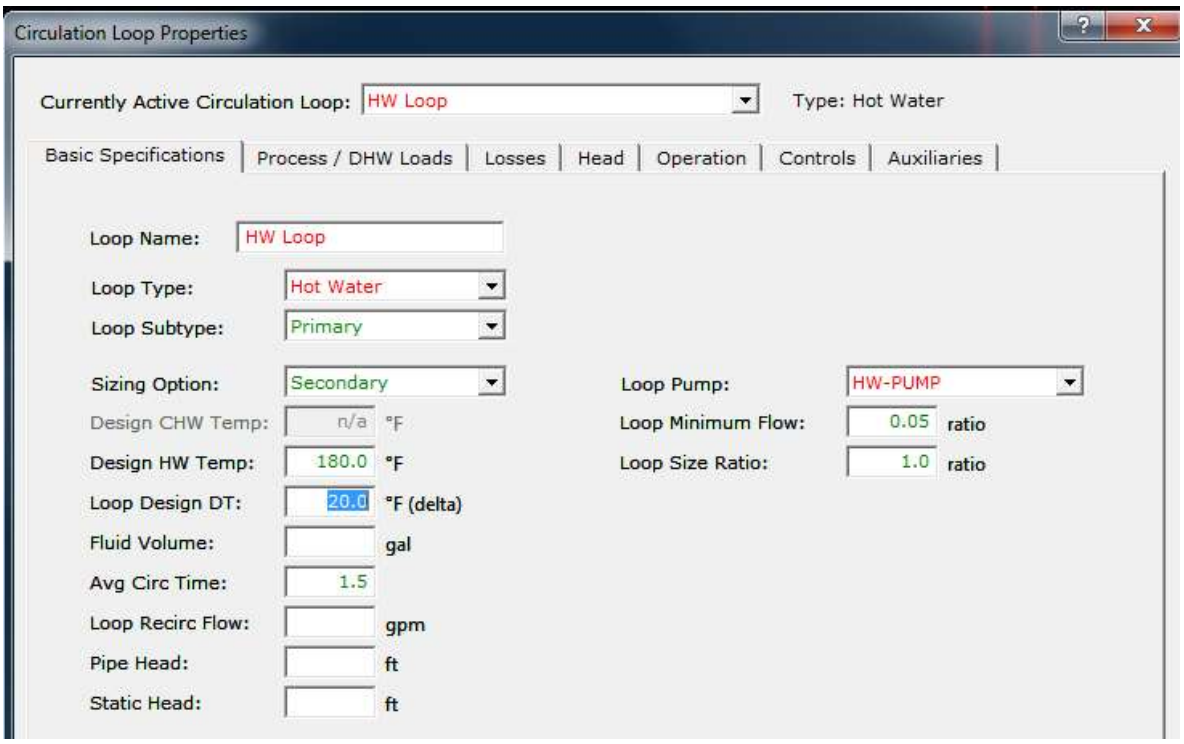
eQuest Example: The proposed scope of work includes the installation of a 1,000 MBH condensing boiler, which is rated at 92% thermal efficiency at 80°F return water temperature and at full load (i.e. AHRI rating conditions). Boiler literature states that condensing boilers can achieve efficiencies up to 98% thermal efficiency, which would occur at very low return water temperatures and part load ratios. The current design supply hot water temperature is 180°F, with 20°F design temperature drop.

The heat input ratio (HIR) for the condensing boiler must reflect the return water temperature input and full load capacity. Therefore, HIR of 1.087 (HIR = 1 / 92%) should be used in the simulation tool rather than HIR of 1.02 (HIR = 1 / 98%). When the equipment operates at part load, eQuest will capture boiler efficiency improvements.

Electric Input Ratio (EIR) must be entered to capture electricity usage associated with fans,

controls, etc.





eQuest software contains default condensing boiler curves that can be used to simulate the improvement. However, several boiler manufacturers have performance curves readily available for their equipment. Custom performance curves may be simulated in the proposed case if the

curves and curve formula are provided as part of the submission.

Trane TRACE 700 Example: Using the example presented for eQuest, boiler efficiency at the specified return water temperature per drawings shall be used. While literature rates equipment up to 98% thermal efficiency and equipment operates at 92% efficiency at 80°F water temperature, the efficiency corresponding to full load operation and the design return water temperature shall be used. The boiler curve above or manufacturer boiler curves may be submitted to justify proposed efficiency based on return water temperature.

4.5.13.8 Performance Curves

Table G3.5.2 prescribes full load efficiency (FL) and part load efficiency (IPLV) for the baseline chillers depending on chiller type and capacity. Similarly, construction documents provide FL and IPLV of the specified equipment. Commonly used simulation tools allow entering chiller full load efficiency and performance curves that determine chiller operation at lower loads, but do not the IPLV input.

Previously, performance curves corresponding to the prescribed baseline chiller IPLV were not provided in 90.1. As a result, modelers often used default curves that differed between simulation tools and did not reflect the intended performance of the baseline chillers. The issue was addressed by 90.1 2019 addendum bd[24] which prescribed the performance curves that must be used for the baseline chillers.

The addendum also requires that where the performance curves for the chillers specified in the proposed design are not available, the provided default performance curves are used based on the specified chiller type. The addendum also prescribes chiller minimum part-load ratio (ratio of load to available capacity at a given simulation time step) and minimum compressor unloading ratio (part-load ratio below which the chiller capacity cannot be reduced by unloading and chiller is false loaded) of 0.25. Chiller performance must be modeled as required in 90.1 2019 addendum bd[24~~22~~].

Performance of heating and other cooling systems at part load must be modeled using performance curves for the appropriate system type from the PNNL 90.1 2016 Performance Rating Reference Manual:

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[24] https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_bd_20220531.pdf

- Boilers: page 3.217
- ~~Chillers: Tables 77 – 83~~
- DX systems: Tables ~~6~~ 0 - 62

Exceptions:

- Custom performance curves may be used in the proposed design based on the manufacturer data. Custom performance curves must be submitted with the supporting calculations and are subject to program approval.
- ~~If proposed design has chillers that meet Path B efficiency, the performance curves specified in Appendix B of this Guide may be used~~[25]

4.5.13.9 Humidification and Dehumidification Systems

If the proposed design includes humidification, then the baseline building design shall use adiabatic humidification. Exception: if the proposed building humidification system complies with Section 6.5.2.4, then the baseline building design shall use non-adiabatic humidification.

For systems serving computer rooms, the baseline building shall not have reheat for the purpose of dehumidification.

If the proposed design HVAC systems have humidistatic controls, the baseline shall use mechanical cooling for dehumidication and shall have reheat available to avoid overcooling. When the baseline design HVAC system does not comply with any of the exceptions of 90.1 Section 6.5.2.3, then only 25% of the system reheat energy shall be included in the baseline. The reheat type shall be the same as the system heating type.

4.5.14 Commercial Refrigeration

4.5.14.1 Refrigerated Cases

Commercial refrigeration equipment addressed by this section includes the following types:

- Walk-in refrigerators
- Walk-in freezers
- Refrigerated casework and/or display cases

[25] ~~California Alternative Calculation Method, 2016 ACM Appendices,Appendix _5.7_PerformanceCurves~~

To claim performance credit for refrigerated cases included in the scope of 90.1-201~~9~~6 Section 6.5.11, baseline energy consumption shall be determined using ASHRAE 90.1-201~~9~~6 Table G3.10.1 and G3.10.2.

In addition, the refrigerated cases in the proposed design must meet all requirements of ASHRAE 90.1-201~~9~~6 Section 6.5.11 Refrigeration Systems and rated following AHRI 1200.

The modeling inputs used for the baseline shall be based on converting ASHRAE 90.1-~~2016~~ 2019 Table G3.~~,~~10.1-2 values into electricity load (Watt or Watt/SF) and schedule inputs. The modeling inputs used for the proposed design shall be based on converting AHRI 1200 rating for the specified equipment into electricity load (Watt or Watt/SF) and schedule inputs.

Per the *Refrigeration Modeling Method* section of the ANSI/ASHRAE/IEC Standard 90.1-2016 Performance Rating Method Reference Manual (2016 PRM RM)[26], two aspects of performance must be accounted for when using the Performance Rating Method:

- Electricity consumption of the refrigeration equipment
- Internal heat gain/removal into the thermal zone for the purposes of HVAC interactivity

Both aspects shall be explicitly captured in the model. The refrigeration system electricity consumption and the HVAC system interactivity should be modeled as two separate values. To claim credit for commercial refrigeration systems, Partners shall use the Refrigeration Energy Calculator, and associated Technical Topic, available on the Partner Portal.

AHRI Certificates and Refrigeration Energy Calculator:

- Partners shall gather AHRI 1200 certificates from manufacturers for each refrigeration unit. Each certificate shall mimic the format shown in the AHRI 1200 *Data Format* tab of the Program's Refrigeration Energy Calculator, which is available for download on the Partner Portal.
- Using the Refrigeration Energy Calculator and the AHRI 1200 certificates, Partners shall report each refrigeration unit type as separate columns in the *Ref Data Entry* tab.
- To determine the applicable equipment class geometry (e.g., HZO, SVO, etc), Partners shall use diagrams of Appendix D of AHRI 1200 for reference.
- The Refrigeration Energy Calculator will automatically calculate baseline kWh/day allowances of each eligible commercial refrigeration unit, which shall be used if measurements were not performed.

[26] https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-26917.pdf

Refrigeration Energy Input:

- Refrigeration energy (excluding internal gains/losses) should be modeled as a direct load to the electric meter or assigned to a thermal zone but with the zero sensible and latent heat gains to the space.

HVAC Interactivity Modeling Input

- The Refrigeration Energy Calculator will calculate Q per thermal zone on the Model Inputs tab for the purposes of modeling internal heat gain or removal for each thermal zone to capture HVAC system interactivity.
- Note: Q is the rate of heat removal from the space due to the continuous operation of the refrigeration system (kBtu/h). Q can be positive or negative depending on condenser location.

Credit for refrigerated cases not regulated by 90.1 may be claimed using exceptional calculation methods and as described in Section 4.5.14.2.

4.5.14.2 Refrigeration Systems Not Regulated by 90.1

As a general rule, refrigeration systems not covered in ASHRAE 90.1-~~2016~~ 2019 Section 6.5.11 shall be treated as unregulated loads and modeled the same in the baseline and proposed design. The associated energy should be determined based on ANSI/ASHRAE/IEC Standard 90.1-2016 Performance Rating Method Reference Manual or alternative sources as approved by the program manager.

Credit for refrigeration systems not regulated by ASHRAE 90.1 may be claimed using Exceptional Calculations (See Section 4.2.1). Baseline systems and components shall meet or exceed standard practice and be supported by other jurisdictions and/or standards such as USGBC or California Title 24 and as described in Section 4.5.23 of this document. The baseline and exceptional calculations are subject to approval by the program manager.

One of the following approaches may be used to simulate unregulated refrigeration systems:

- Model unregulated refrigeration systems using the version of eQuest, EnergyPlus, OpenStudio, or Trane TRACE that support explicit modeling of such systems and their interactions with other building systems and components such as space heating and cooling systems.
- Provide supporting spreadsheet calculations that determine baseline and proposed electricity consumption of refrigeration equipment and internal heat/gain removal into the

thermal zone for the purposes of HVAC interactivity. Refrigeration energy (excluding internal gains/losses) should be modeled as a direct load to the electric meter or assigned to a thermal zone. Internal heat gain or removal for each thermal zone shall be modeled to capture HVAC system interactivity.

The following energy modeling guidelines may be used to establish unregulated refrigeration system baseline assumptions for components outside the scope of ASHRAE 90.1-~~2016~~2019: https://www.gcca.org/sites/default/files/protected-docs/protdocs/EnergyGuidelines_2013-12-19.pdf

4.5.15 Distribution Transformers

ASHRAE 90.1-~~2016~~2019, Section 8 includes low voltage dry-type distribution transformers. Distribution transformers can be included as an EEM if the proposed building transformers exceed the efficiency requirements of Table 8.4.4 and meet the characteristics below.

Measure Requirements

A low voltage distribution transformer has the following characteristics:

- Air-cooled,
- Does not use oil as a coolant,
- Has an input voltage ≤ 600 V, and
- Is rated for operation at a frequency of 60 Hz

Key Model Inputs

All inputs should be included for the baseline and proposed design:

- Transformer Capacity (kVA)
- Transformer Efficiency (%)
- Ratio of capacity to peak electrical load

4.5.16 Infiltration

Infiltration shall be modeled using the same methodology ~~, air leakage rate,~~ and adjustments for weather and building operation in both the baseline and proposed designs. ASHRAE 90.1-201~~6~~96 Appendix G includes explicit requirements to model infiltration. ~~-~~Below is an ~~example~~example of how to determine infiltration rates using the variables presented in Appendix G for the baseline and proposed models.

Number of ~~Stories~~ stories = 5

Gross ~~Floor~~ floor ~~Area~~ area = 40,000 SqFt

Gross ~~Roof~~ roof ~~and Floor Area~~ = 8,000 SqFt ~~each~~

Slab on grade floor area = 8,000 SqFt

Total above grade wall area = 17,000 SqFt
Total conditioned volume = 360,000 ft^3

S = 8,000 SqFt + ~~8,000 SqFt +~~ 17,000 SqFt = ~~33~~25,000 SqFt (slab on grade floor area is excluded from S)
I_{75PA} = 0.~~6~~4 CFM/SqFt in the proposed design and 1.0 CFM/SqFt in the baseline per Table G3.1#5b.

Baseline
I_{FLR} = 0.112 x ~~0.4~~ 1.0 CFM/SqFt x ~~33~~25,000 SqFt / 40,000 SqFt = 0.~~037~~ 07 CFM/SqFt
I_{AGW} = 0.112 x ~~0.4~~1.0 CFM/SqFt x 25~~33~~,000 SqFt / 17,000 SqFt = 0.~~087~~ 165 CFM/SqFt
CFM = 0.112 x ~~0.4~~1.0 CFM/SqFt x 25~~33~~,000 SqFt = ~~1,480~~2,800 CFM
ACH = ~~1,480~~2,800 CFM x 60 min/hr / 360,000 ft^3 = 0.~~47~~25 ACH

Proposed
I_{FLR} = 0.112 x 0.6 CFM/SqFt x 25,000 SqFt / 40,000 SqFt = 0.042 CFM/SqFt
I_{AGW} = 0.112 x 0.6 CFM/SqFt x 25,000 SqFt / 17,000 SqFt = 0.099 CFM/SqFt
CFM = 0.112 x 0.6 CFM/SqFt x 25,000 SqFt = 1,680 CFM
ACH = 1,680 CFM x 60 min/hr / 360,000 ft^3 = 0.28 ACH

Infiltration rates must be ~~the same in the Baseline and Proposed design~~modeled as 0.6 cfm/ft at a fixed building pressure differential of 0.3 in. of water ~~,~~(I_{75Pa}) except when whole-building air leakage testing, in accordance with ASTM E779, is specified during design and completed after construction. In this case, the proposed design air leakage rate of the building envelope shall be as measured and included in the As-Built energy model.

In residential occupancies including multifamily, hotels, motels and dormitories, infiltration shall be modeled at 100% of the calculated rate (hourly fraction of 1) during all hours. In non-residential spaces, infiltration shall be modeled at 100% (hourly fraction of 1) during unoccupied hours, and at 25% (hourly fraction of 25%) during occupied hours (PNNL Performance Rating Method Reference Manual p.3.30)

4.5.17 Ventilation

4.5.17.1 Proposed and Baseline Ventilation Rates ~~(Appendix G Path Only)~~

Proposed outdoor air ventilation rates shall be consistent with mechanical system design documents. Baseline outdoor air ventilation rates shall be equal to the proposed design or the rates

prescribed by ASHRAE 62.1-~~2016~~2019, whichever is less. Local ventilation codes, if applicable, shall be used in lieu of ASHRAE 62.1-~~2016~~ 2019 to determine baseline ventilation rates. ~~-~~For laboratory spaces that are prohibited from recirculating return air by code or accreditation standards, the baseline system shall be modeled as 100% outdoor air. The baseline exhaust air energy recovery shall be modeled following G3.1.2.10.

Following 90.1 2019 Addendum i[27], HVAC systems serving laboratory HVAC zones with a total laboratory exhaust volume greater than 15,000 cfm should **not** be modeled with exhaust air energy recovery in the baseline. Prior to the addendum, a proposed laboratory design with variable flow exhaust and energy recovery would be required to model both heat recovery and variable exhaust in the baseline HVAC system, which misrepresents 90.1 2004 requirements.

4.5.17.2 Performance Credit for Ventilation Design

Performance credit for ventilation design is permitted under the following scenarios:

- Modeling ~~demand controlled~~demand-controlled ventilation in the proposed design for systems with outdoor air flow rate less than or equal to 3,000 CFM serving areas with an average occupancy density of 100 people per 1,000 SqFt or less. ~~While DCV may contribute to the project's PCI (for projects following Appendix G path) as it's not required by Appendix G, DCV may only contribute to incentives if it's not required by ASHRAE 90.1 Section 6.4.3.8.~~
- When designing systems in accordance with Standard 62.1, Section 6.2, "Ventilation Rate Procedure." The baseline zone air distribution effectiveness (E_z) shall be equal to 1.0. Calculations must be provided to take credit for ventilation rate reductions.
- Performance credit can be claimed for ERV exceeding Appendix G section G3.1.2.10.

4.5.17.3 Performance Credit for Parking Garage Demand Control Ventilation

The following parameters shall be used to establish parking garage DCV baseline energy consumption:

- Ventilation rate shall be equal to 0.75 OA CFM/SqFt per ASHRAE 62.1.
- Fan power shall be modeled as 0.3 W/CFM or 0.225 W/SqFt.
- Baseline OA fraction (% OA) shall be equal to 50% when the proposed case OA fraction

[27] ASHRAE 90.1 2019 Addendum I https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_i_20201030.pdf

is less than or equal to 50%.

- Baseline OA fraction shall be equal to 100% when the proposed case OA fraction is greater than 50%.

The following conditions shall be met to claim parking garage DCV as an energy efficiency measure:

- Proposed case ventilation rate and fan power shall be modeled per design.
- Ventilation rates shall meet ASHRAE 62.1 requirements.
- Proposed case ventilation shall be able to maintain at least 0.05 CFM/SqFt at all times.
- Proposed turn-down ratio shall be explicitly modeled.
- Fan performance curves shall be used to determine fan power at part-load ratios.
- Parking garage ventilation profiles shall be provided to justify flow rates and OA fractions.

4.5.18 Elevators

Elevators are a regulated load in ASHRAE 90.1-~~2016~~ 2019 and have mandatory requirements. ~~Performance credit may be claimed~~ The baseline and proposed shall be modeled per below~~for any component that meets or exceeds mandatory or prescriptive requirements such as fan power, lighting power density, elevator motor efficiency, and elevator mechanical efficiency~~.

The baseline shall be modeled as follows:

- ≤ 4 stories: hydraulic motor, 58% mechanical efficiency
- > 4 stories: traction motor, 64% mechanical efficiency
- 0.33 W/CFM for ventilation fans
- 3.14 W/SqFt lighting power density
- Cab motor power shall be calculated using the following equations:

$$bhp = (Weight\ of\ Car + Rated\ Load - Counterweight)\ x\ Speed\ of\ Car/(33{,}000\ x\ h_{mechanical})$$

$$P_m = bhp * 746/h_{motor}$$

Where:

- *Weight of Car* = proposed design elevator car weight, lb
- *Rated Load* = proposed design elevator load at which to operate, lb
- *Counterweight of Car* = elevator counterweight,

- *hydraulic elevators:* no counterweight
- *traction elevators*: same as in proposed design; if not specified, weight of car + 40% of rated load

- *Speed of Car* = speed of the proposed elevator, ft/min
- *Pm* = peak cab motor power
- $h_{mechanical}$ = mechanical efficiency of the elevator
- h_{motor} = motor efficiency
  - Cab motor efficiency (h_{motor}) shall be determined using the following tables if existing conditions cannot be verified
    - Table G3.9.3 for hydraulic baseline elevators
    - Table G3.9.1 for traction baseline elevators

Table G3.9.3 *Performance Rating Method* Hydraulic Elevator Motor *Efficiency*

Horsepower	Full-Load *Efficiency*
10	72%
20	75%
30	78%
40	78%
100	80%

Table G3.9.1 *Performance Rating Method* Motor *Efficiency* Requirements

Motor Horsepower	Minimum Nominal Full-Load *Efficiency*, %
1.0	82.5
1.5	84.0
2.0	84.0
3.0	87.5
5.0	87.5
7.5	89.5
10.0	89.5
15.0	91.0
20.0	91.0
25.0	92.4
30.0	92.4
40.0	93.0
50.0	93.0
60.0	93.6
75.0	94.1
100.0	94.5
125.0	94.5
150.0	95.0
200.0	95.0

Baseline full load hours shall be calculated as follows:

$$EFLH_{elev} = DH \times 365$$

Where:

- $EFLH_{elev}$ = elevator effective full load hours
- DH = average travel time from the below, based on building type and size, and the elevator application type. Alterative elevator run hours may be considered upon Program Manager approval.

Elevator Usage Categories

Usage Intensity/ Frequency	Very Low Very Seldom	Low Seldom	Medium Occasionally	High Frequently	Very High Very Frequently
Average Travel Time (hours per day)	0.2	0.5	1.5	3	6

Typical Type of Buildings and Use	Residential building with up to 6 dwellings. Small office or administrative building with few operations.	Residential building with up to 20 dwellings. Small Office or Administrative Building with 2 to 5 floors. Small Hotels Goods lift with few operations.	Residential building with up to 50 dwellings. Small office or administrative building with up to 10 floors. Medium Sized Hotels Goods lift with medium operations	Residential building with more than 50 dwellings. Tall office or administrative building with more than 10 floors. Large Hotel Small to Medium Sized Hospitals Good lift in production process with a single shaft.	Office or administration building over 100 meters in height. Large Hospital Goods lift in production process with several shafts.

Baseline elevator fans and lighting shall operate continuously, 24/7.

Proposed Design

The proposed design elevator cab motor power [Watt] must be calculated as follows:

$$P_{m,prop} = bHP_{prop} \times 746/h_{motor,prop}$$

Where:

- bHP_{prop} and $H_{motor,prop}$ are the brake horse power and electrical efficiency of the proposed elevator motor, respectively. Tables G3.9.3 & G3.9.1 referenced above must be used as applicable if the proposed elevator motor efficiency is unavailable.

Design fan and lighting power shall be based on design documents.
The same effective full load hours ($EFLH_{elev}$) must be modeled for the baseline and proposed cases. If the proposed elevator cab lighting has occupancy sensor controls, the annual lighting runtime must be equal to $EFLH_{elev}$.

Elevator usage may be included in the baseline and proposed simulation models in lieu of using the Elevator Energy Consumption Calculator. However, elevators are not expected to interact with

other building systems and components. Thus, either method should result in the same energy savings.

Example: The proposed case of a 10-floor office building includes four (4) passenger elevators (Car 1) and one (1) service elevator (Car 2). Parameters of both elevators are shown in the figure below

	Elevator ID	1	2
Application	Elevator Name	Car 1	Car 2
	Quantity	4	1
	Passanger or service elevator?	Passenger	Service
	Buildings and elevator type	Office or administrative building 6 - 10 floors	Goods lift with few operations
	Average Travel Time (hours per day)	1.5	0.5
	Usage Type: Intensity/ Frequency	Medium/ Occasionally	Low/ Seldom
	Number of Stories Served (including below grade floors)	10	10
Proposed Design	Counterweight of Car (lbs) (if unknown, leave blank)		
	Weight of Car (lb.)	8,098	8,824
	Rated Load (lb.)	3,500	4,000
	Speed of Car (ft./min)	1,200	1,200
	bhp	81.94	53.43
	Motor efficiency (%)	94.5%	93.6%
	Cabin Fan Power (Watt)	90	90
	Cabin Airflow (CFM)	325	325
	Cabin Lighting Power (Watt)	100	100
	Cabin Occupancy Sensor Lighting Controls (Y/N)	Yes	Yes
	Cab Area (Square Feet)	56	56

Elevator Calculat~~oo~~r - Description of the Proposed Equipment

4.5.19 Unmet Load Hours

Unmet load hours shall not exceed 300 hours per year. Exceptions to these limits must be submitted to the Program Manager for approval and will require justification indicating that accuracy of the simulation is not compromised by these unmet load hours and there is no significant impact on the project's performance rating.

4.5.20 ENERGY STAR Appliances

Performance credit for ENERGY STAR appliances such as refrigerators, clothes washers, clothes dryers, and dishwashers may be claimed. For multifamily buildings, please follow ENERGY STAR Multifamily Program Simulation Guidelines. The required inputs are provided in the 90.1 Performance-based Compliance Form. For commercial buildings, the ENERGY STAR Appliance Calculator available on the ENERGY STAR website may be used to estimate savings. For Appendix G projects, because appliances are unregulated in ASHRAE 90.1-~~2016~~2019, the same values may be used for the baseline model and to demonstrate that this component exceeds ASHRAE 90.1-~~2016~~ 2019 requirements. For equipment specified by NJ A5160, the below ENERGY STAR versions shall be used to establish baseline:

- Commercial dishwasher – ENERGY STAR v2.0
- Commercial fryer - ENERGY STAR v2.0
- Commercial oven - ENERGY STAR v2.2
- Commercial hot-food holding cabinet - ENERGY STAR v2.0
- Commercial steam cooker - ENERGY STAR v1.2

4.5.21 Data Centers

The following energy modeling guidelines may be used to establish unregulated data center IT equipment load assumptions. These guidelines may only be used for unregulated components outside the scope of ASHRAE 90.1-~~2016~~2019.
http://www.calmac.org/publications/2016_PG%26E_Data_Center_Baseline_and_M%26V_Guidelines.pdf

4.5.22 Receptacle Controls

Automatic receptacle controls such as controls on 15- and 20-amp receptacles in private offices, conference rooms, rooms used primarily for printing and/or copying functions, break rooms, classrooms and individual workstations may be modeled as a measure. The following types of control qualify:

- A scheduled basis using a time-of-day operated control device that turns receptacles off at specific programmed times with an independent program schedule controlling areas of no more than 5000 ft^2 and not more than one floor
- An occupant sensor that turn receptacles off within 20 minutes of all occupants leaving a space, or
- An automated signal from another control or alarm system that turn receptacles off within 20 minutes after determining that the area is unoccupied.

The savings shall be modeled using the methodology and rules in ASHRAE 90.1 2019 Table G3.1 #12 by reducing the hourly receptacle schedule in the proposed design relative to the baseline as follows:

$$RPC = RC \times 10\%$$

Where:

RPC = Receptacle power credit

$EPS_{pro} = EPS_{bas} \times (1 - RPC)$

RC = Percentage of controlled receptacles

EPS_{bas} = Baseline *equipmen*t power hourly schedule (fraction)
EPS_{pro} = Proposed *equipment* power hourly schedule (fraction)

4.5.23 Other Systems Regulated by ASHRAE Standard 90.1-~~2016~~ 2019

This may include parking garage ventilation; freeze protection and snow/ice melting systems; exhaust air energy recovery for service water heating; kitchen hoods; laboratory fume hoods; swimming pools; all building power distribution systems; exit signs; parking garage lighting; exterior lighting power; and permanently wired electric motors. For all systems regulated by ASHRAE Standard 90.1-~~2016~~2019, the proposed model must reflect actual specified systems. The baseline for projects following Appendix G path must be based on Appendix G. Systems introduced in ASHRAE 90.1-~~2016~~ 2019 that do not have explicit baseline requirements may be eligible for incentives if their performance exceeds ASHRAE 90.1-~~2016~~ 2019 requirements.

4.5.24 Other Systems Not Regulated by ASHRAE Standard 90.1-~~2016~~2019

In order to claim performance credit for systems and equipment not regulated by 90.1-~~2016~~ 2019 or this document, including but not limited to improvements to industrial systems, the baseline shall be established based on one of the following:

- Current requirements of other codes and jurisdictions, such as California Title 24.
- Baseline established by national programs for high performance buildings such as LEED NC
- Standard practice for new buildings of similar type and size

In all cases, the baseline and savings calculation methodology is subject to the Program Manager approval.

4.5.25 LEED BD~~&~~+C Interpretations

LEED interpretations for Energy & Atmosphere credits applicable to LEED BD+C: New Construction contain approaches to claim savings for energy efficient design that exceeds standard practice and is unregulated by ASHRAE 90.1. LEED interpretations and associated calculations to justify model inputs and/or calculate energy savings may be submitted for Program Manager review and approval. When using this approach, measure descriptions in the ERP must reference the ~~interpretation~~interpretation identification number and the ruling must be included as an appendix. LEED interpretations are located at www.usgbc.org/leed-interpretations.

4.5.26 On-Site Renewable Energy

On-Site renewable energy shall not be included in the Proposed building performance model.

4.5.27 Multiple Building Modeling

Sometimes projects include several buildings that have identical characteristics, such as garden-style multifamily buildings, in which case a simplified modeling approach may be used with prior approval from Program Manager. The buildings involved must have *similar envelopes and mechanical systems* as described below:

- Buildings are considered to have similar envelopes if all of the following conditions are met:
    - Building geometries are similar
    - Total conditioned building area differs by no more than 20%
    - Percentage of area taken by common spaces differs by no more than 20 percentage points.
    - Spaces in buildings are of a similar occupancy type
    - Areas of surfaces of each type (exterior and below grade walls, windows, roof, slab) differ by no more than 20%
    - Thermal properties of envelope components are similar
- Buildings are considered to have similar mechanical systems if *all* of the following conditions are met:
    - HVAC or domestic hot water equipment in buildings is of similar type
    - Overall plant efficiency varies by no more than 5 percentage points.
    - Mechanical ventilation rates are similar.

4.5.28 Core and Shell vs. Tenant Fit-Out

Core and shell and tenant fit-out projects shall be modeled as follows:

Appendix G Path Baseline:

- The baseline model must be modeled as described in these guidelines.

Appendix G Proposed Design:

- *Core and Shell projects*: The model must reflect the project's design parameters. All unspecified (yet-to-be-designed) systems and components must be modeled as minimally complying with 90.1-~~2016~~2019.
- *Tenant Fit-out:* The model must reflect the project's design parameters, EXCEPT
    - The systems and components that are outside of the tenant fit-out area must be

excluded from the scope of the whole building model

- Existing systems and components that are within the tenant fit-out area but outside of the project scope, such as envelope, must be modeled as described in **Table 4-1 New Construction vs. Gut Rehab Component Modeling**, *Existing Components Left As-Is* row~~.~~

For Core & Shell projects applying to P4P NC, tenant spaces must be included into the whole building model. Miscellaneous plug loads appropriate for tenant occupancy type must be included in the simulation. Assume office occupancy if tenant occupancy type is unknown.
For Tenant Fit-out Projects, only the tenant spaces must be included into the whole building model.

Example 1: The developer designed and will construct envelope and HVAC, as well as lighting in the lobby, corridors, and other common areas, of a future office building (Core & Shell scope). Tenants that will lease office spaces are responsible for lighting design and fixture purchase/installation in their spaces (Tenant Fit-out scope).

Program Path

The Core & Shell scope may participate in P4P NC, and may qualify for incentives based on envelope, HVAC, and common area lighting design assuming all program requirements are met. The incentives will be calculated based on the whole building square footage.
The Tenant Fit-out scope may participate in SmartStart for eligible lighting to be installed inside the offices, supplemental tenant-metered HVAC (if any), as well as certain plug loads.

Modeling Approach

The Core & Shell project participating in P4P NC must follow P4P NC Partner~~-~~ Guidelines, with the lighting included in the tenant scope treated as a "future building component." The tenant space must be explicitly modeled. With Appendix G approach, the baseline lighting must be modeled following the general rules applicable to NC projects. The proposed lighting must be modeled as minimally compliant with 90.1-~~2016~~ 2019 Section 9.

Example 2: The developer designed and will construct building envelope for a future retail strip mall (Core & Shell scope). Tenants are responsible for HVAC and lighting design in the areas that they will lease (Tenant Fit-out).

Program Path

The Tenant fit-out scope(s) may participate in P4P NC and apply for incentives for comprehensive design improvements, assuming all program requirements are met. The incentives will be calculated based on the square footage of the participating Tenant spaces.
The Core & Shell scope may participate in SmartStart Custom Measure for incentives for efficient

building envelope, assuming program requirements are met.

Modeling Approach

Only the Tenant portion of the building envelope needs to be modeled (if only a part of total strip mall). With Appendix G approach, the baseline envelope must be modeled following the general rules (same as for all NC projects). The proposed envelope must be modeled as minimally compliant with 90.1-~~2016~~ 2019 Section 5.

4.5.29 Energy Penalties ~~(Appendix G Path Only)~~

Building components are considered to be an *energy penalty* when the proposed component does not result in energy cost or source energy savings compared to the baseline model. Proposed systems that are energy penalties must be included in the proposed model *as designed*, using separate parametric run(s)/alternative(s) and modeled last following all other proposed EEMs. They must also be included in the ERP Tables and organized in the order modeled (e.g. last).

4.5.30 Controlled Environment Horticulture Facilities

Prior to initiating projects, Partners shall discuss project scopes and modeling approach with the Program Manager. ASHRAE 90.1-2019 Appendix G and these Simulation Guidelines shall be followed with the following modifications:

- The following building area type shall be added to Table 4.2.1.1 Building Performance Factors:

Building Area Type	Climate Zone																
	0A and 1A	0B and 1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Controlled environmental horticulture	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

- The following requirements shall be added to Section G3.1.1 Baseline HVAC System Type and Description

  For Controlled Environmental Horticulture buildings, use system types 3 or 4. For thermal zones classified as Controlled Environmental Horticulture, portable dehumidification systems shall be modeled in accordance with Table G3.5.7. Portable dehumidification shall not be modeled for any other zone such as office or retail space.

- The first sentence of Section G3.1.2.1 Equipment Efficiencies shall be replaced with:

  All HVAC equipment in the baseline building design shall be modeled at the minimum efficiency levels, both part load and full load, in accordance with Tables G3.5.1 through G3.5.7 .

- The following exception shall be added to the Baseline Building Performance column of Table G3.1 5. Building Envelope bullet b (Opaque Assemblies).

  Exception: For controlled environmental horticulture spaces, opaque assemblies used for new buildings, existing buildings, or additions shall match the appropriate maximum U-factors in Tables 5.5-1 through 5.5-8.

- The following exception shall be added to the Baseline Building Performance column of Table G3.1 5. Building Envelope bullet c (Vertical Fenestration Areas).

  Exception: For controlled environmental horticulture spaces, vertical fenestration area for new buildings and additions shall equal that in the proposed design and shall be distributed on each face of the building in the same proportions as the proposed building.

- The following exceptions shall be added to the Baseline Building Performance column of Table G3.1 5. Building Envelope bullet d (Vertical Fenestration Assemblies).

  Exceptions: For indoor growing spaces, fenestration U-factors shall match the appropriate requirements in Tables 5.5-1 through 5.5-8 for U_{all}. For greenhouses, the fenestration U-factor shall be modeled as U-0.7.

- For controlled environmental horticulture spaces, fenestration SHGCs shall match the appropriate requirements in Tables 5.5-1 through 5.5-8 for the SHGCall.
- The following exceptions shall be added to the Baseline Building Performance column of Table G3.1 5. Building Envelope bullet e (Skylights and Glazed Smoke Vents).

  Exception: For controlled environmental horticulture spaces, skylight and non-opaque roof U-factor and SHGCs shall match the appropriate requirements in Tables 5.5-1 through 5.5-8.

- The following exceptions shall be added to the Baseline Building Performance column of Table G3.1 6. Lighting

  Exception: For controlled environmental horticulture spaces, lighting controls shall comply with the requirements of Table 9.6.1.

- For controlled environmental horticulture spaces, exterior lighting in areas identified as "Tradable Surfaces" in Table G3.6 shall be modeled with the baseline lighting power

shown in Table 9.4.2-2. Other exterior lighting shall be modeled the same in the baseline building design as in the proposed design.

- The following exception shall be added to Section G3.1.2.6 Economizers:

  Exception: For controlled environmental horticulture buildings, air economizers shall not be included in the baseline.

- The following system types shall be added to Table G.3.1.1-2 Baseline Service Water-Heating System:

Building Area Type	Baseline Heating Method
Controlled environmental horticulture	Gas storage *water heater*

- Table G3.5.7 *Performance Rating Method* Portable Dehumidification Systems shall be added:

Equipment Type	Size Category	Minimum *Efficiency*	Test Procedure
Portable dehumidifier	*≤ 25 pints per day*	1.3 L/kWh	10 CFR 30
Portable dehumidifier	*> 25 and ≤ 50 pints per day*	1.6 L/kWh	10 CFR 30
Portable dehumidifier	*> 50 pints per day*	2.8 L/kWh	10 CFR 30

- The following common space types shall be added to Table G3.7 *Performance Rating Method Lighting Power Density Allowances and Occupancy Sensor Reductions Using the Space-by-Space Method*.

Common *Space Types*[a]	*Lighting Power Density*, W/ft²	*Occupancy Sensor Reduction*[b]
Greenhouse[4]	Proposed PPE ÷ 1.7 x Proposed W/ft²	None
Indoor Growing[5] ≥ 40 kW connected lighting load	Proposed PPE ÷ 1.9 x Proposed W/ft²	None
Indoor Growing[6] < 40 kW connected lighting load	Proposed PPE ÷ 1.7 x Proposed W/ft²	None

4.6 Energy rates

Energy rates shall be used from the local utility schedule. If unavailable, the most recent average rates for the applicable rate class and location posted by DOE Energy Information Administration (EIA) at www.eia.doe.gov, or from COMNET MGP Tables 5-2-8 (Climate Zone 4A) and 5-2-11 (Climate Zone 5A) may be used. Energy rates are allowed to differ in the baseline and proposed cases if the following requirements are met:

- Provide the documentation from utility with the rate class and rate structure for all fuels. Based on Appendix G Section G2.4.2, rates from different sources cannot be mixed.

- If the actual rate structure is used for electricity, the actual rate structure must also be used for all other fuels.
- Model actual utility rates, including usage, demand, time of use, block charges, etc. within the simulation tool.
- If a simulation tool used does not support this modeling approach, calculate energy cost by applying the actual utility rate structure to hourly energy consumption model output.
- Calculate the virtual $/kWh and $/therm rates for the baseline and proposed designs (e.g. $150,000 electric cost / 1,000,000 kWh = $0.15/kWh virtual rate)

4.7 Documenting Model Inputs

Project lighting and mechanical plans and schedules must be provided to support ERP Tables and modeling inputs.

All measure descriptions in the ERP Tables shall include all key model inputs. Key model inputs include but are not limited to the following: equipment capacity/size, equipment efficiency, appliance and lighting power density, R-values, U-factors, SHGC, etc. Energy Reduction Plans missing a significant number of key model inputs will not be accepted.

Example: DHW: Install Direct-fired Boiler

Description of Energy Efficiency Recommendation

- One central DHW natural gas heater located on the 1st floor; 500,000 Btu/hr.
- Storage Tank: 350 gallons
- Thermal Efficiency: 93%
- Energy Factor: 0.89
- Proposed storage tanks have R-12.5 insulation and temperature set point of 120ºF

Appendix G Baseline Component ~~(for Appendix G path only)~~

- One 500,000 Btu/h natural gas domestic hot water boiler
- Storage Tank: 350 gallons
- Thermal Efficiency: 80%
- Baseline storage tanks have R-12.5 insulation and temperature set point of 120ºF

ASHRAE 90.1-~~2016~~ 2019 Requirement

- One 500,000 Btu/h natural gas domestic hot water boiler
- Storage Tank: 350 gallons
- Thermal Efficiency: 80%
- Standby-losses: 936 Btu/h

In addition to the key modeling inputs mentioned above, the description of the proposed measure

must also include quantity, model numbers (where available), and equipment location (where applicable). This information must be included for all measures, including not only equipment and appliances, but also any envelope measures. For example, the number of windows and square footage of wall insulation should be included with the description of the corresponding energy efficiency measures for windows and walls. For any lighting measures, descriptions must include a schedule of the proposed lighting including fixture types by space, as shown on lighting plans for the project. HVAC measure descriptions should include system type, size, manufacturer/model (if available) and efficiency in the appropriate units. This is necessary for facilitating post-installation inspections.

4.7.1 Modeling File Submittal

Table 4-1 lists modeling files and/or reports that must be submitted as an Appendix with the Energy Reduction Plan. Reports should be organized in a manner that clearly identifies which reports are for the baseline or proposed design, and which are for each energy efficiency measure. Appendix shall minimally include the files and reports listed below, with reports in the following formats:

- eQuest users shall submit reports using "*.sim" formats.
- DOE-2 users shall submit reports using "*.pdf" or "*.doc" formats.
- TRACE users and other approved software package users shall submit reports in data "*.pdf" format.

Additional files and/or reports may be requested by Program Manager:

Table 4-2. Modeling Documents for Submittal

Software	Modeling Files	Key Output Report (for baseline and each EEM)
DOE-2 (including eQuest)	*.pd2,*.inp, *.prd *(eQuest only)*	Building Energy Performance Summary (BEPS) Building Energy Performance–Utility (BEPU) Energy Cost Summary (ES-D) Summary portion of LV-D report SV-A report PS-C report PS-E report
TRACE	*.TAF	Project Information Energy Cost Budget/ PRM Energy Consumption Summary Monthly Energy Consumption Monthly Equipment Energy Consumption Entered Values Plants Entered Values Systems System Checksums

		Monthly Utility Costs
HAP	HAP file	EA Credit 1 Summary Annual Cost Summary Energy Cost Budget by System Component Zone Temperature Report and Unmet Report (for systems and plants) Monthly Energy Use by Component Monthly Air and System and Plant Simulation Results Air Systems Input Data Boilers Input Data Chilled Water Input Data Chiller Input Data Space Input Data
EnergyPlus	*.idf file for each simulation run	Annual Building Utility Performance Summary LEED Summary METERS.csv Input Verification and Results Summary Demand End Use Components Summary Source Energy End Use Components Summary Climatic Data Summary Equipment Summary Envelope Summary Surface Shadowing Summary Shading Summary Lighting Summary HVAC Sizing Summary System Summary Component Sizing Summary Outside Air Summary Object Count Summary
IES	n/a	General Information Space Summary Advisory Messages Comparison of proposed vs. baseline design energy model inputs Energy Type Summary Exceptional Calculation Measure Summary Performance rating Method Compliance Report
Other		Consult with Program Manager

4.8 As-Built Model

Unless otherwise noted in this document, components in the As-Built Building model must reflect

the actual building components, as verified or measured during inspections. At the completion of the project, these same guidelines can be used to calculate the performance rating for the As-Built model, by substituting "As-Built" where you find "Proposed". Please see the following Section 5 for additional information on As-Built Energy Reduction Plan.

5 As-Built Energy Reduction Plan Development

5.1 Overview

After construction is complete, the As-Built Energy Reduction Plan and model must be submitted to the Program Manager. This submission will incorporate any changes that occurred during construction from what was originally approved in the Proposed Energy Reduction Plan, as well as the Commissioning Report (reference Section 6).

5.2 Rules and Requirements

5.2.1 Incorporating Equipment and System Changes

The Program recognizes that changes to the scope of work may occur during construction. The As-Built ERP must verify that the equipment specified in the final Proposed ERP was installed, and identify any deviations in equipment, systems, and/or operating schedules. The Partner must update the model, as appropriate, to incorporate these changes and obtain revised energy savings estimates.

For each measure with significant changes, the As-Built ERP must include:

1. Actual equipment specifications and operating conditions
2. Method followed to update building model, or justification that energy savings were not significantly affected
3. As-built energy savings
4. Actual installed cost

Changes to the scope of work that deviate from the approved Proposed ERP in regards to project cost, measures installed, and square footage will be handled per **Table 5-1** below. The project, after changes, must still meet all Program requirements.

Table 5-1. As-Built ERP Changes and Incentive Payment Processing

	Decrease	Increase
As-Built Scope of Work	If the as-built scope of work is reduced (e.g. measure is removed, scaled back, or installed so that it no longer qualifies, etc.), then the As-Built ERP must be adjusted accordingly. The final 2nd and 3rd incentive will be reduced based on the As-Built model savings. If savings drop the project into a lower incentive Tier, Incentive #2 will be trued-up to account for Incentive #1 overpayment.	If the as-built scope of work is increased (e.g. measures added, expanded, etc.), then the As-Built ERP must be adjusted accordingly and the final 2nd and 3rd incentive may be increased based on the As-Built model savings for eligible measures. If savings bump the project into a higher incentive Tier, Incentive #2 will be trued-up to account for Incentive #1 underpayment. Scope changes leading to significantly higher incentives will require review and approval by the Program Manager and potentially the NJ Board of Public Utilities.
As-Built Square Footage	If the as-built square footage is less than that in the approved Proposed ERP, then the final 2nd and 3rd incentives will be reduced accordingly. Additionally, the 2nd incentive will be trued-up for any overpayment in the 1st incentive.	If the as-built square footage is more than that in the approved Proposed ERP, then all three incentives will be increased by no more than 5%. Underpayment of 1st incentive will be compensated in the 2nd incentive. Square footage changes leading to significantly higher incentives will require review and approval by the Program Coordinator and potentially the NJ Board of Public Utilities.

5.2.2 Invoices

In addition to the As-Built ERP and revised model, the Partner must submit invoices/purchase orders/etc. to support the details of installed equipment, as well as substantiate any partner fees.
Additional Requirements
In addition to the items listed above, the As-Built ERP shall also include:

1. A current utility bill for all fuels on-site. This is used to verify project name, address, and payment of SBC costs. The name on the utility bill must correspond to the Participant name listed on the Initial Application, except as specified in Section 2.4.2.
2. Revised mechanical and lighting schedules and plans.
3. Revised external calculations, if applicable.
4. A narrative explaining key changes between the Proposed Design and As-built ERPs and models.
5. Commissioning Report (see Section 6).

5.3 Inspections

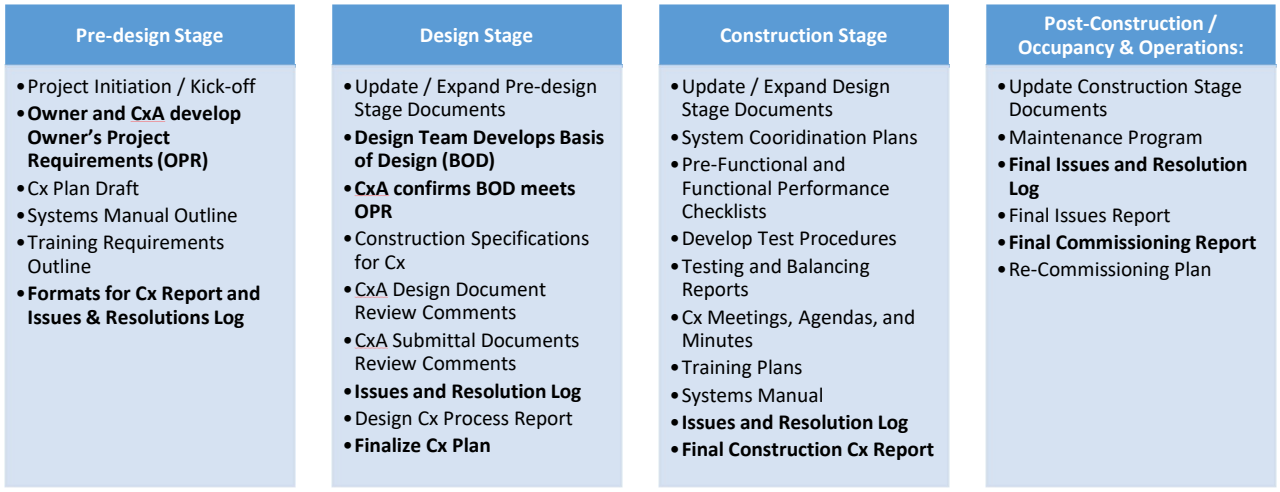
Program Manager will visit a project site to verify that the information provided in the As-Built ERP and/or invoices is accurate with regard to project equipment, site conditions, and monitoring configurations. These inspections may occur at any time after project installation. Should the Program Manager decide to inspect a site, the Program Manager, or its Technical Consultant, may or may not contact the Partner to schedule the inspection. In other words, an inspection may occur without advance notice given to the Partner. If the conditions are found to be different from those represented in the Proposed and/or As-Built ERP, the Program Manager may refuse any further incentive payments.

6 Commissioning Guidelines

6.1 Overview

Commissioning (Cx) is an ongoing collaborative and quality process between the owner, design team, contractors, and the Cx Authority (CxA). Cx, as a systematic process, verifies and documents the performance of new facility equipment and confirms that building equipment and systems meet the design intent and operational needs of the owner, developer, and occupants. Cx shall also confirm the system performance assumptions documented in the As-Built ERP, ensuring the facility achieves the expected energy savings. Efficient new buildings will fall short of the energy savings potential without an effective Cx program. The Cx process, as shown in **Figure 6-1** below, focuses on verifying and documenting the facility and its systems are designed, installed, tested, operated and maintained to meet owner and Program requirements, and as a result, is expected to take place from pre-design and design stages through construction completion and post-construction/occupancy. Commissioning, including preparation of the Commissioning Plan, is a mandatory requirement of the Program. Projects that are not commissioned will not eligible for any P4P NC incentives.

Figure 6-1. Commissioning Milestones



6.2 Commissioning Standards and Guidelines

- **ASHRAE Guideline 0 - The Commission Process** – This Guideline describes the Commissioning Process capable of verifying that a facility and its systems meet the Owner's Project Requirements. The procedures, methods, and documentation requirements in this guideline describe each phase of the project delivery and the associated

Commissioning Processes from pre-design through occupancy and operation. The guideline also contains numerous appendices that contain examples how to execute Cx activities as well as sample forms (e.g. construction / testing checklists).

- **ASHRAE Standard 202p - The Commission Process –** This Standard describes how to plan, conduct, and document commissioning activities. Informative appendices provide sample documentation, including checklists, systems manual, reports, training plan, among other resources.

- ASHRAE has two additional commissioning guidelines, Guideline 1.1 and Guideline 1.5. Guideline 1.1-2007 focuses on HVAC&R systems while addressing total building commissioning processes by validating interfaces and possible interferences between all building systems. Guideline 1.5 describes the technical requirements for the application of the Commissioning Process described in ASHRAE Guideline 0 that will verify that the smoke control system achieves the Owner's Project Requirements (OPR).

- All ASHRAE Commissioning Guidelines are available at the ASHRAE bookstore in both electronic forms and print editions: https://www.ashrae.org/resources--publications/bookstore/commissioning-essentials

6.3 Commissioning Authority

The Cx process must be overseen by a qualified Commissioning Authority (CxA). The CxA is a person or team with extensive commissioning, building design and construction experience, generally retained at the onset of the project-design phase.

The CxA must be *independent from the design and construction teams*, and must have the proper credentials and industry experience. Documented CxA experience in at least two (2) building projects of similar technical complexity is required. The CxA may be a qualified staff member of the Partner, a consultant retained by the Partner, or a Participant's consultant to the project.

The CxA shall be involved at the beginning of the design process to ensure Cx components, specifications and responsibilities are defined and in place prior to bid and construction. The intent is to ensure new construction projects funded through the Program are correctly designed, constructed, and yield the highest industry standard performance. As an example, subcontractor contracts must contain appropriate direction, defining their responsibilities during the Cx activities.

In addition to verifying the installation and operation of building systems, the CxA must work with the Partner to ensure assumptions used in energy savings calculations are incorporated into the Cx Plan and to identify any discrepancies between system operation and modeling assumptions.

6.4 Commissioning Plan

An outline of the project's commissioning team, planned activities and reporting shall be completed using the *Cx Plan template* provided by the program and submitted with the Proposed ERP. Once energy efficiency measures are installed, the Cx process can begin and shall follow the outline of the Cx Plan. At minimum, all energy efficiency components of the P4P project must be commissioned, although Owner may choose to expand commissioning activities beyond the P4P scope of work.

Partners, CxAs, and sub-contractors involved in Cx activities shall observe industry best practices. The Cx Plan, testing procedures, and reporting need to reference ASHRAE Guideline 0. These guidelines contain information on best practice procedures and documentation for Cx, which are an example of typical Cx tasks. Additional references for industry *best practices* and guidelines for Cx and functional testing have been provided in Section 6.6.

An Energy Management System (EMS) may be designed to serve as the means to quantify and confirm energy efficient operation. The EMS shall trend-log process variables to demonstrate stable control and intended sequences. Performance graphs developed within the EMS to demonstrate performance and can also be used in subsequent years as a benchmark for comparison purposes.

6.4.1 Owner's Project Requirements (OPR)

Definition[28] – A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information. (The term Project Intent is used by some owners for their Commissioning Process Owner's Project Requirements). Section 5.2.2.4 of ASHRAE Guideline 0 contains a comprehensive list of items that should be included in the OPR. Informative Annex I contains an example how to collect information for the OPR and Informative Annex J contains a sample format to compile this information into an OPR document.

[28] ASHRAE Guideline 0-2013 Section 4

The Owner's Project Requirements are generally a collaborative effort between the Owner and Commissioning Authority (CxA). During the pre-design phase, the Owner's Project Requirements (OPR) should be established to understand the owner's needs and goals. Information about the project is gathered, including program requirements, community context, codes and regulations, site and climate, facility context and function, facility technology, sustainability, cost, schedule, and the client's (including owner, occupants, operators, and maintenance personnel) needs and capabilities[29]. The OPR is the basis of the commissioning plan, and informs the project team to properly design, construct, and operate a building and its systems.

> "The OPR document must clearly reflect the priorities and objectives of the building owner. That's why a successful project team must include a skilled CxA who can work closely with the owner to help capture the details of the owner's requirements."
>
> Dave McFarlane, "Technical vs. Process Commissioning Owner's Project Requirements," ASHRAE Journal, August 2013

Program Requirements: Per Section 3.2, to earn pre-design incentives, Partners must document how preliminary "simple box" energy modeling analysis informed building design decisions relative to owner's project requirements, basis of design, and eventual design of the project. Inclusion of the Owner's Project Requirements (OPR) document in the Commissioning Plan (or as an Appendix to the Commissioning Plan) and as an attachment within the pre-design submittal is required to demonstrate pre-design activities took place and earn pre-design bonus incentives.

6.4.2 Basis of Design Document (BOD)

Definition[30]– A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. The Basis of Design is developed by the design

[29] ASHRAE Guideline 0-2013 Section 5.1.1

[30] ASHRAE Guideline 0-2013 Section 4

team and is reviewed by the CxA.

The basis of design (BOD) document provides the design team with a tool to clearly present the assumptions and specifications used to develop construction documents to all parties involved from the owner through contractors and suppliers. The OPR can be considered as the foundation of the BOD. The BOD specifically addresses how each of the owner's project requirements are included in the building design. The BOD should generally include the following[31]:

- System and assembly options
- System and assembly selection reasoning
- Facility, system, and assembly performance assumptions
  - Assumptions for calculations/sizing
  - Analytical procedures and tools
  - Environmental conditions
  - Limiting conditions
  - Reference make and model
  - Operational assumptions
- Narrative system and assembly descriptions
- Codes, standards, guidelines, regulations, and other references
- Owner guidelines and directives
- Specific descriptions of systems and assemblies
- Consultant, engineering, and architectural guidelines for design developed by the design team or others

Program Requirements: The Basis of Design (BOD) must be included in Section 4 of the Program's Commissioning Plan template.

6.4.3 Commissioning Scope in P4P

While commissioning must cover all P4P measures, commissioning must also be performed on building components and systems that have a significant impact on projected energy savings of the building and operational needs of the owner, developer, and occupants. Excluding major systems from commissioning activities could have a significant impact on building operation post-construction and occupant comfort. For example, a new construction multifamily building has a rooftop unit providing corridor OA that meets the Minimum Performance Standards and a new boiler that only meets ASHRAE 90.1 requirements. The scope of work includes wall and roof

[31] ASHRAE Guideline 0-2013 Section 6.2.2.1

insulation, triple pane windows, and RTU measures, but the boiler is not included as a measure. The boiler must be commissioned because it impacts occupant comfort and has direct impact on the envelope measures.

Excluding major systems can significantly impact Incentive 3, which provides incentives for buildings that earn the ENERGY STAR Certification or equivalent ASHRAE Building Energy Quotient In-Operation Certification.

6.4.4 Schedules

The Commissioning Plan must include a schedule of Cx process activities. Generally, construction and commissioning schedules will be much more detailed and include several sub-milestones as well as duration. For the purposes of developing a Cx Plan for P4P, a schedule with the level of detail similar to **Figure 6-2** below may be used. The schedule must demonstrate that all Cx process activities have been integrated into design and construction.

Figure 6-2. Sample Cx Schedule

#	Tasks	Planned Date	Actual Date
1	Complete Draft of OPR		
2	Start Schematic Design		
3	Commissioning Kick-off Meeting (Design)		
4	Develop Draft of Commissioning Plan		
5	CxA Schematic Design Review		
5	Complete Schematic Design		
6	Develop Draft of BOD		
7	CxA Design Development Review		
7	Complete Design Development		
8	Complete Construction Documents		
9	Pre-bid Meeting		
10	Finalize Construction Contracts		
11	Pre-construction Meeting		
11	Start Construction		
12	Review and Approve All Submittals		
13	Commissioning Kick-off Meeting (Construction)		
14	Construction Inspections		
15	Complete Construction / Pre-Functional Testing Checklists		
16	Complete Functional Performance Testing		
17	Complete O&M and Systems Manual		
18	Complete Training Manual		
18	Conduct Maintenance Staff Training		
19	Project Completion		
20	Address All Outstanding Issues and Discrepancies		

20	Finalize Commissioning Report		
21	Warranty Review		
22	Lessons Learned Meeting		

Program Requirements: Schedules for Cx activities are required for all commissioning plans and reports.

6.5 Commissioning Report

Once the Cx process is complete, the pre-approved Commissioning Authority (CxA) must work with the Partner to complete a *Cx Report*. The Cx Report must update and elaborate on the activities outlined in the Cx Plan and include the stipulated documentation. The purpose of the Cx Report is to verify and/or identify, but not limited to, the following:

1. Measures are the same as originally planned, or at least equivalent or better, in their energy savings than the As-Built ERP.
2. Nameplate data, such as model number, size, power rating, energy efficiency rating, etc. are the same as those in the As-Built ERP.
3. Actual energy consumption or equipment output matches assumptions in the As-Built ERP model and energy savings calculations.
4. Control systems are set and functioning such that they match the assumptions used in the As-Built ERP energy savings calculations.
5. Proper operator training of measure equipment is completed.
6. Deficiency log, level of impact to energy savings, and proposed and/or completed corrective action.
7. Measures are likely to achieve (or exceed) their expected energy savings, or if not, that all reasonable corrective measures have been undertaken and that final savings have been accurately re-estimated, as necessary.

The report, including guidelines for functionality to achieve continued energy savings and any other O&M requirements, should also be provided to the building owner, along with system maintenance manuals and warranties. The contents of the report should minimally include the following:

- Final commissioning plan
- Commissioning methodology
- Basis of design
- Commissioning schedule

- Field reports
- Pre-functional test forms for all mechanical and electrical systems
- Functional test forms for all mechanical and electrical systems
- Contractor start-up reports
- Building envelope commissioning reports
- Issues and resolution log with all discrepancies and punch list items addressed and corrected
- Warranties of equipment
- Description of training performed and/or training syllabus including details when training took place and who participated

Commissioning reports that do not meet all requirements may be rejected and potentially result in forfeiture of Incentive #2.

6.5.1 Commissioning Team Responsibilities

1. **Owner and/or Partner**. Provides definition and support of project and Cx goals. Empowers the CxA to participate in construction activities within the Plan boundaries. Provides discretionary decision making based on input from Cx team members and others. Defines communication protocols, assures CxA is included in applicable document distribution and present at relevant project meetings.
2. **Commissioning Authority (CxA)**. Organizes and leads the Cx team, develops and coordinates execution of the Cx Plan. Provides services as the energy efficiency advocate, manages preparation and organization of Cx documents, and participates during key construction startup, testing, training and closeout. The CxA facilitates problem resolution where appropriate.
3. **General Contractor (GC).** Assigns a Cx coordinator, whom will proactively participate in the Cx process. Facilitates execution of Cx Plan and associated activities. Coordinates and ensures sub-contractor participation and cooperation while integrating Cx into the construction, startup, and testing and closeout process. Provides scheduling, preparation and/or compilation of related record documents.
2. **LEED Consultant**. Retained to facilitate achievement of credits and submittal requirements for targeted certification level if LEED goals are a part of the project goals.
3. **Architect**. Primary architectural design responsibility and associated authority. Prepares

architectural plans, specifications, reviews and approves applicable submittals and shop drawings. Supports Cx Plan strategies and participates in select Cx tasks. Performs periodic site inspections, prepares punch lists, advises on acceptance and supports project closeout.

4. **Mechanical & Electrical Engineers**. Have primary engineers-of-record responsibility and design authority. Prepares engineering plans, specifications and Basis of Design (BOD), reviews and approves equipment submittals and shop drawings. Supports Cx Plan strategies and participates in select Cx related tasks. Performs periodic site inspections, prepares punch lists, advises on Owner acceptance and supports project closeout.
5. **Mechanical & Electrical Contractors**. Assigns a Cx coordinator, who will participate in the Cx process. Participates in Cx and related tasks.
6. **EMS Controls Contractor**. Assigns a Cx coordinator, who will participate in the Cx process. Participates in Cx and related tasks, including preparation of EMS trending data, which demonstrate properly operating system sequences and performance.

6.5.2 Commissioning Process

For the purposes of the Program, the Program Manager will focus the review on components of the building design that are affected by the proposed energy efficiency measures.

6.5.2.1 Design Phase

The Cx objectives during the design phase include introducing the Cx process to the design team and other stakeholders. The CxA will initiate meetings and establish the Cx role, provide Cx-focused design review, comment, and recommendations. The CxA will coordinate Cx activity and related tests and inspections, and make sure other QA/QC requirements are clearly specified and organized.

6.5.2.2 Construction Phase

1. **Construction Phase Scoping Meeting:** The introductory Cx meeting will be organized by the CxA with the appropriate team members. Topics of the scoping meeting include:
    a. Establish team introductions, roles, responsibilities and expectations.
    b. Review Cx Plan, Cx process interpretation and focus.
    c. Establish Pre-testing documentation responsibilities and expectations.
    d. Define testing responsibilities and expectations.
    e. Schedule highlights.
    f. Obtain consensus by team members on Cx plan strategy.

2. **Regular Meetings and Job Walks:** The CxA will schedule, meet and walk the project periodically to:
    a. Facilitate the Cx progress, including general coordination and other meetings.
    b. Observe construction, startup, testing, inspections and other field activities.
    c. Coordinate EMS controls sequence of operation implementation and trending of system point data for demonstration of system acceptance.

    The CxA will also provide appropriate meeting minutes, memorandums, or field observation reports using standard forms, as applicable.

3. **Control System Cx:** Controls coordination meetings will be periodically held to track the following topics for primary and third party furnished controls.
    a. Construction shop drawings and equipment submittals.
    b. Final sequences of operation, advanced energy management features, manual and automatic setpoint adjustment strategies.
    c. Application, work station graphic screen and process software development including operator interface optimization.
    d. Sensor and device calibration plan.
    e. Pre-functional checklists.
    f. Functional performance test plan.
    g. Trend logging and report generation.

4. **Pre-Functional Testing Checklists:** These checklists will be generally provided by the GC with CxA oversight.
    a. Pre-functional checklists (PFCL's) include a combination of:
        i. In-house developed checklists,
        ii. Manufacturer start-up checklists, and/or
        iii. Field technician furnished startup checklists.
    b. CxA will help develop, review, and provide comments on proposed PFCL's.
    c. The CxA will organize and produce a binder of PFCL's for equipment and systems in preparation for startup and testing.

5. **Functional Performance Testing (FPT) Plans:**
    a. Functional performance tests demonstrate operation of:
        i. EMS communications infrastructure and operator work station.
        ii. EEM Equipment operation

iii. Sequences of operation including system scheduling, mode and process loop control, alarm reporting, failure operation and data logging.

b. FPT plans will include table summaries describing equipment testing, observed discrepancies and corrective actions.

c. The CxA will incorporate key performance parameters used in the building energy simulation by the P4P Partner into the FPT plans.

d. The CxA will prepare the FPT plan forms and will incorporate them into a binder in preparation for actual testing.

6. **Resolving and Reporting Deficiencies:** The CxA will develop procedures to be followed in cases where deficiencies are found during pre-functional and functional testing activities, including:

   a. Methods for both reporting and resolving the deficiency.

   b. Determination of effect on expected building performance, as reported in the As-Built ERP.

   c. Communication and decision requirements for Project Team, Owner, Partner, and Program Manager.

6.5.2.3 Startup, Testing, and Optimization Phase

1. **Pre-Functional Startup, Checkout**

   a. GC will confirm completion of construction and pre-startup activities, including permanent power, natural gas, domestic cold water, fire protection water and other utilities. Duct and piping systems are tested and cleaned, water treatment and filtration systems are in place and other pre-conditions for startup are in completed and operational.

   b. CxA will observe and provide comments during startup/checkout for each piece of primary equipment, unless there are multiple units, where a sampling strategy will be used. Observed discrepancies will be corrected.

2. **Functional Performance Testing (FPT)**

   a. Functional performance testing will include execution of FPT plans and documentation of results. Execution will be achieved by using a combination of the following strategies:

      i. Manual observation, testing and reporting.

      ii. EMS Control system trend log reporting and analysis.

b. Testing will proceed from components to subsystems to systems and finally to interlocks and connections among systems, including life safety.

6.5.2.4 Closeout

1. **Closeout meeting.** This meeting will be held strategically and/or in association with a regular Cx meeting near project completion. Relevant closeout items include:
   a. Completion of functional performance testing. Closeout will not occur until after successful completion of testing has occurred, unless agreed to otherwise by the project team.
   b. Record documentation**.** GC will receive and distribute record documents and other information representing the constructed condition. The Architect will submit record documentation as appropriate.

2. **Training.** CxA and GC will confirm that training has been completed and will issue applicable documentation, including training activity, attendees, outline of reference material, and schedule. CxA will participate in training summary by integrating energy management, continuous Cx and other design intent features with training syllabus.

3. **Warranties.** GC will compile warranties, including milestone dates, inclusions, exclusions, contacts, procedures and other relevant items.

4. **LEED documentation.** CxA will compile information, and prepare and upload LEED prerequisite and credit documentation, if applicable.

5. **Final Commissioning Report.**
   a. CxA will aggregate relevant data and information collected throughout the project cycle.
   b. CxA will prepare written text summarizing the Cx activity. The CxA will also identify relevant data and other information collected where legacy value can be accrued by permanent building operations teams.
   c. CxA will produce Final Cx Report and electronically and in paper form for submission to Owner and P4P Partner.
   d. Partner will submit Final Cx Report to P4P Program Manager for approval.

6.5.3 Commissioning Sampling

The level of commissioning rigor will often be dictated by project size and complexity. For P4P

NC, the sampling strategy used must demonstrate confidence in the energy savings presented in the ERP in addition to meeting owner, developer, and occupant needs. The Program will not require specific sampling rates as each project has unique functional requirements. However, the program requires that *quality based* sampling is performed as discussed in the following excerpt from Guideline 0[32].

> "Because the contractor is responsible for 100% construction and checking of work, the commissioning process utilizes a sampling strategy in accomplishing verifications and tests. For construction checklist verifications, during site visits, the completed construction checklists are verified (typically 2%–10%). The following is general guidance for selecting and verifying construction checklists.
>
> 1. Identify the construction checklists that have been completed since the last site visit.
> 2. The following is a general guide for sample rates based on the number of new construction checklists. ***Please note that this is not meant to be used directly for your project due to the many variables in determining acceptable sample rates and owner input.*** Randomly select the construction checklists to be verified. Note that you often want to sample similar components as a group so that if there is only 1 or 2 of a particular component, it is not missed. Because the sampling rate is lower for these than for other components, you can compare results between similar components more easily."

Figure 6-3. Recommended Sampling Requirements from ASHRAE Guideline 0, Informative Appendix N

# New Construction Checklists	Overall Sample Rate	Component Sample Rate
1–10	100%	70%–100%
11–20	80%	50%–70%
21–50	50%	30%–50%
51–100	30%	15%–30%
>100	2–20%	2%–10%

Program Requirements: With respect to the equipment/component testing activities of commissioning, sampling of systems is permitted if it generally follows the approach described

[32] Informative Annex N, Quality Based Sampling Examples of ASHRAE Guideline 0-2013

above. The sampling procedure used should be described in the final commissioning report. Note that this approach is a rule of thumb and will not apply for all projects and scenarios. For example, for some building types, the criticality of systems must be considered (e.g. the sampling rate of 11 CRAH units in a data center should be higher than 70%).

6.5.4 Issues and Resolutions Log

The Issues and Resolutions Log is the on-going list of issues, discrepancies, and questions throughout design and construction of a project that needs to be communicated to the project team for resolution or action. These are often shown in table format and supplemented with pictures and drawings where necessary. **Figure 6-4** below is an example of an acceptable Issues and Resolutions log to be included in commissioning reports.

Figure 6-4. Sample Issues and Resolution Log

Issue number	Date of Issue	Issue description	Effects of issue on building operation	Possible cause of issue or problem	Recommendation for resolution	Person assigned to issue	Resolution Approval & Date	Pictures of Issue	Picture(s) of Resolution	Notes

Figure 6-5 contains a list of common deficiencies often missed during initial Cx, leading to underperforming buildings. Particular care should be taken by the CxA, to ensure each of these potential issues is addressed.

Figure 6-5. Commissioning Findings

Top Ten Deficiencies Discovered by Commissioning New and Existing Buildings

1. Incorrect scheduling of lighting and HVAC equipment
2. Incorrect cooling and heating sequences of operation
3. Incorrect calibration of sensors and instrumentation
4. Lack of control strategies for optimum comfort and efficient operation
5. Malfunctioning air and water side
6. Underutilized computer based control systems
7. Short cycling of HVAC equipment
8. Lack of design intent and building documentation
9. Lack of training for building operators on complex systems
10. Missing specified and paid-for equipment.

Program Requirements: An Issues and Resolutions Log must be included in the final commissioning report. The log must include the descriptions of issues and the measures taken to correct them. All significant issues impacting building energy performance must be resolved prior to the approval of the commissioning report.

6.6 Additional Resources for Commissioning Best Practices

For further references on Cx and functional testing procedures that meet P4P Program requirements, please consult ASHRAE Guideline 0and related documents. The following resources contain additional information on current industry best practices for design, implementation, and documentation of Cx plans for commercial new construction. This list is provided as a supplemental reference to ASHRAE Guideline 0-2005, to aid in preparation of Cx Plans and design of functional testing procedures:

- *California Commissioning Guide for New Building*.pdf
- *Portland Energy Conservation, Inc. (PECI) - Model Commissioning Plan and Guide Specificati*~~*Specifications*~~ ~~html~~
- *National Institute of Building Sciences - Whole Building Design Guide*~~.php~~
- *Building Commissioning Association (BCI) - Commissioning Process Templates*:

http://www.bcxa.org/resources/templates/index.htm

7 Building Performance

7.1 Overview

The purpose of submittal is to assess the energy performance of the project building based on its first year of operation, and promote quality construction and energy efficient operation and maintenance practices resulting in low post-construction energy use.

7.2 Eligibility

Projects may be eligible for this incentive if they can achieve a score of 75 or higher through ENERGY STAR Portfolio Manager and show proof of receiving ENERGY STAR Certification. Note, only certain building types[33] are eligible to receive an ENERGY STAR Score.
Building types not eligible for ENERGY STAR Certification may obtain *ASHRAE Building Energy Quotient (bEQ) In-Operation* Certification and receive a score equivalent to the Minimum Performance Target as calculated by the ERP Tables. Building types eligible for this option are listed in Appendix C.

Alternatively, if the project is not a building type eligible for ENERGY STAR or *bEQ In-Operation* Certification the project may be eligible for this incentive if the first year of operation utility bills show equal or less source energy consumption compared with the proposed design model's projected annual source energy consumption. A licensed professional is required to validate that the building is operating per the model inputs related to outdoor air ventilation rates, occupancy schedules, and production/process equipment schedules and capacities.

7.3 Limitations

ENERGY STAR Portfolio Manager accommodates Multifamily building types, but it requires

[33] https://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/identify-your-property-type-0

energy use from all tenant spaces in addition to common areas. Partners are strongly encouraged to discuss this limitation with their client and determine a plan for obtaining all tenant data. If this requirement cannot be met, please discuss with Program Manager as soon as possible. Depending on the proposed equipment and/or meter layout, the Program may be able to provide an alternative path for estimating tenant energy use.

The Program is currently limited to ~~incentivizing savings~~incentivizing savings resulting from energy efficient design components. It does not give credit for energy cost or source energy savings resulting from on-site renewable energy or Combined Heat and Power / Cogeneration. The Program Manager will work with projects that include these technologies during the performance period. It is strongly advised that such components are metered separately to more easily separate their load from that of the building itself.

If the P4P project is design as an addition to an existing building, or an addition is added to the P4P project before completing the program, it is critical that each portion is metered separately in order to isolate the energy use of the P4P project from that of other attached structure(s).

Similarly, projects that are pursuing only Core & Shell or only Tenant Fit-Out will need to work with the Program Manager in order to accurately measure building performance during the performance period.

Appendix A

NJCEP Measure Lives

The measure lives listed below are used to populate default measure life for each measure listed in the ERP Tables for the purposes of reporting lifetime savings. ~~Deviation from the below stipulated measure lives must be supported by appropriate documentation. For example, if actual measure lives are available through nameplate information or other manufacturing specifications with proper documentation, those measure lives should be utilized to calculate lifetime savings.~~

NEW JERSEY STATEWIDE ENERGY-EFFICIENCY PROGRAMS
Measure Lives Used in Cost-Effectiveness Screening – October 2020

Measure	Measure Life
Residential Sector	
Lighting End Use	
CFL	5
LED	15
HVAC End Use	
Central Air Conditioner (CAC)	15
CAC QIV	15
Air Source Heat Pump (ASHP)	15
Mini-Split (AC or HP)	17
Ground Source Heat Pumps (GSHP)	25
Furnace High Efficiency Fan	15
Heat Pump Hot Water (HPHW)	10
Furnaces	20
Boilers	20
Combination Boilers	20
Boiler Reset Controls	10
Heating and Cooling Equipment Maintenance Repair/Replacement	10
Thermostat Replacement	11
Hot Water End-Use	
Storage Water Heaters	11
Instantaneous Water Heaters	20
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Appendix B

Minimum Performance Standards

This Appendix contains information on minimum performance standards for measures included in the project work scope (derived from the NJ SmartStart Buildings Program).

In addition to the guidance already noted in the above sections, ~~Measures are defined as components that exceed ASHRAE 90.1-2016 requirements and~~Pproject components are required to ~~comply~~ the minimum performance standards ~~within~~ Appendix B, ~~(except where otherwise noted in the partner guidelines, see Section 4.5.9 Interior Lighting),~~ where applicable. Requirements may be waived or modified by Program Manager on a ~~case by case~~case-by-case basis due to limited market availability of equipment.

Additionally, all applicable equipment must be new and listed by UL or other OSHA approved Nationally Recognized Testing Laboratory (NRTL), such as CSA, in accordance with applicable US standards. Manufacturer's specification sheets may be requested by Program Manager to confirm performance.

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B-1. Chillers

- Proposed equipment must comply with both Full Load and Part Load (IPLV) minimum efficiencies as stipulated by ASHRAE 90.1-~~2016~~2019.

    - Water-cooled chillers: All ~~water cooled~~water-cooled chillers must be submitted at AHRI *Standard 550/590 conditions*. If an applicant has a ~~water cooled~~water-cooled centrifugal chiller that is designed to operate at other than the AHRI standard conditions the procedure in ASHRAE Standard 90.1-~~2016~~2019, Section 6.4.1.2.1 may be used by the applicant to adjust the manufacturer's published efficiency at non-AHRI conditions to the efficiency at AHRI standard conditions. The applicant will need to provide the manufacturer's non-AHRI ratings as well as the calculations for the chiller efficiency at AHRI conditions.

    - Air-cooled chillers - Efficiencies are based on the unit's compressor kW per capacity (tons) at AHRI conditions.

    - Gas Absorption Chillers - Full and part-load efficiencies are determined in accordance with AHRI Standard 550/590/2003. Chillers > 400 tons must be two-stage in order to qualify.

- Path B Chiller Performance Curves – see 90.1 2019 addendum bd[~~24~~22] which prescribes the performance curves that must be used.

~~**PATH B**~~

~~**Water Cooled Positive Displacement < 75 tons**~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~0.3341277~~	~~0.7668089~~	~~-0.2012063~~
~~b~~	~~0.0210146~~	~~-0.0243168~~	~~1.0939141~~
~~c~~	~~-0.0001024~~	~~0.0002620~~	~~0.1112860~~
~~d~~	~~-0.0014070~~	~~0.0074109~~	~~0.0043863~~
~~e~~	~~-0.0000285~~	~~0.0001177~~	~~5.42951E-08~~
~~f~~	~~0.0000707~~	~~-0.0001820~~	~~-0.004460292~~
~~-~~	~~-~~	~~-~~	
~~**Water Cooled Positive Displacement > 75 tons & <150 tons**~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~

~~a~~	~~0.3341277~~	~~0.7668089~~	~~-0.2012063~~
~~b~~	~~0.0210146~~	~~-0.0243168~~	~~1.0939141~~
~~c~~	~~-0.0001024~~	~~0.0002620~~	~~0.1112860~~
~~d~~	~~-0.0014070~~	~~0.0074109~~	~~0.0043863~~
~~e~~	~~-0.0000285~~	~~0.0001177~~	~~5.42951E-08~~
~~f~~	~~0.0000707~~	~~-0.0001820~~	~~-0.004460292~~
~~-~~	~~-~~	~~-~~	
~~**Water Cooled Positive Displacement >=150 & < 300 tons**~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~0.3341277~~	~~0.7668089~~	~~-0.2012063~~
~~b~~	~~0.0210146~~	~~-0.0243168~~	~~1.0939141~~
~~c~~	~~-0.0001024~~	~~0.0002620~~	~~0.1112860~~
~~d~~	~~-0.0014070~~	~~0.0074109~~	~~0.0043863~~
~~e~~	~~-0.0000285~~	~~0.0001177~~	~~5.42951E-08~~
~~f~~	~~0.0000707~~	~~-0.0001820~~	~~-0.004460292~~
~~-~~	~~-~~	~~-~~	
~~**Water Cooled Positive Displacement >=300 tons**~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~0.3341277~~	~~0.7668089~~	~~-0.2012063~~
~~b~~	~~0.0210146~~	~~-0.0243168~~	~~1.0939141~~
~~c~~	~~-0.0001024~~	~~0.0002620~~	~~0.1112860~~
~~d~~	~~-0.0014070~~	~~0.0074109~~	~~0.0043863~~
~~e~~	~~-0.0000285~~	~~0.0001177~~	~~5.42951E-08~~
~~f~~	~~0.0000707~~	~~-0.0001820~~	~~-0.004460292~~
~~-~~	~~-~~	~~-~~	
~~**Water Cooled Centrifugal <150 tons**~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~0.1809801~~	~~0.8731141~~	~~0.0099221~~
~~b~~	~~0.0318442~~	~~-0.0252076~~	~~0.0540020~~
~~c~~	~~-0.0001541~~	~~0.0003686~~	~~0.9184546~~
~~d~~	~~0.0095659~~	~~0.0182921~~	~~0.0105967~~
~~e~~	~~-0.0001355~~	~~0.0000470~~	~~-3.36692E-05~~
~~f~~	~~-0.0000532~~	~~-0.0003577~~	~~-0.00877031~~
~~-~~	~~-~~	~~-~~	
~~**Water Cooled Centrifugal >=150 tons & < 300 tons**~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~0.1809801~~	~~0.8731141~~	~~0.0099221~~
~~b~~	~~0.0318442~~	~~-0.0252076~~	~~0.0540020~~
~~c~~	~~-0.0001541~~	~~0.0003686~~	~~0.9184546~~
~~d~~	~~0.0095659~~	~~0.0182921~~	~~0.0105967~~
~~e~~	~~-0.0001355~~	~~0.0000470~~	~~-3.36692E-05~~
~~f~~	~~-0.0000532~~	~~-0.0003577~~	~~-0.00877031~~

~~Water Cooled Centrifugal >=300 tons & < 600 tons~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~0.3639582~~	~~0.9743185~~	~~-0.0360120~~
~~b~~	~~0.0450223~~	~~-0.0046317~~	~~0.5577921~~
~~c~~	~~-0.0002742~~	~~0.0000480~~	~~0.4882417~~
~~d~~	~~-0.0020280~~	~~-0.0020126~~	~~0.0038291~~
~~e~~	~~-0.0000883~~	~~0.0001588~~	~~3.72811E-05~~
~~f~~	~~-0.0000122~~	~~-0.0002120~~	~~-0.005296304~~
~~Water Cooled Centrifugal >=600 tons~~			
~~-~~	~~Cap-fCHWT&ECT~~	~~EIR-fCHWT&ECT~~	~~EIR-fPLR&dT~~
~~a~~	~~-0.4552040~~	~~0.3670232~~	~~-0.0895426~~
~~b~~	~~0.0313469~~	~~0.0124665~~	~~0.3209110~~
~~c~~	~~-0.0000571~~	~~-0.0000688~~	~~0.7393448~~
~~d~~	~~0.0203831~~	~~0.0059340~~	~~0.0095381~~
~~e~~	~~-0.0001534~~	~~0.0000824~~	~~1.55174E-05~~
~~f~~	~~-0.0001271~~	~~-0.0002267~~	~~-0.008206781~~

B-2. Electric Unitary HVAC

- Electric Unitary HVAC equipment capacity rated at AHRI Certified Net Capacity and Rating at operating conditions.

B-3. Ground Source Heat Pumps

- Performance ratings (EER, COP) for qualifying closed loop Ground Source Heat Pump equipment are calculated at 77 degrees Fahrenheit entering water temperature per test procedure ISO-13256-1.
- No incentives are available for open loop Ground Source Heat Pump equipment.

B-4. Gas Heating

- Gas Heating equipment capacity at AHRI Certified Net Capacity and Rating at operating conditions.

B-5. Gas Water Heating

~~• Equipment must exceed ASHRAE 90.1-2016~~ 2019 ~~requirements (mandatory and prescriptive). For water heater types that reference USDOE minimum efficiencies, please refer to the minimum requirements in the table below~~ASHRAE 90.1-2019 Appendix F Table F-2~~.~~

~~U.S. DOE Definitions of Tank Style and Size~~		~~Minimum Efficiency~~
~~Gas-fired, Storage~~	~~≤ 75,000 Btu/h (consumer)~~	~~0.64 UEF~~
	~~>75,000 Btu/h and ≤ 105,000 Btu/h (residential duty commercial)~~	~~82% Et or 0.64 UEF~~
	~~>105,000 Btu/h (commercial)~~	~~82% Et~~
~~Gas-fired, Instant (tankless)~~	~~< 200,000 Btu/h (consumer)~~	~~90% Et or 0.90 UEF~~
	~~≥ 200,000 Btu/h (commercial)~~	~~90% Et~~

- Gas Water Heating equipment capacity at AHRI Certified Net Capacity and Rating at operating conditions.

B-6. Premium Efficiency Motors

- Motors must meet Federal Standards as shown below[1], or ASHRAE 90.1-~~2016~~2019, whichever is more stringent:

[1] https://www.ecfr.gov/current/title-10/chapter-II/subchapter-D/part-431/subpart-B

TABLE 5—NOMINAL FULL-LOAD EFFICIENCIES OF NEMA DESIGN A, NEMA DESIGN B AND IEC DESIGN N MOTORS (EXCLUDING FIRE PUMP ELECTRIC MOTORS) AT 60 HZ

Motor horsepower/ standard kilowatt equivalent	Nominal full-load efficiency (%)							
	2 Pole		4 Pole		6 Pole		8 Pole	
	Enclosed	Open	Enclosed	Open	Enclosed	Open	Enclosed	Open
1/.75	77.0	77.0	85.5	85.5	82.5	82.5	75.5	75.5
1.5/1.1	84.0	84.0	86.5	86.5	87.5	86.5	78.5	77.0
2/1.5	85.5	85.5	86.5	86.5	88.5	87.5	84.0	86.5
3/2.2	86.5	85.5	89.5	89.5	89.5	88.5	85.5	87.5
5/3.7	88.5	86.5	89.5	89.5	89.5	89.5	86.5	88.5
7.5/5.5	89.5	88.5	91.7	91.0	91.0	90.2	86.5	89.5
10/7.5	90.2	89.5	91.7	91.7	91.0	91.7	89.5	90.2
15/11	91.0	90.2	92.4	93.0	91.7	91.7	89.5	90.2
20/15	91.0	91.0	93.0	93.0	91.7	92.4	90.2	91.0
25/18.5	91.7	91.7	93.6	93.6	93.0	93.0	90.2	91.0
30/22	91.7	91.7	93.6	94.1	93.0	93.6	91.7	91.7
40/30	92.4	92.4	94.1	94.1	94.1	94.1	91.7	91.7
50/37	93.0	93.0	94.5	94.5	94.1	94.1	92.4	92.4
60/45	93.6	93.6	95.0	95.0	94.5	94.5	92.4	93.0
75/55	93.6	93.6	95.4	95.0	94.5	94.5	93.6	94.1
100/75	94.1	93.6	95.4	95.4	95.0	95.0	93.6	94.1
125/90	95.0	94.1	95.4	95.4	95.0	95.0	94.1	94.1
150/110	95.0	94.1	95.8	95.8	95.8	95.4	94.1	94.1
200/150	95.4	95.0	96.2	95.8	95.8	95.4	94.5	94.1
250/186	95.8	95.0	96.2	95.8	95.8	95.8	95.0	95.0
300/224	95.8	95.4	96.2	95.8	95.8	95.8		
350/261	95.8	95.4	96.2	95.8	95.8	95.8		
400/298	95.8	95.8	96.2	95.8				
450/336	95.8	96.2	96.2	96.2				
500/373	95.8	96.2	96.2	96.2				

TABLE 6—NOMINAL FULL-LOAD EFFICIENCIES OF NEMA DESIGN C AND IEC DESIGN H MOTORS AT 60 HZ

Motor horsepower/standard kilowatt equivalent	Nominal full-load efficiency (%)					
	4 Pole		6 Pole		8 Pole	
	Enclosed	Open	Enclosed	Open	Enclosed	Open
1/.75	85.5	85.5	82.5	82.5	75.5	75.5
1.5/1.1	86.5	86.5	87.5	86.5	78.5	77.0
2/1.5	86.5	86.5	88.5	87.5	84.0	86.5
3/2.2	89.5	89.5	89.5	88.5	85.5	87.5
5/3.7	89.5	89.5	89.5	89.5	86.5	88.5
7.5/5.5	91.7	91.0	91.0	90.2	86.5	89.5
10/7.5	91.7	91.7	91.0	91.7	89.5	90.2
15/11	92.4	93.0	91.7	91.7	89.5	90.2
20/15	93.0	93.0	91.7	92.4	90.2	91.0
25/18.5	93.6	93.6	93.0	93.0	90.2	91.0
30/22	93.6	94.1	93.0	93.6	91.7	91.7
40/30	94.1	94.1	94.1	94.1	91.7	91.7
50/37	94.5	94.5	94.1	94.1	92.4	92.4
60/45	95.0	95.0	94.5	94.5	92.4	93.0
75/55	95.4	95.0	94.5	94.5	93.6	94.1
100/75	95.4	95.4	95.0	95.0	93.6	94.1
125/90	95.4	95.4	95.0	95.0	94.1	94.1
150/110	95.8	95.8	95.8	95.4	94.1	94.1
200/150	96.2	95.8	95.8	95.4	94.5	94.1

TABLE 7—NOMINAL FULL-LOAD EFFICIENCIES OF FIRE PUMP ELECTRIC MOTORS AT 60 HZ

Motor horsepower/ standard kilowatt equivalent	Nominal full-load efficiency (%)							
	2 Pole		4 Pole		6 Pole		8 Pole	
	Enclosed	Open	Enclosed	Open	Enclosed	Open	Enclosed	Open
1/.75	75.5		82.5	82.5	80.0	80.0	74.0	74.0
1.5/1.1	82.5	82.5	84.0	84.0	85.5	84.0	77.0	75.5
2/1.5	84.0	84.0	84.0	84.0	86.5	85.5	82.5	85.5
3/2.2	85.5	84.0	87.5	86.5	87.5	86.5	84.0	86.5
5/3.7	87.5	85.5	87.5	87.5	87.5	87.5	85.5	87.5
7.5/5.5	88.5	87.5	89.5	88.5	89.5	88.5	85.5	88.5
10/7.5	89.5	88.5	89.5	89.5	89.5	90.2	88.5	89.5
15/11	90.2	89.5	91.0	91.0	90.2	90.2	88.5	89.5
20/15	90.2	90.2	91.0	91.0	90.2	91.0	89.5	90.2
25/18.5	91.0	91.0	92.4	91.7	91.7	91.7	89.5	90.2
30/22	91.0	91.0	92.4	92.4	91.7	92.4	91.0	91.0
40/30	91.7	91.7	93.0	93.0	93.0	93.0	91.0	91.0
50/37	92.4	92.4	93.0	93.0	93.0	93.0	91.7	91.7
60/45	93.0	93.0	93.6	93.6	93.6	93.6	91.7	92.4
75/55	93.0	93.0	94.1	94.1	93.6	93.6	93.0	93.6
100/75	93.6	93.0	94.5	94.1	94.1	94.1	93.0	93.6
125/90	94.5	93.6	94.5	94.5	94.1	94.1	93.6	93.6
150/110	94.5	93.6	95.0	95.0	95.0	94.5	93.6	93.6
200/150	95.0	94.5	95.0	95.0	95.0	94.5	94.1	93.6
250/186	95.4	94.5	95.0	95.4	95.0	95.4	94.5	94.5
300/224	95.4	95.0	95.4	95.4	95.0	95.4		
350/261	95.4	95.0	95.4	95.4	95.0	95.4		
400/298	95.4	95.4	95.4	95.4				
450/336	95.4	95.8	95.4	95.8				
500/373	95.4	95.8	95.8	95.8				

Motor horsepower/standard kilowatt equivalent	Average full load efficiency Polyphase Open motors (number of poles) 6	4	2
0.25/0.18	67.5	69.5	65.6
0.33/0.25	71.4	73.4	69.5
0.5/0.37	75.3	78.2	73.4
0.75/0.55	81.7	81.1	76.8
1/0.75	82.5	83.5	77.0
1.5/1.1	83.8	86.5	84.0
2/1.5	N/A	86.5	85.5
3/2.2	N/A	86.9	85.5

Motor horsepower/standard kilowatt equivalent	Average full load efficiency Capacitor-start capacitor-run and capacitor-start induction-run Open motors (number of poles) 6	4	2
0.25/0.18	62.2	68.5	66.6
0.33/0.25	66.6	72.4	70.5
0.5/0.37	76.2	76.2	72.4
0.75/0.55	80.2	81.8	76.2
1/0.75	81.1	82.6	80.4
1.5/1.1	N/A	83.8	81.5
2/1.5	N/A	84.5	82.9
3/2.2	N/A	N/A	84.1

B-7. Variable Frequency Drives

- For HVAC Systems - VFDs must be installed in a system that incorporates pressure sensors (or other applicable sensor devices) in the flow stream.

- For Boiler Systems – VFDs must be controlled by an automatic signal in response to modulating air/water flows.

B-8. Lighting – Fixtures

General:

- Applicant and/or partner shall be responsible for maintaining and confirming adequate light levels.
- Screw-in or plug-in lighting measures in non-permanent fixtures are not eligible for incentives. For example, screw-in or plug-in lamps installed in refrigerator, oven, floor or desk lamps are not eligible for incentives.
- Multifamily in-unit lighting must be hard-wired to be eligible for incentives.
- Lighting measures installed for use as retail display lighting do not qualify for incentives (i.e. lamps/fixtures for sale).

LED:

- LED product must be listed on ENERGY STAR® or Design Lights Consortium (DLC*) qualified products list. Horticultural LEDs are listed on a discreet DLC product list.
- DLC qualified products must be installed in line with the Primary Use Category (For example, a fixture designated by DLC under the primary use category Outdoor Full-Cutoff Wall-Mounted Area Luminaires will not receive an incentive when installed in an interior space).

**Note*: DLC regularly releases updates to their list of qualified products. The impact is that some LED products will no longer be qualified once changes take place. Changes to the DLC Qualified Products List poses unique challenges for the P4P program. For instance, due to the amount of time between application approval, ERP approval, and Installation approval, the Qualified Products List may change several times. Additionally, many projects at the ERP stage do not know exactly what type of fixture will eventually be purchased. Therefore, in order to assist participants, the Pay for Performance Program will support approval of LED measures qualified either at the time of equipment purchase (so long as purchase does not pre-date submission of application to the program), or at the time of ERP submission. This assumes appropriate invoices, specification sheets, and DLC print-outs can be provided demonstrating that the delisted products in question were qualified at the time of purchase and/or ERP submission. DLC products can be searched by listed and delisted products, and the dates in which products were listed and delisted will be displayed. https://www.designlights.org/search/*

B-9. Lighting - Controls

- Lighting controls, where installed, must control eligible energy efficient lighting fixtures.

- ~~Credit may only be claimed for lighting controls that exceed the minimum requirements of ASHRAE 90.1-2016, except where prohibited by state or local building or safety code. For example, and eligible measure would be implementing Automatic Full-off controls where only Partial-off controls are required.~~

Occupancy Sensor Wall Mounted (OSW):

- OSW sensors must not allow manual override to the "ON" position.

High-Low Controls (OHLC):

- Not eligible in spaces smaller than 250 square feet.

- "Low level" shall be no more than 60% of "high level."

Daylight Dimming Controls (DDC):

- Dimming shall be continuous or stepped at 4 or more levels.
- Daylight dimming control systems must be designed in accordance with IESNA practice as delineated in "RP-5-99, IESNA Recommended Practice of Daylighting."

~~B-10. Computers~~

- ~~Installation of new computers must be in a facility where they will be permanent (e.g. school, public library, etc.)~~
- ~~Computer and monitor must be ENERGY STAR®.~~

B-101~~1~~. Refrigeration Covers/Doors

- Doors must have either heat reflective treated glass, be gas filled, or both.
- Aluminum night curtains only applicable for refrigerated cases, used for non-frozen products which do not have doors or other means of full or partial closure to reduce cold air loss to ambient room air.

B-112. Food Service Equipment

Equipment must comply with performance requirements as outlined in the corresponding NJCEP SmartStart Food Service Equipment application: https://njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/application-forms/application-forms

For select equipment (i.e. Commercial Dishwasher, Commercial Fryer, Commercial Oven, Commercial Hot Food Holding Cabinet, and Commercial Steam Cooker) baseline equipment efficiency shall align with NJ A5160, which states minimum ENERGY STAR version certification.

~~B-13. Low-Flow Hot Water Fixtures~~

~~Low Flow Shower Head: Can be either a low-flow shower head or shower flow control valve. Cannot exceed 2 GPM (EPA Water Sense)~~

~~Low Flow Faucet: Can be either faucet aerator or flow control valve. Cannot exceed 1.5 GPM (EPA Water Sense).~~

Appendix C

ASHRAE Building Energy Quotient (bEQ In-Operation) Eligible Building Types [For historic applications only]

Education

College/university

Elementary/middle school

Highschool

Preschool/daycare

Other classroom education

Food Sales

Convenience store

Convenience store with gas station

Grocery store/food market

Other food sales

Food Service

Fast food

Restaurant/cafeteria

Other food service

Healthcare

Medical office (diagnostic)

Clinic/other outpatient health

Hospital/inpatient health

Laboratory

Laboratory

Lodging

Dormitory/fraternity/sorority

Hotel

Motel or Inn

Other lodging

Nursing

Nursing home/assisted living

Office

Administrative/professional office

Bank/other financial

Government office

Medical office (non-diagnostic)

Mixed-use office

Other office

Public Assembly

Religious worship

Entertainment/culture

Library

Recreation

Social/meeting

Other public assembly

Public Order and Safety

Fire station/police station

Other public order and safety

Retail

Vehicle dealership/show room

Retail store

Other retail

Strip shopping mall

Enclosed mall

Residential

Apartment (5+ units)

Service

Post office/postal center

Repair shop

Vehicle service/repair shop

Vehicle storage/maintenance

Other service

Warehouse

Distribution/shipping

Non-refrigerated warehouse

Refrigerated warehouse