

# BUILDING ENVELOPE

## *Insulation*

It is well known that improvements to household and building insulation can reduce the amount of energy needed for heating and cooling by retaining warm air inside during colder times and keeping warm air out during warmer times. Air infiltration is responsible for 25-60% of the energy used to heat and cool a home.<sup>1</sup> Installing insulation with higher R-values in new homes and buildings and retrofitting older homes and buildings by sealing cracks and replacing insulation can help reduce energy costs and the GHG emissions that occur when energy is provided by a fossil fuel source. Some sources say that about 90% of US homes are under-insulated relative to modern construction practices and municipal building codes,<sup>2</sup> and a study found that retrofitting all American homes up to modern insulation standards would lead to avoidance of 110 billion tons of CO<sub>2</sub> entering the atmosphere as a result of power plant emissions for electric heating and cooling and gas, propane, and oil-fired furnaces.<sup>3</sup>

- Fishery friendliness: Insulating homes and buildings has no direct impact on fisheries or fishery ecosystems. Furthermore, by reducing the amount of energy needed for heating and cooling, insulation can reduce the amount of energy production needed to maintain current standards of living, including energy that is produced in fishery-unfriendly ways.
- Co-benefits: Enhancing insulation can help home/building owners and tenants save money on heating and cooling bills and maintain a more comfortable ambient temperature. Furthermore, the reduced energy use brought about by these enhancements is associated with reductions in air pollutants produced through the combustion process, such as carbon monoxide, nitrogen dioxide, particles, and sulfur dioxide.<sup>4</sup>
- Environmental externalities: Some insulation materials may be more environmentally friendly than others, but in general, there are no major environmental externalities associated with improvements to insulation.
- Policy catalysts: Energy efficiency gained through better insulation of homes and buildings can be enabled and incentivized through rebates, tax incentives, building codes, utility-based demand reduction programs, low-income energy efficiency programs, government procurement and lead-by-example policies, enabling of financing instruments (e.g., property assessed clean energy programs, energy savings

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<sup>1</sup> Project Drawdown. Insulation. <https://drawdown.org/solutions/insulation>

<sup>2</sup> The Climate Advisor (October 10, 2020). "Insulation – The Low Hanging Fruit of Carbon Reduction (and money savings!)" <https://theclimateadvisor.com/insulation-the-low-hanging-fruit-of-carbon-reduction-and-money-savings/>

<sup>3</sup> Levy, Jonathan I. *et al* 2016 *Environ. Res. Lett.* **11** 034017 <https://iopscience.iop.org/article/10.1088/1748-9326/11/3/034017>

<sup>4</sup> EPA. "What are combustion products?" <https://www.epa.gov/indoor-air-quality-iaq/what-are-combustion-products>

performance contracting, green banks), certification incentives (e.g., LEED, Energy Star), and carbon pricing.

- More information:
  - [Drawdown: Insulation](#)

*Windows.* According to the Department of Energy, heat gain and loss through windows is responsible for 25-30% of residential heating use.<sup>5</sup> Replacing older windows with new ones that have layered panes, reflective low-emissivity coatings, insulating gas between panes, and tightly sealed frames can help reduce this loss. For buildings, innovations in window design such as high-performance glass and dynamic glass are now available. High performance glass reduces a building's energy load for lighting and improves heating and cooling efficiency.<sup>6</sup> Dynamic or "smart" glass changes color in response to sunlight and weather, thereby providing shade during the brightest and warmest parts of the day or year and solar illumination at other times.<sup>7</sup>

- Fishery friendliness: Energy efficient windows have no direct impact on fisheries or fishery ecosystems. Furthermore, by reducing the amount of energy needed for heating and cooling, these window technologies can reduce the amount of energy production needed to maintain current standards of living, including energy that is produced in fishery-unfriendly ways.
- Co-benefits: Energy efficient windows can help home/building owners and tenants save money on heating and cooling bills and maintain a more comfortable ambient temperature. Furthermore, the reduced energy use brought about by these enhancements is associated with reductions in air pollutants produced through the combustion process, such as carbon monoxide, nitrogen dioxide, particles, and sulfur dioxide.
- Environmental externalities: There do not appear to be any significant environmental externalities associated deployment of high-performance and dynamic glass.
- Policy catalysts: Energy efficiency gained through deployment of high-performance and dynamic glass can be enabled and incentivized through rebates, tax incentives, building codes, utility-based demand reduction programs, low-income energy efficiency programs, government procurement and lead-by-example policies, enabling of financing instruments (e.g., property assessed clean energy programs, energy savings performance contracting, green banks), certification incentives (e.g., LEED, Energy Star), and carbon pricing.
- More information:
  - [Drawdown: High performance glass](#)
  - [Drawdown: Dynamic glass](#)
  - [Department of Energy: Update or replace windows](#)

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<sup>5</sup> Department of Energy. "Update or replace windows." <https://www.energy.gov/energysaver/update-or-replace-windows>

<sup>6</sup> Drawdown. "High performance glass." <https://drawdown.org/solutions/high-performance-glass>

<sup>7</sup> Drawdown. "Dynamic glass." <https://drawdown.org/solutions/dynamic-glass>

*Roofs.* Green and cool roofs are two solutions that reduce the need for air conditioning. Cool roofs are made of materials that are light-colored, such as wood shingles, terra cotta tiles, or light-colored membranes. Cool roofs can reflect up to 80% of the sunlight that hits the roof, helping to reduce the need for air conditioning, but in the cooler months, they may increase the need for heating.<sup>8</sup> Green roofs are plantings of vegetation on the roof that provide “living insulation.” They can double as places to relax and recreate or to grow food, or they can be a carpet of self-sufficient groundcover that absorbs rainwater.

- Fishery friendliness: Green and cool roofs have no negative impact on fisheries or fishery ecosystems. Furthermore, by reducing the amount of energy needed for heating and cooling, they can reduce the amount of energy production needed to maintain current standards of living, including energy that is produced in fishery-unfriendly ways. In addition, green roofs that include fruit and vegetable gardens can reduce “food miles” by increasing hyper-local food production. Moreover, green roofs may provide fishery-related co-benefits such as absorption of rainwater / avoidance of runoff.
- Co-benefits: Cool and green roofs can help home/building owners and tenants save money on heating and cooling bills and maintain a more comfortable ambient temperature. Furthermore, the reduced energy use brought about by these enhancements is associated with reductions in air pollutants produced through the combustion process, such as carbon monoxide, nitrogen dioxide, particles, and sulfur dioxide. In urban settings, cool and green roofs can reduce the urban heat island effect. Green roofs can also provide places to recreate and grow food, reduce runoff, reduce noise pollution through sound absorption, and provides urban wildlife habitat.
- Environmental externalities: Cool roofs do not appear to have any environmental externalities, and all of the environmental externalities associated with green roofs appear to be positive.
- Policy catalysts: Green and cool roofs can be enabled and incentivized through rebates, tax incentives, building codes, utility-based demand reduction programs, low-income energy efficiency programs, government procurement and lead-by-example policies, enabling of financing instruments (e.g., property assessed clean energy programs, energy savings performance contracting, green banks), certification incentives (e.g., LEED, Energy Star), and carbon pricing.
- Additional resources:
  - [Drawdown: Green and cool roofs](#)
  - [Department of Energy: “Cool roofs”](#)
  - [Environmental Protection Agency: “Using green roofs to reduce heat islands”](#)
  - [Green Roofs for Healthy Cities \(2019\): \*Green roof and wall policy in North America: Regulations, Incentives, and Best Practices.\*](#)
  - [Home Advisor: “How much does a green roof cost?”](#)

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<sup>8</sup> Drawdown. “Green and cool roofs.” <https://drawdown.org/solutions/green-and-cool-roofs>

Continue reading at <https://fisheryfriendlyclimateaction.org/solutions>

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