Roofing
Going Green and Reducing Energy

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Roofing: *Going Green and Reducing Energy*

Topics

1. How roofing systems effect a building's energy use.
2. LEED-USGBC and roofing systems.
3. Reflective roofing membranes.
4. Roofing insulation.
5. Photovoltaic and Garden Roofing solutions.
6. Maximizing the energy value of existing roofing systems.

Roofing Systems and Energy Use

- Energy use is effected by the roofing system in two ways:
  - **Roofing Membrane**
    - *Reflective membranes* (TPO, white coatings, etc.) ease cooling needs;
    - *Emmisive membranes* (EPDM) ease heating needs;
    - *Ballasted Systems* greatly reduce the speed of reaching peak temperatures
  - **Roofing Insulation**
    - reduces the range of thermal change inside building

LEED-USGBC & Roofing

“'Green' building codes sprout up across USA,”

USA Today, Thursday, August 7, 2008:

As energy costs rise, more states and cities are adopting policies that encourage or require new construction to be energy-efficient.

"There's been a huge groundswell in green-building leadership at state and local levels. It's remarkable," says Jason Hartke of the U.S. Green Building Council, a private group that tracks legislation and sets guidelines that become construction industry standards.

Nearly three times as many cities and counties approved green-building policies last year as did four years ago. A record number of states, 14, took such action last year, as compared with one in 2004, according to the council. So far this year, at least eight states and 22 localities have endorsed green policies.

Hartke attributes the trend to higher energy costs and climate-change concerns. Buildings account for 40% of greenhouse-gas emissions, he says.

LEED-USGBC & Roofing

- LEED Credits available through Roofing:
  - ID (Innovation in Design) Credit 1-1.4
    - Obtained by using polyisocyanurate (ISO), the only zero-ozone depleting, negligible global warming potential, high-performing foam insulation with certified LTTR-values.
  - EA (Energy & Atmosphere) Prerequisite 2
    - Thermally efficient roofing insulations (ISO, XPS, etc.) that comply with ASHRAE 90.1-2004 and building codes
  - EA (Energy & Atmosphere) Credit 1
    - Demonstrate a percentage improvement in the proposed building performance rating compared to the baseline building performance rating per ASHRAE Standard ASHRAE 90.1-2004

LEED-USGBC & Roofing

- LEED Credits available through Roofing:
  - MR (Materials & Resources) Credit 5 Regional Materials
    - Use building materials that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10% (based on cost) of the total materials value
    - 1 point for this credit
    - 1 additional point for 20%
  - MR (Materials & Resources) Credit 4.1 Recycled Content
    - Use material with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least 10% (based on cost) of the total value of the materials in the project
    - 1 point for this credit
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Reflective Membranes and Membrane Coatings

Membranes:

- TPO (white or tan)
- White Modified Bitumen (white)
- PVC (white)
- White EPDM

*Titanium Dioxide used to bounce the suns rays off the membrane.

*Reflectivity ratings and Solar Reflectance Index ratings are available from all manufacturers.

*Any rating over .70 is very beneficial in sunny climates.

Reflective Membranes and Membrane Coatings

Membranes:

- *White (or tan) membranes* are required in California (Title 24).
- *Provides significant cost savings* in areas where the number of annual cooling days greatly exceeds heating days.
- *Does not help* in areas where there is a balance of cooling/heating, or where heating exceeds cooling.
- *TPO* specifically has taken over the national commercial roofing market, exceeding all other membrane types.
- *Mechanically-attached TPO* is the most cost-effective application. Mechanical attachment, however, is not always possible (pre-cast concrete decks, old steel decks, gypsum or tectum decks, etc.)

Reflective Membranes and Membrane Coatings

Coatings:

- Acrylic white (EPDM)
- Aluminum (Mod Bit and BUR only)

*Coatings are a maintenance item and require inspection every 5 years min.

*Coatings must be reapplied at least every 10 years to retain their effectiveness.

Roofing Insulation

Why is there insulation on the roof?

- Serves as a substrate for the roofing system.
- Comprises horizontal component of *thermal building envelope*.

Roofing Insulation - Types

- Board stock
  - Polyisocyanurate
  - Perlite
  - Glass mat gypsum board (GMGB)
  - Polystyrene, two kinds:
    - expanded/EPS
    - extruded/XPS
  - Foam glass

Roofing Insulation - Types

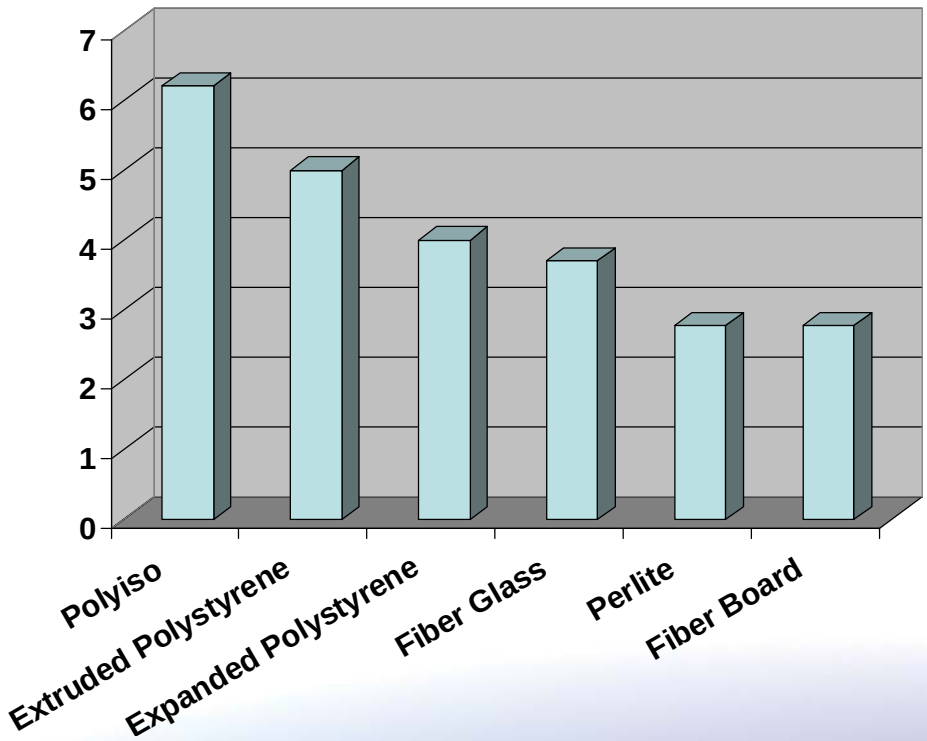
- Spray-applied →
  - Urethane
  - Cellulose
  - Fibrous glass

← • Blankets or batts
  - Under residential roofs and wood decks
  - Under metal roof systems

Roofing Insulation - Types

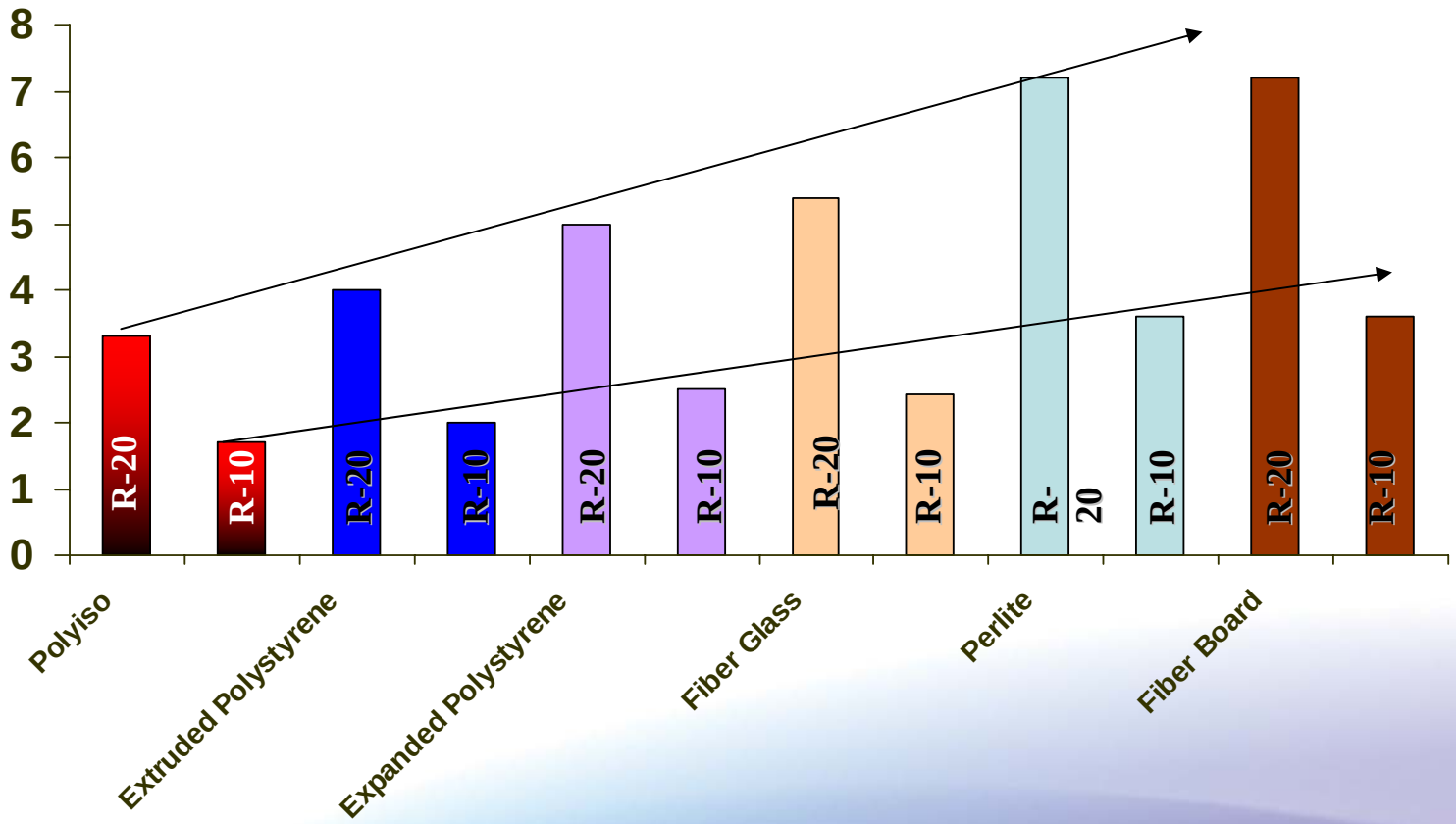
- Why *board stock* dominates:
  - Good mechanical properties.
  - Spans flutes in steel decks.
  - Compatible with common roofing membranes.
  - Ease of installation.
  - Economical cost factors.

LTTR-Value per inch



Roofing Insulation

Thickness (in inches) Required for R-20 & R-10

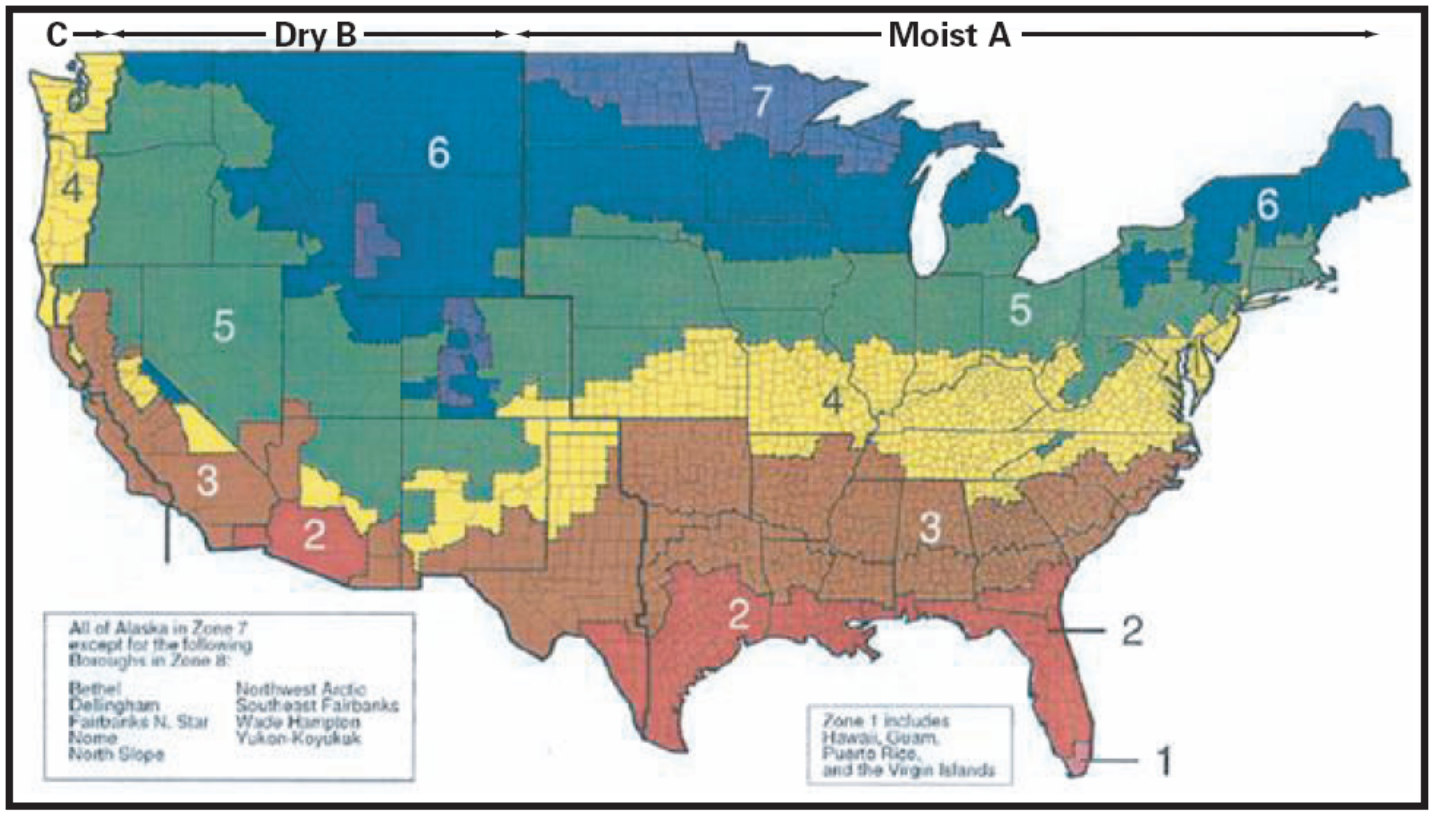


Roofing Insulation

New ASHRAE 90.1-2007 Standard

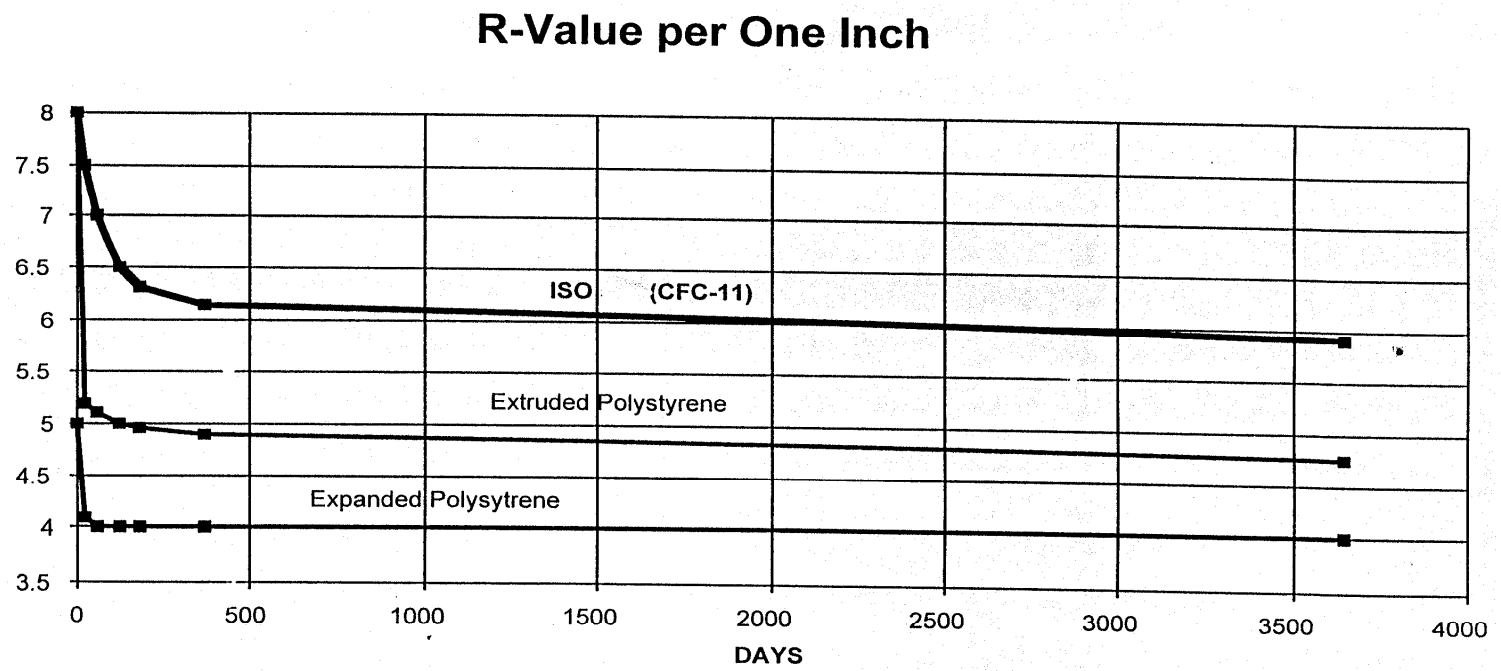
– minimum R-Value for above-deck insulation: ***Zone 1: R-15; Zones 2-7: R-20***

Many northern US states require <u>R-30</u>.



Roofing Insulation

Long-Term Thermal Resistance (LTTR)



Energy Saving Calculations

- Energy Star:

http://www.roofcalc.com/RoofCalcBuildingInput.aspx

- U.S. Dept of Energy:

http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcPeak.htm

CHANGE FOR THE BETTER WITH ENERGY STAR

ENERGY STAR ROOFING CALCULATOR

In Steps 1 - 5, you will be asked to specify details about your building, heating and cooling systems, existing and proposed roof, and location. Some of the questions have both numeric and text options. The text options should be used when you don't know the required value, and will supply a default, listed in parentheses. If you know the correct numeric value please select it from the list.

Step 1. Building Details

?	Year of construction	Before 1980
?	Building type	Office
?	Days of operation per week	5 day(s)

Step 2. Heating and Cooling Systems

	Type of heating system	Gas Furnace
?	Gas furnace efficiency	Moderate (post 1980) 78%
?	A/C SEER	Moderate (1982-1992)

Step 3. Roof Details

	Roof insulation R-Value	Medium (11)
?	Existing dark roof solar reflectance	Bitumen, Black (.05)
?	ENERGY STAR® labeled roof products solar reflectance	Membrane, White (.75)
?	Conditioned flat roof area (sq. ft.)	

? A/C SEER: Moderate (1982-1992)

Step 3. Roof Details

Roof insulation R-Value: Medium (11)

? Existing dark roof solar reflectance: Bitumen, Black (.05)

? ENERGY STAR® labeled roof products solar reflectance: Membrane, White (.75)

? Conditioned flat roof area (sq. ft.): (Min: 3,000 Max: 1,000,000)

Step 4. Energy Prices

Cost of electricity (cents/kWh): (Min: 2.0 Max: 20.0)

? Cost of natural gas (cents/therm): (Min: 30 Max: 200)

Step 5. Location

? Zip Code

- OR -

City and

State: --

Enter Reset

Send any questions or comments you have about this site to the webmaster at softdev@cadmusgroup.com.

CHANGE FOR THE BETTER WITH ENERGY STAR

Roofing Comparison Calculator

ENERGY STAR ROOFING CALCULATOR

Savings Per Year

	Per 1000 sq. ft.		Total	
	Qty.	$	Qty.	$
Electricity	574.72 kWh	$40.80	37,356.52 kWh	$2,652.31
Natural Gas	-4.54 therms	$-5.94	-294.89 therms	$-386.31
Total		$34.86		$2,266.01

Weather Details

? Cooling degree days	1006
? Heating degree days	5629

Building Details

? Year of construction	Before 1980
? Building type	Retail
? Days of operation per week	7 day(s)

Heating and Cooling Systems

Type of heating system	Gas Furnace
? Gas furnace efficiency	Low (pre-1980) 70%

?	Gas furnace efficiency	Low (pre-1980) 70%
?	A/C SEER	Energy Star (12)

Roof Details

	Roof insulation R-Value	19
?	Existing dark roof solar reflectance	Built-up w/Dark Gravel (.10)
?	ENERGY STAR® labeled roof products solar reflectance	Membrane, White (.75)
?	Conditioned flat roof area (sq. ft.)	65,000

Energy Prices

	Cost of electricity (cents/kWh)	7.1
?	Cost of natural gas (cents/therm)	131

Location

?	Zip Code	
	- OR -	
	City and	Indianapolis
	State	IN

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Send any questions or comments you have about this site
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Photovoltaics and Roofing Systems

- *Panel systems:*
  - Higher initial cost
  - Higher kW production and ROI
  - Easier to maintain

- *Thin-film systems:*
  - Lower initial cost
  - Lower KW production and ROI
  - More difficult to maintain

Photovoltaics and Roofing Systems

- *Panel systems:*
  - Sit on a single-ply roofing system
  - Panels can easily be replaced
  - High kW yield

Photovoltaics and Roofing Systems

- *Thin-film systems:*
  - Adhere to the membrane of a single-ply roofing system
  - Film must be pulled off the membrane for PV service/leak repair
  - Lower kW yield
  - Lower installed cost

Garden Roofing Systems

- *Strengths:*
  - Retain stormwater
  - Excellent thermal insulator
  - Low maintenance
- *Weaknesses:*
  - Heavy dead load on roof deck
  - Cost
  - Difficult to re-roof

Maximizing Existing Systems

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Maximizing Existing Systems

1. *Move that water off the roof:*
   - Clean out drains
   - Remove obstacles to drainage flow
   - Replace old scuppers, gutters, etc.

2. *Brighten up what you've got:*
   - Have a licensed roofing contractor apply a white coating to your EPDM or Mod Bit roofs

3. *Throw on another blanket:*
   - Recover instead of reroof, whenever possible – add a layer of insulation to increase R-Value

4. *Change to a new color:*
   - Consider membrane color relative to building location
   - Consider a ballasted system

Roofing

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Questions ?

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