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

July 14, 2005

Conclusions

ICF Consulting completed two broad analyses for NAIMA and PIMA: conducting an analysis to assess the energy savings and incremental costs associated with the increased wall insulation requirements in the 2004 IECC supplement, and reviewing a PNNL report which assessed these impacts.

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 polyiso assessed in this study.

Findings of these two analyses include the following:

- In all climate zones, including 4 Marine, at least one of the wall insulation scenarios analyzed had a simple payback period of zero years. This signifies 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).

- ICF Consulting examined various metrics for evaluating the cost effectiveness of the increased wall insulation requirements and generally found that there were cost effective options for each metric. However, as indicated in ACEEE's[1] evaluation of these code changes, the ICC development committee is not required to justify code changes using an economic analysis. As a result, there is no single standard measure of cost effectiveness that is universally accepted to assess the increase in insulation. For example, ACEEE chose to evaluate cost effectiveness in part by assessing total potential energy savings for the country as a whole – versus other metrics such as payback period, life cycle cost analysis, etc. It is also interesting to note that the state of Oregon has maintained wall insulation levels equivalent to the 2004 IECC Supplement in its state code since 1992[2].

- When ICF Consulting calculated cost effectiveness in terms of annual cash flow for the homeowner, accounting for reduced utility bills and an increased mortgage to finance the insulation upgrades, it found values between -$12 and $45 for the insulation scenarios that meet code. This signifies that the impact of the increased insulation on 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. These financial savings are based on an assumption that fuel costs are fixed for the period of analysis. Hence, they would be conservative if fuel prices increase.

- The cash flow resulting from the 2004 IECC insulation level improvements occurs each and every year, regardless of how long an owner stays in their home. There are a number of

[1] http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=10140941.
[2] Changes to Code in 1992, Oregon Department of Energy, www.obrt.state.or.us/ENERGY/CONS/Codes/cdres.shtml.

benefits associated with this, including creating the possibility for 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. In addition, any positive cash flow is a long term benefit since the increased insulation levels will physically last in the home significantly longer than the heating and air conditioning equipment. Thus, there will not be any replacement costs associated with the increased insulation levels.

- There are multiple wall insulation scenarios that can be used to meet or exceed the code requirements. However, estimates of cost effectiveness vary significantly between the scenarios. Among the 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 study[3], 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.)

- When ICF Consulting calculated cost effectiveness in terms of simple payback period, the same metric used by PNNL, it found values between 0 and 42 years in the major 4 climate zones assessed by PNNL. This is in contrast to a range of 11 to 89 years predicted by PNNL. For climate zone 4 Marine, a small sub-climate not assessed separately by PNNL, ICF Consulting found values between 0 and 67 years. Ranges were predicted, rather than single values, due to variations in climate zones, insulation scenarios, and estimated financial values. 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 of the increased insulation levels in the 2004 IECC was more limited in scope, and hence does not provide as comprehensive of an assessment as was requested by NAIMA and PIMA. PNNL's analysis was based on a single house configuration, national average upgrade costs, a single wall insulation scenario (i.e., medium versus high-density fiberglass batt insulation), and climate zone 4 Marine was combined with climate zone 4. In contrast, ICF Consulting's analysis was based on 324 house configurations, regional factors applied to estimated local upgrade costs, four upgrade wall insulation scenarios, including rigid insulated sheathing options; and climate zone 4 Marine was analyzed separately from the rest of climate zone 4.

Conducting an economic analysis of any energy efficiency improvement can be challenging. These challenges include determining reasonable estimates for upgrade costs, utility rates, fuel escalation rates and the impact of increasing product demand on upgrade costs. In addition, it is difficult to assess less-tangible impacts such as builder acceptance and impacts on occupant comfort. Where possible, estimates should be made for these factors in future analyses to provide an even more complete impact assessment of the increased wall insulation requirements in the 2004 IECC supplement.

[3] "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.