



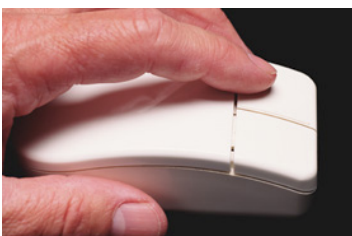
Review and Economic Analysis of Increased Wall Insulation Required by the 2004 IECC Supplement



**Prepared for
The North American Insulation
Manufacturers Association and
The Polyisocyanurate Insulation
Manufacturers Association**



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Executive Summary

The 2004 IECC supplement contains fundamental changes designed to improve its usability and enforceability. One of the key changes decouples the envelope efficiency requirements from the window efficiency and window area requirements for the home. To compensate for a potential decrease in overall efficiency of the homes built to this code, amendments were made during the code development hearings, in accordance with the ICC code development process, to increase the required wall insulation in many parts of the country. Since the adoption of the 2004 IECC supplement, questions have arisen about the cost effectiveness of this increase in wall insulation requirements.

At the request of the North American Insulation Manufacturers Association (NAIMA) and the Polyisocyanurate Insulation Manufacturers Association (PIMA), ICF Consulting conducted an independent analysis to assess the cost effectiveness associated with the increased wall insulation requirements. For its analysis, ICF Consulting simulated the annual energy consumption of single-family homes that were configured with one of four wall insulation scenarios that meet or exceed the code requirements and compared this to homes configured to meet the code prior to the increase in wall insulation. Cost effectiveness was then calculated by translating the energy savings into utility bill savings and comparing these to the material and labor costs of each wall insulation scenario. To increase accuracy, ICF Consulting modeled multiple housing configurations in multiple locations and accounted for regional variations in utility costs, material and labor costs, housing starts, and housing characteristics. In all, over 1.23 million simulations were completed using the DOE2.1E simulation program.

This study assessed the impacts of achieving the 2004 IECC wall insulation requirements through the use of specific wall insulation products. However, the energy savings results of this analysis are generally equivalent to other insulation products which meet the R-value requirements of the wall insulation scenarios analyzed. For example, wall cavity insulation R-values can be achieved through the use of spray foams (e.g., Icynene) and cellulose insulation products, in addition to the medium and high-density fiberglass batt insulation used in this study. Likewise, exterior insulated wall sheathing can be met by the available array of rigid foam insulation products, including extruded polystyrene (XEPS), expanded polystyrene (EPS), and polyurethane (PUR), in addition to the polyisocyanurate (polyiso) assessed in this study.

ICF Consulting also reviewed a report on the same topic written by the Pacific Northwest National Laboratory (PNNL) to assess how the analytical approach and assumptions differed from ICF Consulting.

Key findings of these two analyses include the following:

- ICF Consulting found that in every climate zone impacted by the increased wall insulation requirements, there is at least one insulation scenario that meets the code, saves energy, and costs less to install than the lower insulation requirements originally proposed for the 2004 IECC (the RICC).
- When evaluating cost effectiveness in terms of simple payback period, ICF Consulting found that in all climate zones, including 4 Marine, at least one of the wall insulation scenarios analyzed had a payback of zero years. Alternatively, when ICF Consulting calculated cost effectiveness in terms of annual cash flow, it found that a homeowner's monthly cash flow would fall between a cost of \$1.00 and a credit of \$3.75 per month. ICF Consulting also found

that certain insulation scenarios, such as using ¾” polyisocyanurate (polyiso) rigid insulation with let-in bracing, can offer homeowners a positive cash flow up to \$89 per year.

- Energy savings derived from increased insulation levels are particularly significant because of their permanence. Unlike energy savings from equipment upgrades, which may decrease over time or be eliminated when equipment is replaced, energy savings from insulation upgrades should continue to accrue throughout the life of the structure. There are a number of benefits associated with this, including creating more affordable homes for both current and future home buyers through potentially lower first costs and a positive cash flow every year. For example, this analysis found that construction costs of a new home can be reduced by as much as \$490 when using insulated sheathing products with corner bracing in place of full structural sheathing.
- Among the wall insulation scenarios analyzed, using rigid insulated sheathing products in combination with medium-density fiberglass batt insulation is the most effective, while upgrading from medium-density fiberglass batt insulation to high-density fiberglass batt insulation is least cost effective. (According to a 1996 NAHB study¹, approximately 30% of all single family homes constructed in the United States used insulated sheathing products, nearly as popular in use as oriented strand board (OSB) sheathing.)
- The differences between ICF Consulting’s results and PNNL’s results are due primarily to ICF Consulting’s accounting for regional variations, for its use of less widely bracketed cost estimates, and for its inclusion of additional insulation scenarios beyond high-density fiberglass insulation. PNNL’s analysis was based on a single house configuration, national average upgrade costs, a single wall insulation upgrade scenario, and four distinct climate zones (i.e., 3, 4, 5, & 6). In contrast, ICF Consulting’s analysis was based on 324 house configurations, regional factors, four wall insulation upgrade scenarios, and five distinct climate zones (i.e., 3, 4, 4 Marine, 5, & 6).

¹ “Factory and Site-Built Housing a Comparison for the 21st Century,” prepared by the NAHB Research Center, October 1998. Table 12: Use of Wall Sheathing Materials in New Conventional Single-Family Housing and Manufactured Housing, 1996. Retrieved from http://www.mfghome.org/developer_resources/factory_vs_sitebuilt/index.asp#_Ref421410668 on June 3, 2005.