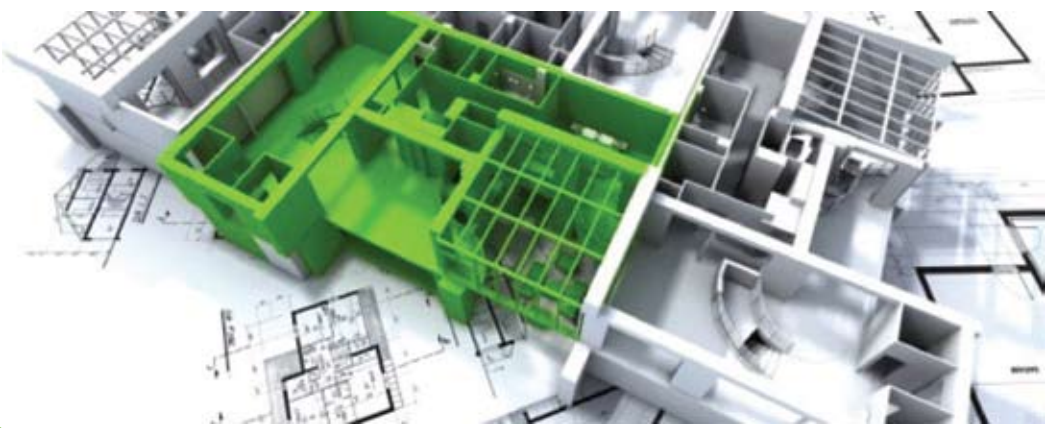
# GREEN BUILDING MATERIALS....

## An overview of common green materials that can be used to build and rebuild properties to green standard



Green building is about making the best use of resources during all stages of construction. By combining a system of components and materials that work in harmony with one another, the goal is to create an energy-efficient, water-saving structure with a low carbon footprint.

While selecting the right materials is a large part of green building, choosing the best materials may not be obvious and will depend on the needs of the building owner.

- **What, if any, green certification is the owner seeking?**
- **Is the owner concerned about lifetime energy use?**
- **Is the carbon footprint of the construction process a factor that concerns the owner?**

In addition to those considerations, budgetary constraints may require making tradeoffs.

There are organizations that certify material as meeting specific green standards. Building owners and insurers need to be cognizant of possible "green washing." This is a term used to define products that claim to be green but, in reality, are only trying to profit from the

green movement. Those organizations offer and advertise products that do not meet green specifications. It is important to look for green logos such as Eco Logo™, Building Green™, Energy Star™, Green Seal™, Green Label™, Green Label Plus™, or other nationally recognized certifying companies. However, not all green materials carry a green label or are part of a green rating system.

Notwithstanding the benefit of certification, the "green-ness" of materials can still be a matter of perspective. For example, when considering framing materials, a builder may face several choices: what to buy and from where??? Buy a product locally made or for any reason much far away from the site. It is difficult to say which is greener, and the decision would depend on the objective of the builder or architect.

Since it can be difficult to define whether a particular building material is green or not, here are some general principles to consider.

- Typically, the best material for any job is the one that performs the best with respect to the green criteria of the owner. That will likely include the product's longevity but may also include how well the material or product works with the rest of the building as a system, whether it contributes to reducing energy or water consumption, or if it helps to improve air quality.
- If two materials perform the same and have roughly equal expected lifetimes, natural materials are generally preferable to man-made ones.
- Local materials are generally preferred to ones that must be shipped long distances, but you should weigh each material case by case.
- If the perfect material is extremely expensive, and the next-best material is relatively inexpensive, it might be "greener" to go with the second-best choice if it allows adding other green choices to the building.

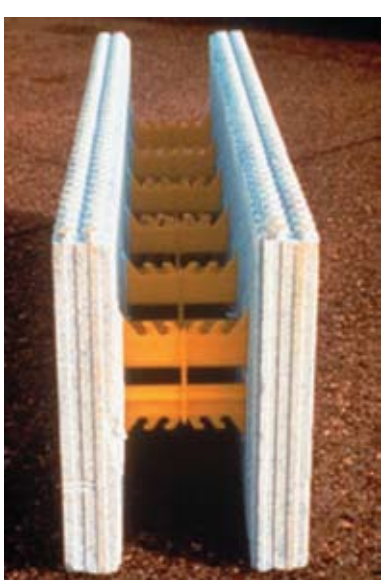
Beyond those principles, the choice of materials depends on the criteria of the builder or owner. The rest of the article will discuss common materials used in green construction. Some are new and cutting-edge, while others have been used in construction for centuries.

## The Framing and building Structure

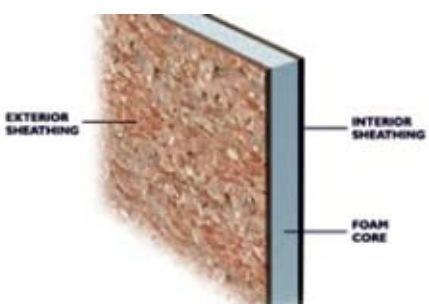
A building is really nothing more than an enclosed space. To maintain an enclosed space that will not collapse, some structure must exist to counter the forces of gravity and the elements. Builders have traditionally met that function by using stone or a wooden frame. While wood is the most common residential building material, there are now greener versions of wood available, as well as several alternatives.

- **Earthen structures** — Builders build rammed-earth, adobe, and other earthen structures using perhaps the greenest building materials. Constructed from dirt, gravel, clay, and lime, and often harvested locally, these homes offer a durable and well-insulated building.

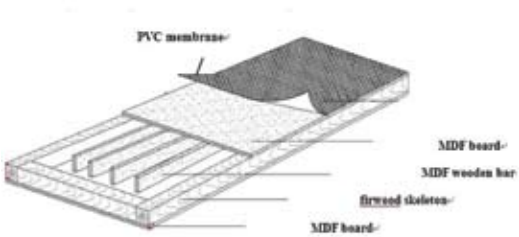
- **Straw bale** — Although straw bale construction is rare, it's gaining in popularity. Builders build these structures in a manner similar to a log home — simply stacking up a solid material. The buildings offer excellent insulation and sound-deadening properties. They are surprisingly resistant to fire due to the inability of air to flow through the straw bales.
- **Insulated concrete forms (ICF)**— Insulating concrete forms result in cast-in-place concrete walls that are sandwiched between two layers of insulation material. These systems are strong and energy efficient. Common applications for this method of construction are low-rise buildings, with property uses ranging from residential to commercial to industrial. Traditional finishes are applied to interior and exterior faces, so the buildings look similar to typical construction, although the walls are usually thicker. The concrete has a very high-embodied energy relative to most building materials, many consider it a green material for its longevity and durability.



- **Structural insulated panels (SIPS)—** SIPS are large panels (4' x 8' up to 24' x 8') typically constructed at a factory. They are composed of foam insulation sandwiched between two sheets of oriented strand board (OSB). You can consider SIPS green because of their superior insulation and air-sealing qualities, but they often must be set in place with a crane. SIPS construction is typically slightly more expensive than conventionally built structures.




- **Wood** — Two types of wood are gaining traction among green builders — engineered wood and wood certified by the authority of various countries like FSC in America. Engineered wood is very common on both green and conventional homes. It uses wood scraps and smaller trees to produce framing that's stronger than traditional sawn logs. Engineered wood allows the builder to use less wood per structure and make use of wood scraps that would otherwise go to waste, wherever conventional sawn timbers are used.



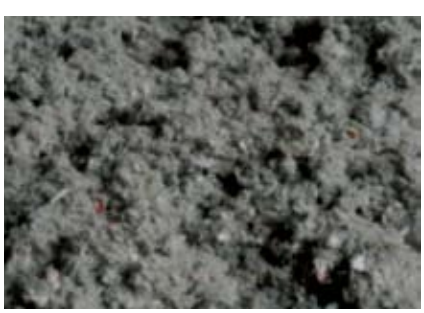

## Insulation

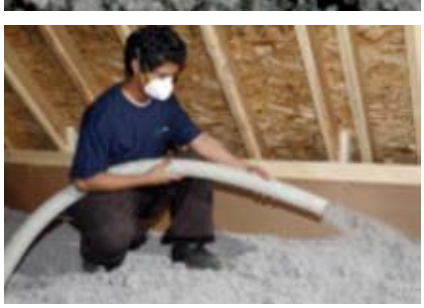
Insulation is critical for any building. Whether the builder is trying to keep the heat out or in, the amount of insulation will indicate how resistant a building is to losing energy.

- **Fiberglass** — Builders or architect generally don't consider fiberglass insulation a green material because it typically contains a toxic binding agent and is very energy-intensive to make. However, super

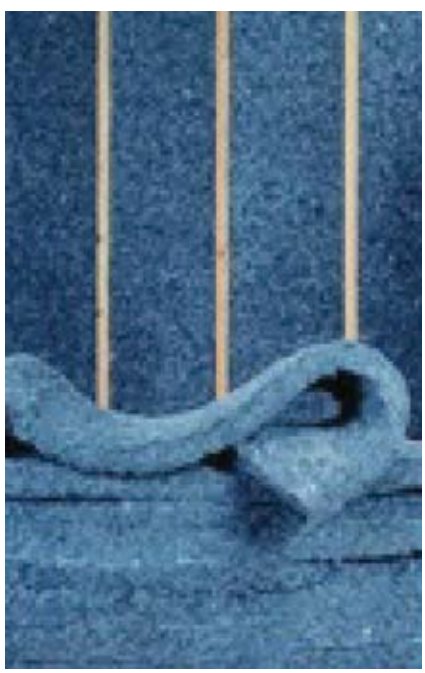
insulating a structure beyond building-code requirements is a fundamental principle of green building. Many green builders take advantage of the low cost and ease of installation to super insulate and save money that they can use for other green features.

- **Cellulose—** Made from recycled paper, cellulose is the second most common insulation material and is considered a very green choice when used properly. Also, it is relatively inexpensive, with costs similar to fiberglass.





- **Natural fiber (cotton, wool)—** Cotton insulation is typically made from recycled cotton fibers formed into a batt, a preformed section of insulation sized to fit snugly in a framed cavity. Wool is an excellent insulator and a rapidly renewable resource. However, while it is commercially available, you can typically find it only in areas where wool is abundant.



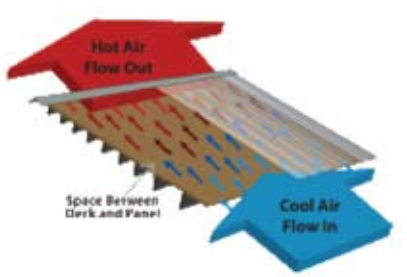
- **Polyurethane—** Expanding spray-on polyurethane foams are quickly becoming very popular. They offer the highest insulation value for a given thickness and, because of their expansion during installation, are excellent at eliminating air leakage.

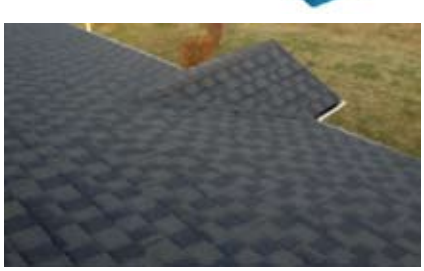
- **Polystyrene and isocyanurate—** These foams are typically installed as preformed sheets. Builders commonly use them to insulate below grade, such as beneath a slab, but also use them as exterior-mounted insulation in some applications.

## Roofing

Keeping the weather out of a structure is not only key to making it a comfortable environment but is also critical to making it last. Like the variety of choices for other building components, there are now numerous ways to cover a building. The color of the material can also have an impact. Light colors are preferable for all types of roofing, as they reflect more energy away from the structure and thus reduce the cooling load.

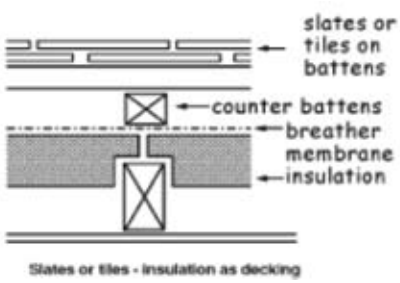
- **Steel—** Steel roofing (both panels and shingles) is an increasingly



popular green choice because of its high recycled content and longevity.

- **Slate/stone—** These natural materials are excellent green choices but are very expensive due to both material and labor considerations but can be cheap at the places where they are easy available. They have a very long life.



Slates or tiles - insulation as decking

- **Composites—** Manufacturers often make composites from plastics and rubber, and they mimic the appearance of natural materials such as slate and wood. They have the advantage of being lighter than their natural counter parts. Composites are frequently made from recycled materials and so have a lower embodied energy than materials that must be mined.

## Exterior Siding

Like roofing, exterior siding helps provide the distinction between indoors and outdoors, but, unlike roofing, siding can play a significant role in the appearance of the structure.

- **Wood** — Wood is a traditional siding choice and, when properly designed and detailed, remains a reliable green building choice. Reclaimed and recycled wood are all popular choices with green builders or architects.
- **Fiber cement** — This material is made from wood, sand, and Portland cement. Fiber cement offers excellent durability and fire resistance and is less expensive than many common wood choices.
- **Composites** — Composite materials such as plastics and vinyl are not inherently green materials, but some consider them green because of their long lifetime and low maintenance requirement.

## Interior Finishes

Green builders and designers typically try to replace the more common synthetic materials used inside the structure with lower-impact natural materials.

- **Natural clay plaster—** Natural clay plasters are a green alternative to the more common gypsum-based plasters.

- **Low/no-VOC (volatile organic compound) paints, stains, and coatings—** Paints and stains are a common source of indoor air-quality issues due to the amount of harmful VOCs needed to keep them in a usable liquid form. VOCs spur the quick evaporation of liquids in paint to leave behind a solid film of color. Many manufacturers are now offering low- or no-VOC alternatives to address this environmental concern.

- **Natural fiber flooring—** Whatever type of flooring is desired, there are green alternatives. Rugs and carpets are available in natural

materials such as wool and cotton, while wood and other solid alternatives such as bamboo and cork offer high durability and/or sustainable harvesting methods.

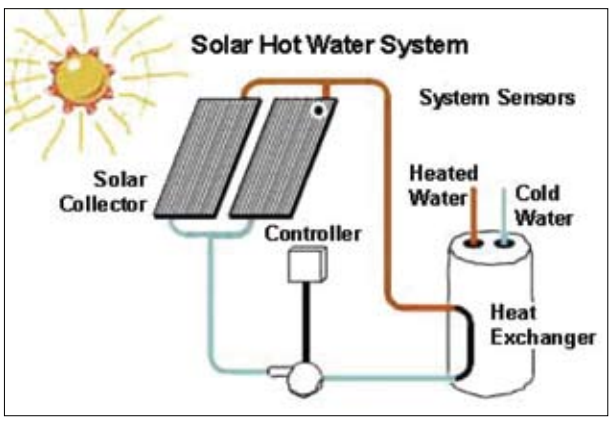
- **Paperless drywal**l — Paperless drywall helps saves on deforestation by eliminating the paper surface manufactured from trees.

## Heating and Air Conditioning

The proper orientation of a building with respect to the sun and other design details can contribute significantly to minimizing the heating and cooling needs of a building. There are also nonconventional HVAC systems that can play a significant role in using less energy in any structure.

- Geothermal — Heat pumps can provide heating and cooling to a building using a fraction of the energy of a conventional system. They work very much like a refrigerator — by using a compressor, evaporator, and condenser, heat can be moved. Heat pumps use the earth, ground water, or even the air as a source of heat, or a place to remove it, depending on the season.

- **Solar hot water—** Solar water heating has been commercially available for decades for domestic hot water needs, but these systems can be used as the primary source of space heating as well when coupled with radiant flooring. By using radiant rather than convective heat transfer, the system can heat water to a lower temperature, which works very well with solar hot water systems.
- **Focus on high efficiency and proper sizing—** Using the most efficient equipment available not only conserves energy but saves money as well. By properly matching the system to the building, you can avoid purchasing an unnecessarily large and expensive system.




## Conclusion

As discussed at the beginning of the article, the "greenness" of building materials is often a matter of perspective. Ultimate choices on what materials to use depend on the goals of the builder, architect and owner. However, our overview of common green materials provides a good summary of the materials builders can use to rebuild properties to a green standard. □

**Vikram Singh is an architect by profession and currently Asso. Professor cum Head of Department at ITM School of Architecture & Town Planning, Bakshi ka Talab, Lucknow. He has B.Arch degree from Intergral University, Lucknow and done Masters in Architecture from YCMOU, Nashik.**

**Photographs and illustrations: Courtesy the Author.**