Climate Action Champion: Technical Assistance to the City of Seattle

Planning for Seattle's new Building Energy Code

Overview

The City of Seattle, identified as a Climate Action Champion (CAC) by the Department of Energy (DOE), is revising its 2012 Energy Code, already one of the most progressive in the country. Seattle has made a pledge to be carbon neutral by 2050. Seattle received technical assistance from the Pacific Northwest National Laboratory in order to develop a strategy for keeping energy codes synchronized with rapidly improving building technology.

The City of Seattle was particularly interested in studying how short-lived equipment tradeoffs in performance based code compliance impact building envelope energy efficiency measures and how to reduce the potentially negative impacts on long-term building energy usage.

DOE techncial assistance to the City of Seattle resulted in modifciations to proposals for the City's and State's 2015 code that will improve the way that designers trade off energy efficiency measures for performance-based compliance.

What is Performance Based Code Compliance?

Performance based code compliance is a way that designers can meet overall code requirements by trading off some energy efficiency measures for others. For example, a designer may install higher efficiency lighting and reduce levels of insulation.

Study Objectives and Design

This study was designed to determine the potential for performance based code compliance tradeoffs that result in poorly performing building envelopes. A sample of 16 recent performance code compliance projects in Seattle were reviewed to understand what trade-offs were being made. Energy modeling was used to analyze the levels of potential variance in building envelopes when designers use performance based code compliance.

Results

The average modeled annual energy savings of the sample buildings was 15.7% compared to the paired standard reference building models. A minimum of 7% savings is required to demonstrate compliance, so further variation from the prescriptive code is possible than was typically pursued.

The buildings that used the performance code were primarily multi-family and office buildings. The most common building component tradeoffs from the prescriptive code included increased window area relative to total exterior wall area (window to wall ratio), omitted economizers, and wall detail insulation and overall wall insulation levels below prescriptive code requirements. Energy savings resulted primarily from fan operation and efficiency, the use of

Outcomes of Technical Assistance to Seattle on Performance Based Code Compliance

- ✓ Identification of weaknesses in current code and proposed solution identified.
- ✓ Proposed solution to weaknesses immediately incorporated into 2015 proposals for State of Washington codes.
- ✓ Compliance based design tradeoffs identified and analyzed in office buildings and multi-family buildings.
- ✓ Recommended solutions to performance based compliance identified to ensure the ongoing integrity of envelope energy performance.

condensing service water heating equipment, condensing boilers for space heating, efficient lighting, and improved HVAC system efficiency. The fan savings were largely due to flaws in the modeling rules that allowed the baseline fan operation and efficiency to be modeled to use more fan energy than typical current practice. This flaw was addressed in the code proposals.

In addition to the review of sample projects, the study conducted energy modeling of prototype buildings to see how much variance from prescriptive code is possible with the performance method. This modeling demonstrated that substantially greater variance such as window to wall ratios of over 50% would be possible with achievable improvements in lighting, HVAC and service water heating reduction. The modeling also showed that weaker building envelope components can increase peak heating and cooling loads and electrical demand even more than they increase energy usage.

Conclusions

This analysis shows that performance based tradeoffs can be used to achieve code compliance but that the potential exists for buildings to include a wide range of worse-than-code envelope changes, potentially resulting in very weak building envelopes. This reinforces the need for some limit to envelope trade-offs. This study identified some weaknesses in the 2012 Seattle Energy Code, helped identify targets for code change proposals, and resulted in immediate modifications to ongoing code change proposals for the 2015 Washington Energy Code.

One of the primary issues with allowing trade-offs under the performance method of long-lived envelope components that don't meet code prescriptive requirements with shorter-lived lighting, HVAC or other components is that the building is left with a permanent energy weakness that is unlikely to ever be fixed. However, the performance method may encourage the use of newer more energy efficient technologies and allow flexibility in building design.

This investigation has broader implications for other jurisdictions and suggests potential changes to state and international energy codes.

Learn More

Learn more about Climate Action Champions at: energy.gov/epsa/climate-action-champions

The title of the full report describing the analysis is: Thornton BA, GP Sullivan, MI Rosenberg, and MC Baechler. 2015. *Preserving Envelope Efficiency in Performance Based Code Compliance*. PNNL-24359, Pacific Northwest National Laboratory, Richland, WA. Available at: http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24359.pdf