New Residential Construction Compliance: Evaluation of the Washington State Energy Code Program

September 1993

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Executive Summary

In 1990, the Washington State Legislature passed a residential energy efficiency code to be effective July 1, 1992. The Bonneville Power Administration (Bonneville) supported passage and implementation of the code to ensure that new electrically heated residences in the State of Washington were as energy efficient as possible. Bonneville contracted with the Washington State Energy Office (WSEO) to provide code implementation support to the building industry and code enforcement jurisdictions through the Washington State Energy Code (WSEC) program. Support under the WSEC program includes training and other activities to provide builders and building inspectors with knowledge of the energy efficiency features of the code to ensure high levels of code compliance.

The WSEC program was initiated in 1992, prior to the effective date of the WSEC. The first phase of the program, consisting primarily of start-up efforts and early training sessions, was the subject of a previous process evaluation by the Pacific Northwest Laboratory (PNL). That evaluation found that systems were in place to accomplish the training and other support planned under the WSEC program. However, few buildings had been constructed to the WSEC at that time and there was no basis for drawing conclusions about the success of the WSEC program in achieving code compliance. Those conclusions are the subject of this report.

The objective of this evaluation of the WSEC program was to assess the components of the program and

determine the effectiveness of the WSEC program in terms of code compliance. Although implementation of the WSEC by local jurisdictions is mandatory, participation in the WSEC program is voluntary. This potentially provided a basis for assessing the effectiveness of the program by comparing results between jurisdictions that participated in the WSEC program and those that did not. Unfortunately, the code compliance scope of this evaluation was largely limited to WSEC program participants due to monitoring protocols established by Bonneville, WSEO, and local jurisdictions. Nevertheless, interviews were conducted with a sample of code officials in non-participating jurisdictions. The interviews revealed that even code officials in jurisdictions not participating in the program typically took part in training and technical assistance offered through the program, reducing their potential as a "control" group for comparison purposes.

Code compliance is difficult to measure and is rarely the subject of evaluation. This evaluation employed methods that relied on field data collected by WSEO to assess compliance. The WSEO data were drawn from a "construction checklist" used by WSEO to identify areas of code implementation that may require specific support in the training they provide. Using the checklist, data were collected for major construction activities and graded on a four-point scale, which gave a relative measure of completeness of compliance. Compliance was measured at the time of inspection, not at completion. Final levels of compliance were not checked. Therefore, conclusions drawn in this report may underrate final levels of compliance.

Simple tabulations of this data are useful for identification of areas of code non-compliance, but they fair to provide a solid basis for assessing energy savings impacts. As a result, PNL developed a method that translated these categorical measures of compliance into measures of heat transfer that could be used in a standard engineering model of heat loss. This model was developed to represent three common home designs and sizes. The WSEO data were translated into indices that reflected the fraction of savings achieved for each construction element in terms of whole house heat loss.

Evaluation results indicate there is some non-compliance with the code; however, this is estimated to have little impact on the thermal performance of typical homes. Near complete achievement of the energy savings objectives of the WSEC was projected based on homes inspected in the first full year after implementation of the code. The role of the WSEC program in achieving this result is unclear. The WSEC was not the first energy efficiency code in Washington; nor did it require a significantly different way of home building. Concurrent with WSEC development, Bonneville was promoting similar energy efficiency standards through voluntary adoption of enhanced code by local jurisdictions and through building standards administered by utilities. The non-WSEC energy efficiency standards included training programs similar to the WSEC program. As a result, differences in code compliance between jurisdictions that participated in the WSEC program and those that did not, or those where construction levels were low, were not significant.

The results of this evaluation need to be placed in a broader context before making inferences to other areas. First, energy-efficient building codes have been aggressively promoted in the Pacific Northwest region since 1983. Washington State was the focus of much of this activity. As a result, the institutional environment for both code adoption and compliance was established prior to code adoption. Second, despite the high projected rate of compliance, improvements in the code and the training are needed. Specific comments indicate a need to simplify compliance under the two most popular compliance 'paths' and changes to the code need to be synchronized with the revision cycles of national building codes, so that training can encompass both. Third, the WSEC program included training for builders, but builders were not aggressively recruited by WSEO and their participation in training was low. Further, participation in training by subcontractors who actually do much of the construction was non-existent. As a result, building inspectors thought they were spending too much time teaching builders about the code during site inspections. Finally, code compliance is heavily dependent on a sense that energy efficiency is valued: by consumers so builders will build to meet the market; by constituents so jurisdictions will adopt and support enforcement; and by jurisdictions so inspectors will enforce the code.

The major conclusions from the evaluation are:

- Training should be continued to ensure high levels of compliance. (It is not clear from this evaluation if the WSEC program is the "best" vehicle for this training.)
- Participation of builders and sub-contractors in training needs to be increased; a certification process might increase participation.
- The WSEC needs to be revised to simplify implementation and to adapt it to building code revision cycles.
- Bonneville should review the role of energy efficiency codes as resource acquisition mechanisms and adopt a clear policy regarding this role.
- Energy efficiency should continue to be promoted to ensure market demand for energy-efficient homes and high levels of code compliance.
- Code compliance can be evaluated and savings projected using quantitative measures.