

# Evaluation of Energy Code Trade-offs for PA

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## Preface and Acknowledgments

This report is one of a series of reports prepared by the Pennsylvania Housing Research Center (PHRC) that document or complement the development of an alternative energy code for the Commonwealth of Pennsylvania. Its intended audience includes policymakers in state and local governments, building code officials, builders, contractors and others involved in the development or implementation of building code regulation in Pennsylvania.

This project was initiated at the request of members of the PHRC's Industry Advisory Council. The Council ensures that projects that are selected are important and relevant to the housing industry in Pennsylvania. This project received financial and other support from the following:

- The Pennsylvania Department of Community and Economic Development (DCED);
- The individuals, associations, and corporations that are members of the PHRC;
- The Pennsylvania State University.

The report was researched and written by Andy Lau, P.E., Associate Professor, Penn State University and Mark Fortney, Assistant Director of the PHRC. Additional research support was provided by William Bahnfleth, P.E., Assistant Professor, Penn State University and Brian Decker. The assistance of Michelle McMullen and Angela Burnett, in producing the final version of this report, is appreciated.



The PHRC was responsible for initiating and producing this report. Two of our more general objectives are to stimulate discussion about housing and to promote the development of better and more affordable housing in Pennsylvania. We therefore welcome questions or other feedback regarding this report.

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Director

## Executive Summary

In November 1999, Pennsylvania's Governor Ridge signed the Uniform Construction Code (UCC) legislation into law, creating a statewide building code across Pennsylvania. The Act requires the Pennsylvania Department of Labor and Industry (DLI) to promulgate regulations to implement the requirements of the legislation. Chapter 3, Section 301 (c) *Prescriptive Methods for Energy Conservation*, requires the DLI to

promulgate regulations for prescriptive methods to implement energy requirements that take into account for the various climatic regions in the Commonwealth. In deriving these standards, “the DLI shall seek to balance energy savings with initial construction costs.”

The PHRC developed the PA-Alternative Chapter 11 to replace the International Residential Code, Chapter 11, Energy Efficiency. The PA-Alternative Chapter 11 has been developed with the intention of providing a code that is simpler, more flexible, and focused on Pennsylvania. It also seeks to have a rational code for Pennsylvania’s climate characteristics.

This project was initiated with a primary and a secondary objective:

**Primary Objective:** To demonstrate that the trade-offs being proposed in the PA-Alternative Chapter 11, Section PA1103.8 provide equivalent energy performance to the International Residential Code’s (IRC) for the Commonwealth of Pennsylvania.

**Secondary Objective:** To reaffirm the findings of PHRC, Report No. 70, *Thermal Envelope Assessment of Energy Code Provisions for Pennsylvania* that found the general envelope requirements in the PHRC PA-Alternative Chapter 11 were equivalent in to the 2000 International Energy Conservation Code (IECC) as well as the IRC 2000 Chapter 11.

For this evaluation the PHRC used two computer programs to evaluate the energy effectiveness of both the trade-offs and the general thermal envelope requirements of the PA-Alternative Chapter 11. PowerDOE was the primary modeling software that modeled overall energy use of the model houses and MECcheck was used to determine compliance with the Model Energy Code (MEC).

A total of 132 computer runs were required to evaluate the various cases. This provided for the modeling of all of the trade-offs in three Pennsylvania towns (Philadelphia, Pittsburgh, and Bradford) for two model house (a one-story and a two-story) with conditioned and unconditioned basements and with two different heating and cooling systems.

In all cases the trade-offs proposed in PA-Alternative Section PA1103.8, result in a reduction in annual energy use relative to the base case constructed to meet IRC 2000 prescriptive standards. These savings range between 1.9 and 15.3 percent. While the magnitude of energy savings was different between the two software packages, they both indicated that trade-offs would result in lower energy usage. On this basis, therefore, the trade-off-s investigated are justified and acceptable.

The comparison of the general thermal envelope requirements for the PA-Alternative was consistent with the findings of the PHRC Report No. 70, *Thermal Envelope Assessment of Energy Code Provisions for Pennsylvania*. Report No. 70 indicated a 1.1% decrease in thermal envelope performance between the PA-Alternative and the IRC 2000 for 14.2% window-to-wall area ratio while the PowerDOE model anticipated a 0.5% increase. Additionally, Report No. 70 indicated that the PA-Alternative would provide an overall improvement in the thermal envelope over the 2000 IECC by 3.2% while the MECcheck software indicated a 2.6% improvement. This report further supports the findings of Report No. 70 that the PA-Alternative is equivalent the 2000 IECC.