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Energy analysis and modeling guidelines PSE new construction energy efficiency program – whole building custom approach

These guidelines are a high-level summary of the analysis and documentation requirements for projects that are participating in PSE's New Construction Efficiency Program and using the Whole Building Custom Approach. Eligible projects must meet the following requirements.

- Located within PSE's electric and/or natural gas service areas, and purchasing fuel on an eligible rate schedule (that provides for energy efficiency program funding).
- Commercial project greater than 50,000 SF and in design or construction phase, and/or has been pre-approved by PSE prior to implementation of efficiency measures.
- Proposed project energy use is documented to be at least 10% less than a baseline version of the project that aligns with the relevant version of the Washington State Energy Code

General process steps

In general, the analysis requires the following steps. A process flow chart is attached that defines more specific process steps involving specific project team members.

1. Use whole building hour-by-hour energy modeling to calculate the predicted energy consumption of the **proposed building**. PSE energy model reviewers will provide a code baseline energy model for your project as well as a review of the proposed energy model to determine the project savings. Savings is relative to the version of the Washington State Energy Code used for project permitting, and addresses all fuels used by the project.
2. Assemble and submit documentation of the proposed energy model. Energy models should represent, as closely as practical, the proposed project as designed and constructed.
3. Coordinate and cooperate with PSE-sponsored review of the proposed energy model. Review is intended to finalize and approve energy savings numbers that will become the basis of incentives issued by PSE to the project Owner. The PSE reviewed models are the final calculation for determining incentives. Once a reviewed model is accepted by PSE, there will be no additional discussion or negotiation with project representatives regarding potential incentive amounts, except as required to verify the final installation.

Required documentation

Analysis documentation, required for submittal, is listed below.

1. Application: An application for pre-approval should be completed and submitted as soon as the project identifies the whole building custom program as a preferred program participation option. This should be submitted for project pre-approval as part of an initial outreach to PSE to be assigned to an Energy Management Engineer (EME) contact person.
2. Analysis Report: Includes the following, at a minimum, submitted at the completion of the energy analysis for review and approval of the savings calculations.
   a. Document software and version of software used.
   b. Confirm energy code version under which the project is permitted. Provide documentation of any code variances that would affect baseline of energy savings measures.

c. List of energy conservation measures included in proposed design
d. Description (narrative) of modeling approach for each measure.
    1) Identify if modeled explicitly within the capabilities of the modeling software or if a "work-around" or external calculation method was used.
    2) If not explicitly modeled, provide more descriptive background of modeling approach.
e. Energy model results summary table, organized by energy end use.

3. Attachments to be submitted with the Analysis Report:
    a. Energy Code Compliance worksheets to support measures listed, especially the NREC forms for envelope and lighting.
    b. Proposed equipment data sheets for equipment utilized in measures listed, potentially including the following:
        1) Design drawings and specifications.
        2) Equipment submittals.
    c. Energy model documentation.
        1) Model input files for proposed design models—electronic copy.
        2) Selected key model output summary reports, covering:
            a) Annual energy use by fuel type and end use (Equest equivalent report BEPU)
            b) Envelope component u-value and area summary (Equest equivalent report LV-D summary)
            c) Overall building HVAC coil loads (Equest equivalent report SS-D)
            d) Overall building plant equipment loads (Equest equivalent report PS-C)

4. Documentation Checklist: Check for the following prior to submittal for review:
    a. Consistency: Modeling files and documentation reports are consistent with one another.
    b. Completeness: Complete documentation checklist (See checklist in attachments to this guideline.)

Modeling and analysis guidelines

General modeling guidelines are briefly outlined below. If modeler needs to take exceptions to these guidelines, they should seek approval from assigned PSE EME, and document those exceptions in the submitted report.

1. Acceptable software: Per C407.6, Washington State Energy Code; hourly energy modeling software including Equest/DOE2, Energy Plus, IES Virtual Systems, Trane Trace, Carrier HAP.

2. Weather file: TMY3 version of closest geographical match to project location.

3. Modeling Protocol: Section C407, Washington State Energy Code, plus applicable appendices, Section C406 prescriptive method, LEED.

4. Proposed system sizes: Proposed model must include actual equipment sizes as identified and specified in proposed design documents. Auto-sizing in proposed model is not acceptable.

5. Savings and incentive calculations: Savings calculations for incentives shall be initially executed by the PSE model reviewer after creating a baseline energy model and completing the proposed model review. The savings calculation follows this general process:
    a. A baseline energy model is created using the 2015 WSEC Standard Reference Design
    b. A 19% decrease is applied to the standard reference design to create the 2018 WSEC baseline
    c. The savings for gas and electric is the 2018 WSEC baseline usage minus the proposed building usage
    d. If eligible fuel shows an energy increase, incentives are zero
    e. If eligible fuel show savings, incentives are estimated as follows:
        1) Electricity savings x $0.35/kWh
        2) Gas savings x $5.00/therm

Best practices / reasonableness checks to avoid common pitfalls

1. Schedules: Define unique schedules for each primary space type, not building type as stated in C407 protocol. Use specific knowledge of actual customer operations as the preferred guideline for schedule definition. Use Appendix B of the Washington State Energy Code as a second guideline for schedule definition.

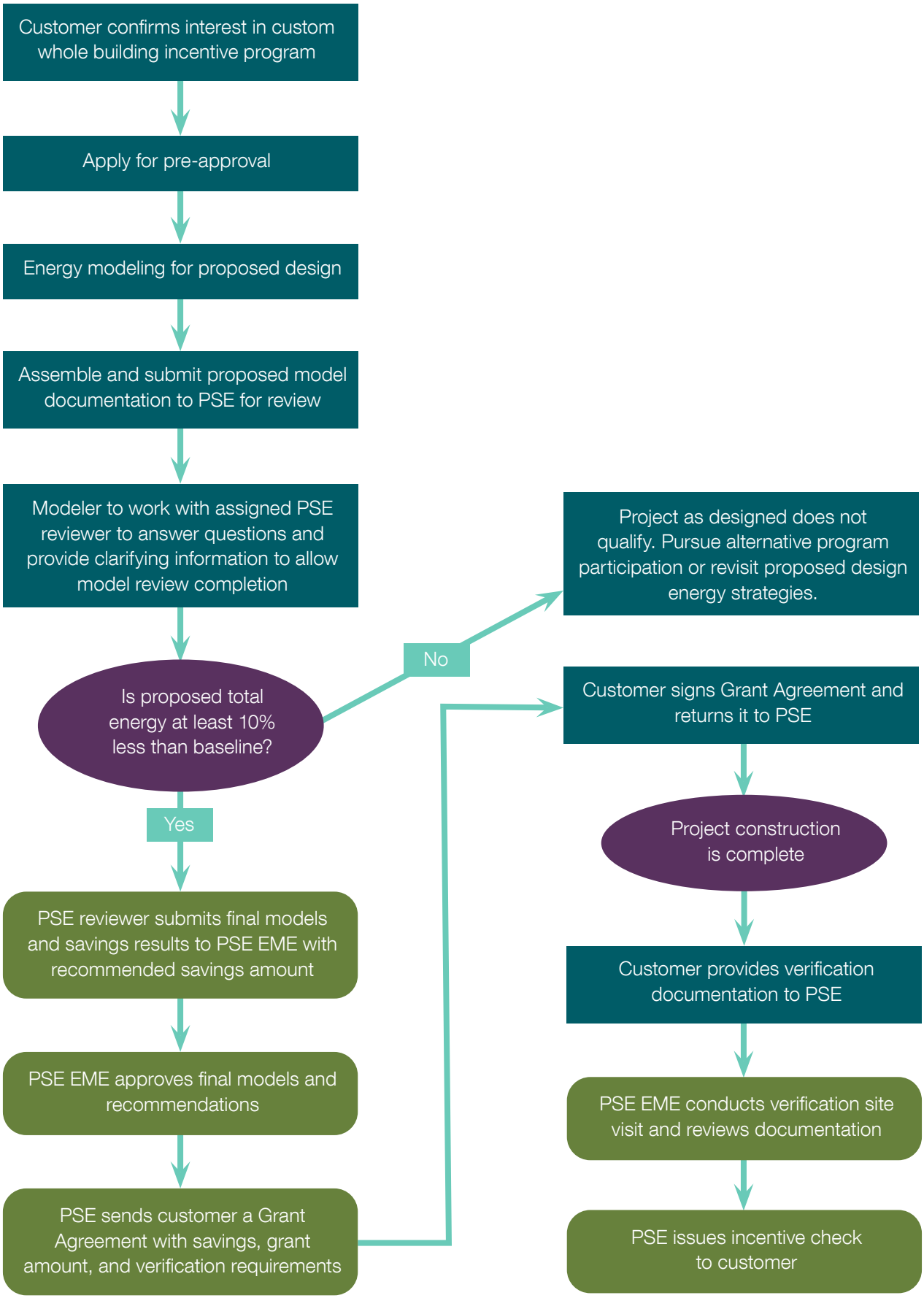
2. Modeling results reasonableness checks: Prior to submission of modeling results for review, modelers shall conduct and document outcomes of reasonableness checks, as summarized below.
   a. Proposed energy use intensity (EUI): Compare proposed model EUI to typical energy use statistics, using EnergyStar Target Finder or other relevant energy use database. In energy report, discuss why proposed model results indicate savings.
   b. Energy end use results: Review energy end use predictions for proposed model. Summarize in Energy Modeling Results Summary Table. Take corrective action in model if energy end use results do not initially appear reasonable.
   c. HVAC systems output:
      1) Air flow rates: Typical system air flow rates should be within 0.6 to 1.2 CFM/SF of area served. If system air flow rates as modeled fall outside of these ranges, provide explanation in submitted report, or take corrective action within either model.
      2) Minimum outside air ventilation rate: Minimum outside air ventilation rates should be between 10% and 50% of total supply air flow rate. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
      3) Loads not met: Zone loads should be predicted to be satisfied in at least 95% of total occupied period hours for both models. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
      4) Packaged equipment average heating and cooling efficiencies: Average packaged equipment efficiencies should be within 15% of integrated part load efficiency as specified and/or code-required value for the equipment being modeled. For example, if an air conditioning unit is rated with an IEER of 12, average efficiency should be within 10.2 to 13.8. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
      5) Fan peak motor load: Peak modeled fan power should not be less than 67% of nominal fan motor power. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
      6) Unoccupied period fan cycle hours: Annual hours of fan operation during unoccupied periods should be no more than 10% of the total annual occupied hours. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
   d. Plant equipment output:
      1) Boiler average efficiency: Average boiler efficiency, as determined in model output, should be within 5% of efficiency as input. For example, if input is at 80%, average modeled efficiency should be within 76% to 84%. (Average modeled efficiency should be estimated by dividing total boiler fuel use (in Btu/yr) by total boiler load met (in Btu/yr.)) If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
      2) Chiller average efficiency: Average chiller efficiency should be within 15% of integrated part load efficiency as specified and intended for the chiller being modeled. For example, if chiller is rated with an IEER of 15, average efficiency should be within 12.75 to 17.0. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.
      3) Pump peak motor load: Peak modeled fan power should not be less than 67% of nominal pump motor power. If this is not the case, provide explanation in submitted report, or take corrective action within energy model.

Attachments

Documentation Checklist

Submittal component		Notes
☐	PSE NC application submitted / pre-approval received	Complete application as early as possible
☐	Modeling software documented	Include version
☐	Permitted code version documented	Example: 2018, 2015
☐	Energy efficiency design measures list submitted	
☐	Measure modeling approach documented (C407, C406, LEED, etc.)	Provide added information for non-standard modeling approaches.
☐	Code compliance forms attached	
☐	Detailed design documentation for measures submitted	Should document all key model input parameters
☐	Proposed model input files submitted	Include weather file if unique
☐	Proposed model output files submitted	

Process Flow Chart



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