

# Reducing Greenhouse Gas Emissions Through Construction

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Every aspect of construction contributes to CO<sub>2</sub> into the atmosphere if you consider embodied energy. Standard insulation manufacturing contributes to greenhouse gases and using straw bale insulation would help decrease emissions. Green roofs are another building alternative that sequester carbon instead of releasing it into the atmosphere like a standard roof. These are two alternative building methods/designs we show to help decrease greenhouse gas emissions in construction.

## GREEN ROOFS

Green roofs have been used in Europe for centuries<sup>8</sup> and are just being created in the United States. They last longer than conventional roofs and with a natural insulation, reduce energy costs. They create peaceful retreats and absorb storm water. Green roofs improve air quality and help reduce the Urban Heat Island Effect (an area that is significantly warmer than its surrounding rural areas due to human activities). While it is used primarily in commercial, it can be done on residential as long as you prepare by having a 10-degree roof slope, waterproofing, planning for structural load, draining, and electrical and water supply in place.<sup>4</sup>

### Conventional roof<sup>5</sup>

- Endures temperatures up to 90 degrees higher than the air around them.
- Harder to cool the floors below.
- Contributes to the urban heat island effect.

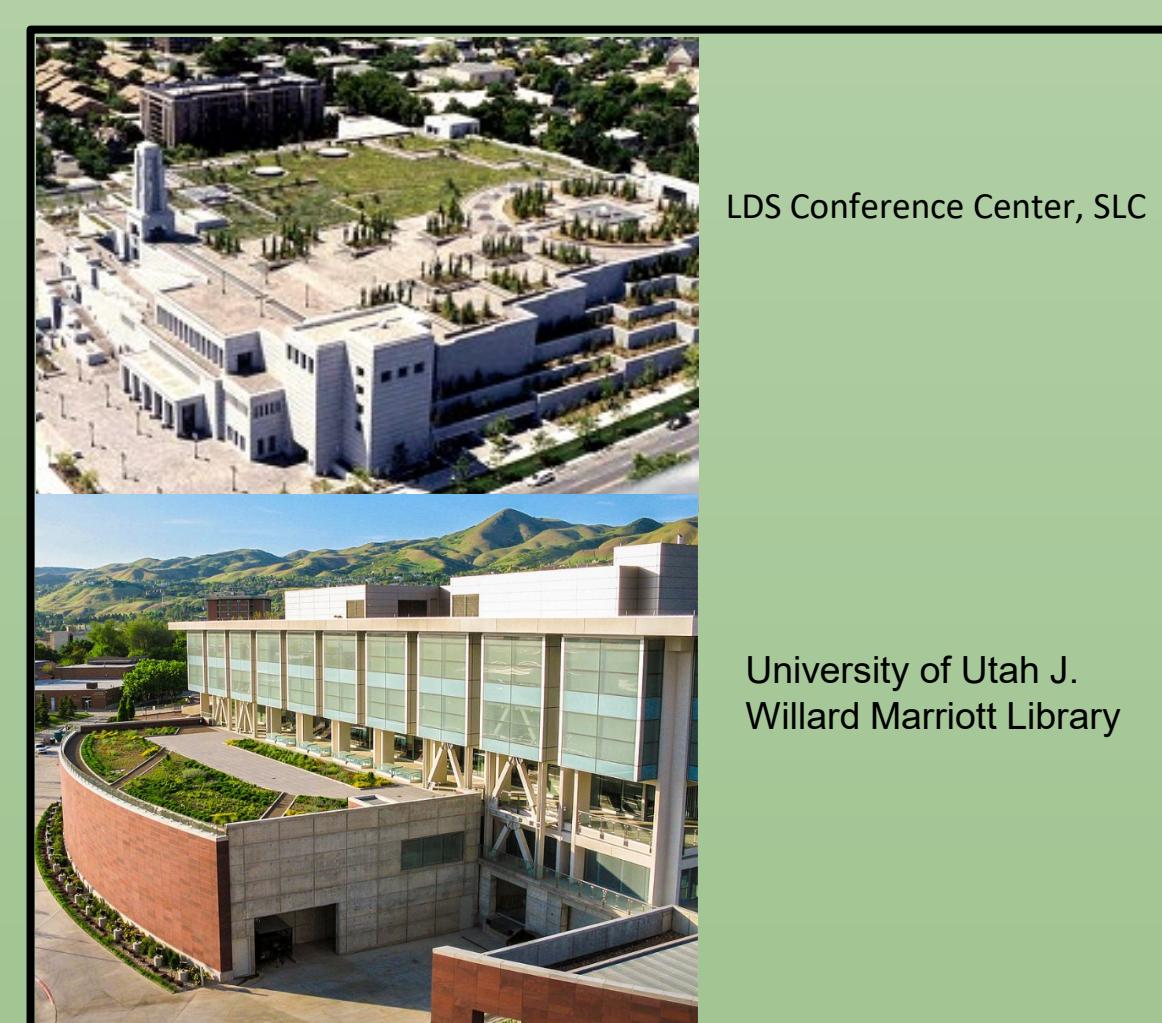
### Green roof<sup>5</sup>

- Sequesters carbon in soils and biomass.
- Reduces rainwater runoff.
- Moderates building temperatures.
- Greenhouse gas emissions are lower (About Green Roofs)
- Filters air pollutants.
- Supports biodensity within cityscapes.
- Reduces energy demands for heating and air-conditioning.



House in Germany from the 1940s<sup>9</sup>

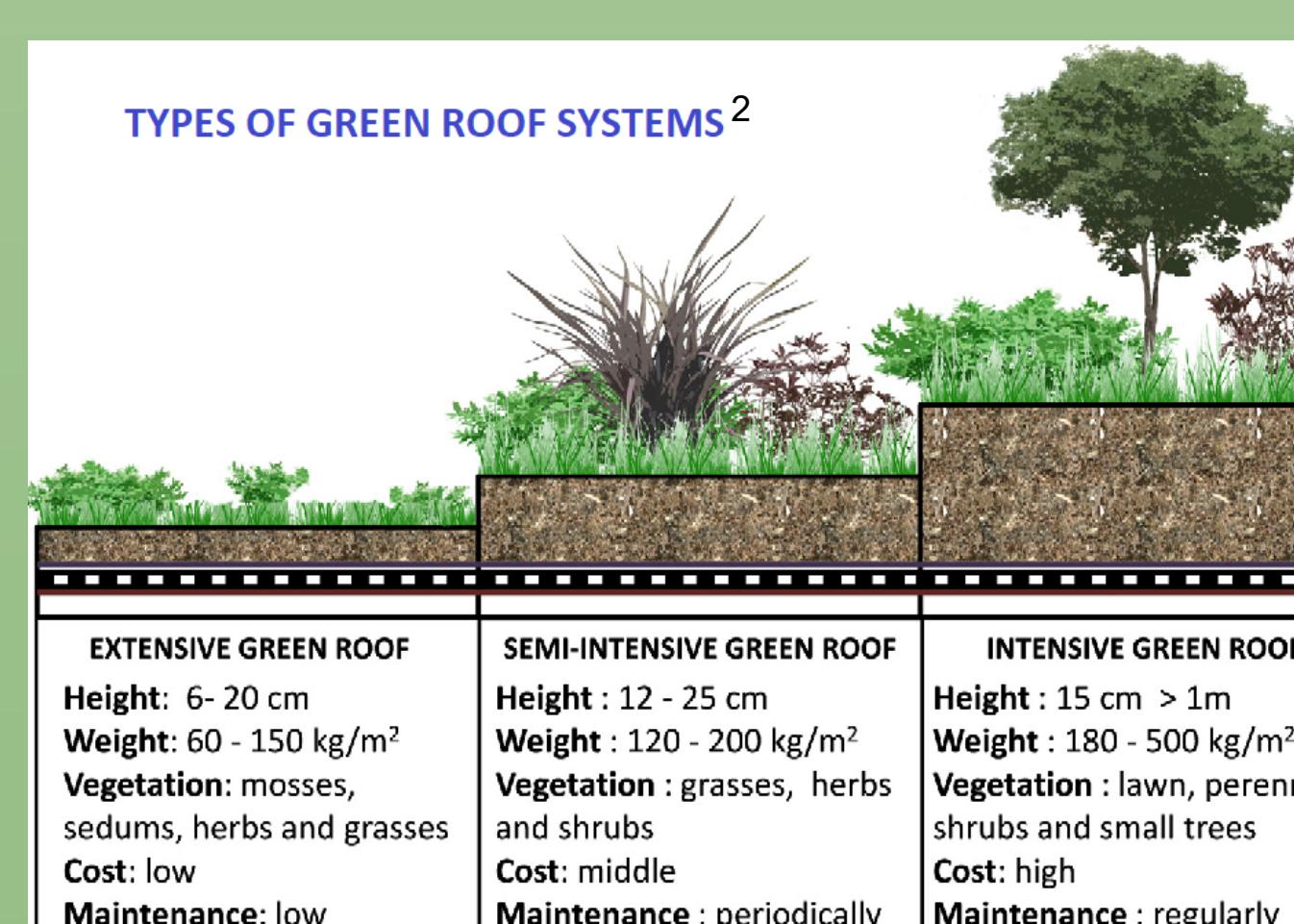
Conventional roof in city  
(Photo: CSR Roofing Contractors, Inc.)



LDS Conference Center, SLC

**The Church of Jesus Christ of Latter-Day Saints (LDS) Conference Center (Salt Lake City):** This is an example of a green roof using a system of fountains, gardens, and a five-acre rooftop alpine meadow. The main axis of the Temple has a central garden of planters of aspen and conifers. The Assembly Building combines rooftop construction technologies and native landscapes.<sup>1</sup>

**University of Utah J. Willard Marriott Library (Salt Lake City):** A roof top garden was installed above the library's three-and-a-half story Automated Retrieval Center (ARC) to protect the structure and to increase the energy efficiency of the building. To reduce the amount of water needed for the garden, the University grounds crew planted drought-resistant plants and installed a programmable subterranean watering system.<sup>3</sup>



**Green Roof** Globally .77 gigatons reduced CO<sub>2</sub>, \$1.39 trillion net cost and \$988.5 billion net savings globally.<sup>5</sup>

**Insulation** Globally - 8.27 gigatons reduced CO<sub>2</sub>, \$3.66 trillion in net cost globally if 54% of existing residential and commercial buildings improve insulation, with 2.51 trillion in net savings in 30 years, but 4.2 trillion in lifetime savings.<sup>5</sup>

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## INSULATION

Air filtration accounts for 25 to 60 percent of energy used to cool or heat a home alone. Much of the energy is wasted in maintaining temperatures in a home from air exchange with the outside world. A lot of energy and resources can be saved if insulation systems in new and current houses are improved, which will in turn result directly in economic savings as well.

### Retrofitting

- Existing homes can be retrofitted to increase insulation and energy savings. Draft proofing, sealing up spaces where air can escape, can be done in any home in a variety of ways.
- Install reflective barrier insulations to address radiant heat gain.
- Install triple pane windows.
- Improve spots where air may leak or escape, usually in gaps, cracks, and heat sensitive building materials.

### New Construction

For newer homes, using natural building materials can help save on emissions. Using straw bales as a building material and insulator is a newer concept. These straw bales are seen as a waste product in most agricultural practices, by using it instead of throwing it away, emissions and energy costs are saved.

Community Rebuilds is a non-profit organization that seeks to provide energy efficient housing and education on sustainability. They operate from Moab, Utah and are providing awareness for low-energy homes and expanding building laws for using straw bale as a viable insulating material.

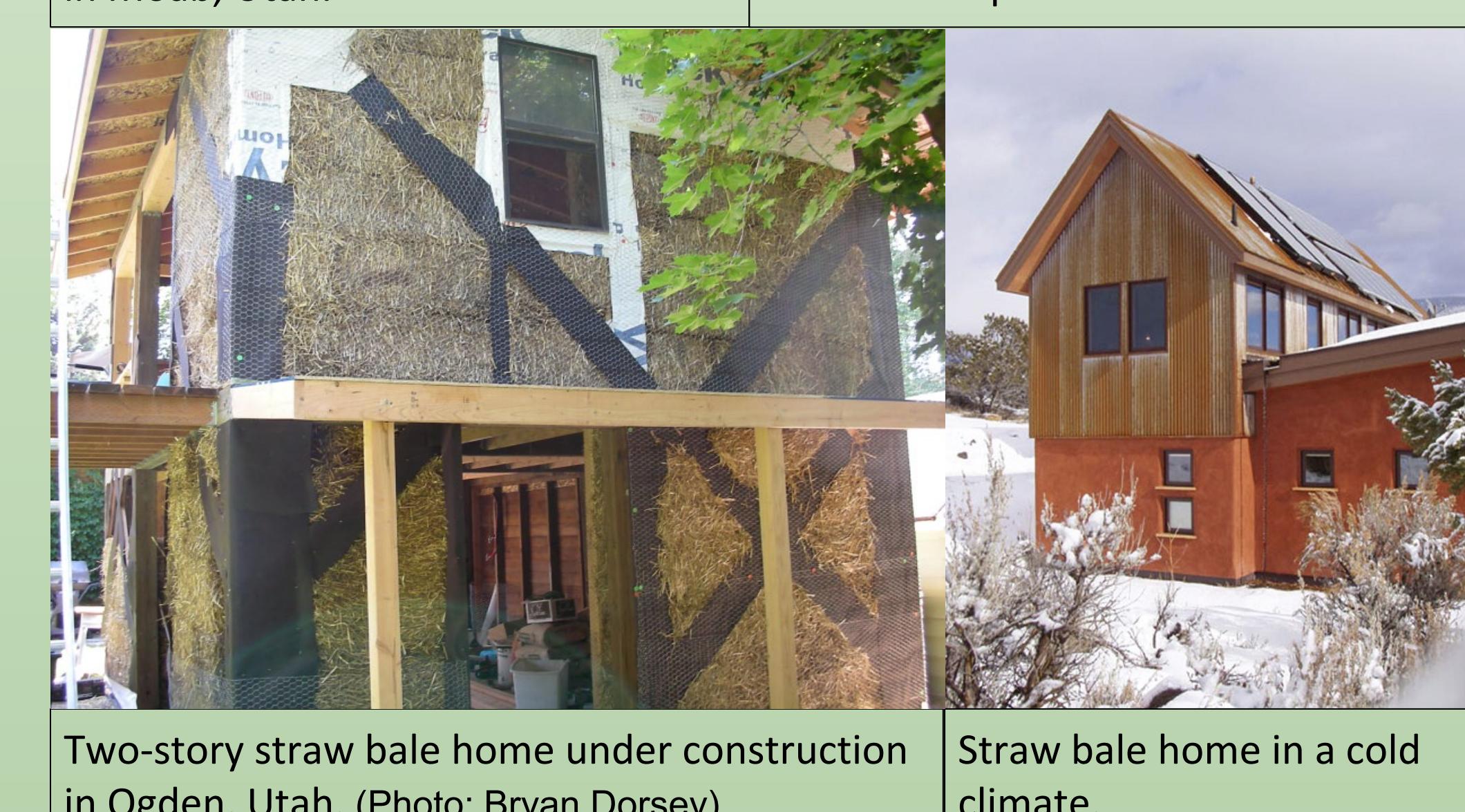
### Alternative Straw Bale Insulation

- R-value - with standard thickness, ranges from 30 to 35.
- Low energy costs to produce.
- Easy to build with.
- 100% biodegradable.
- Highly flame retardant when bundled tightly together.
- Newer material, issues with building codes.
- Inexpensive.



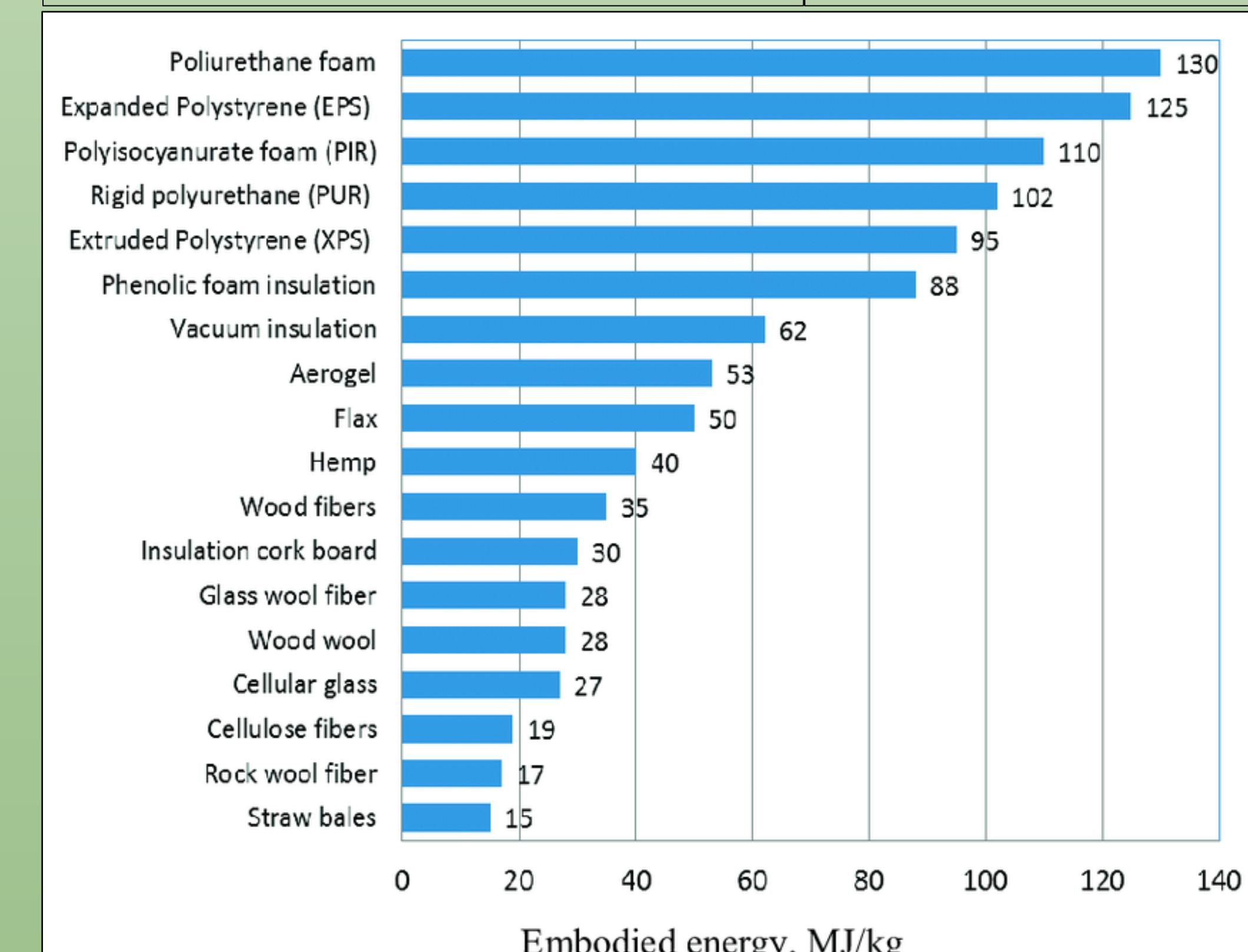
Straw bale home under construction in Moab, Utah.

Straw bale home completed using earth-based plasters.



Two-story straw bale home under construction in Ogden, Utah. (Photo: Bryan Dorsey)

Straw bale home in a cold climate.



Amount of energy required to create various insulation materials commonly found in buildings. Source: Lushnikova, 2016.

### Conventional Fiberglass Insulation

- R-value - with standard thickness, about 30.
- High energy costs to produce.
- Easy to install.
- Issues with disposal.
- Conventional, can be installed by professionals.
- Inexpensive.

