



FOAMULAR® Extruded Polystyrene (XPS) Insulation

Save Tomorrow's Energy Today, Specifying Optimum Insulation

Technical Bulletin

Save Tomorrow's Energy Today

Current minimum energy conservation code requirements for commercial buildings throughout the U.S.A. are, in many cases, based on a recent version of ASHRAE 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings."

The first version of what was to become ASHRAE 90.1 was published in 1975. Since then it has been updated many times due to rapid changes in building technology and energy prices. Recent updates have been published in 2004, 2007 and 2010. The minimum prescribed R-values in 90.1 can't change as rapidly as energy costs often do. As recently as 2004, prescribed R-values in 90.1 were based on economic assumptions from 1990. Of course energy prices increased dramatically during that time period, and, prices are perhaps even more volatile today. Even though 90.1 minimum prescribed R-values have been increased several times in recent editions, in your next building project, consider that, by following the minimum standard, you may be specifying today's insulation levels based on yesterday's economics! It makes sense to anticipate the future for your client, and base today's insulation levels on tomorrow's economics. That is saving tomorrow's energy today. Beyond the immediate economic return of reduced energy cost, a well insulated building envelope contributes to achieving the overall goal of energy conservation on a national level

as expressed in the AIA 2030 Challenge, and it acknowledges the increasing awareness of the value of sustainable design practice. All of the above is motivation to at least meet, if not exceed, the "optimum insulation level." What is "optimum insulation"?

Optimum Insulation

Insulation is an investment. Like other investments, it is expected to provide a return, or, an economic benefit. The obvious economic benefit of insulation is that it saves energy which equals saving money. The question is, "How much insulation is enough?" "What is the optimum amount of insulation?"

"Optimum insulation" is the amount of insulation that has the lowest life cycle cost (LCC). LCC can be expressed as:

$$LCC = FC + M + R + E - RV$$

LCC = Life Cycle Cost (\$)

FC = First Cost (\$)

M = Maintenance and repair cost (\$)

R = Replacement Cost (\$)

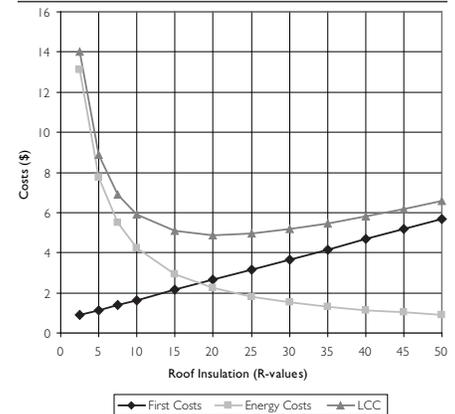
E = Energy Cost (\$)

RV = Resale value or salvage (\$)

Lowest Life Cycle Cost

The concept of determining lowest life cycle cost is illustrated in Figure 1. It shows first cost increasing as R-value increases. Install more insulation, and the first cost of insulation increases. It shows energy cost decreasing as R-value increases. Add more insulation, and energy consumption and cost decreases.

Figure 1
Life Cycle Cost Analysis



The lowest life cycle cost (LCC) is the lowest sum of first cost and energy cost at a given level of R-value. In this hypothetical example, R-20 is the lowest LCC, and, is therefore the optimum insulation level. This example only demonstrates the concept of "optimum insulation". Actual optimum levels must be calculated for specific climates, specific building construction types, specific building usage patterns and specific economic assumptions.

The concept of Life Cycle Cost Analysis and Optimum Insulation are utilized by ASHRAE in the development of Standard 90.1. However, 90.1 is a minimum standard that sometimes lags behind the upward trend of energy and construction costs, particularly when you consider that a building built today will have a useful life several decades into the future. Therefore, it makes sense to anticipate the future for your client, and base today's insulation levels on tomorrow's economics. That is saving tomorrow's energy today.



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Reference

ASHRAE Standard 90.1, "Energy Standard for Buildings Except Low-Rise Residential Building";
American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc (ASHRAE);
1791 Tullie Circle NE,
Atlanta, GA 30329

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OWENS CORNING FOAM INSULATION, LLC
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO 43659
1-800-GET-PINK®
www.owenscorning.com

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