

MATERIALITY RECONSIDERED

Environmental Design:

Industrialized Agricultural Architecture, IAA and the Farmhouse Prototype

Julee Herdt

University of Colorado

2002-2003 ACSA Faculty Design Award

Grant funding for this project was awarded by The United States Department of Agriculture, The University of Colorado and The Geothermal Heat Pump Consortium

ABSTRACT

Industrialized Agricultural Architecture borrows energy from sky and ground; material resources mainly from plant life and waste stockpiles.

Industrialized Agricultural Architecture, IAA, is an environmental method for building with newly developed agriculturally-based materials and energy-efficient systems. Of great importance is that these materials and systems are industrialized, off-the-shelf products. Computerized design processes allow their quick adaptation to a wide variety of U.S. sites and temperature zones. IAA methods are particularly suited to suburban locations and if employed on a large scale could greatly reduce negative environmental impacts of current residential construction methods. The author and the author's architecture students at the University of Colorado have developed the first IAA residential prototype which is referred to as The Farmhouse. The Farmhouse is nearing completion at the base of the Rocky Mountains.

IAA is environmentally derived, off-the-shelf, industrialized construction in which a large percentage of materials are manufactured from bio-based (agricultural) fibers and wood waste. These cellulose sources include but are not limited to soy, jute, kenaf, wheat, flax, corn, hemp, and wood waste. In IAA, bio-based building materials combine with a range of environmental products and renewable heating and cooling systems, specifically solar electric and geothermal, to provide a complete construction palette. IAA is low-energy use, low-maintenance architecture, adaptable to all US sites for environmental projects large and small.

IAA offers the construction industry alternatives to petroleum-based

building materials which are known to be some of the world's most serious environmental polluters. IAA is proving to be cost-efficient as the prototype Farmhouse is being constructed at approximately \$75 per square foot. This is due mainly to labor reductions by reliance on factory-produced modular systems.

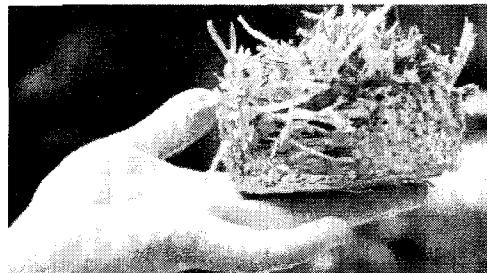


Fig. 1 Structural Insulated Panels, SIP's, from wheatstraw insulation combine with low-environmental impact Styrofoam sips in The Farmhouse construction. Shown is a section of a wheatstraw SIP.

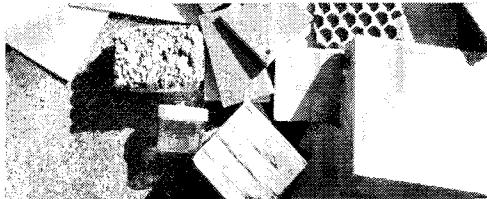


Fig. 2 IAA materials from soy, corn, linseed, rapeseed, wheat, flax, jute, kenaf, hemp, seagrass, and waste wood.



Fig. 3 The author's initial IAA grants focused on kenaf plant fibers for use in structural building panels. Fig. 4 (Below) Sunflowers are one of the bio-based sources used in IAA building materials.





Fig. 5 A student in one of the author's environmental architecture courses built a movable sink from recycled plumbing, an old door, and an old bowl.



Fig. 7 Recycled paper bales are sources for IAA building materials.



Fig. 8 Low-grade waste paper from food boxes was used in initial IAA building material grant research.



Fig. 9 Grants secured by the author helped establish a factory in Long Beach, CA for "Gridcore" production.

Fig. 10 (Below) Gridcore is a high strength-to-weight structural panel from 100% recycled paper.

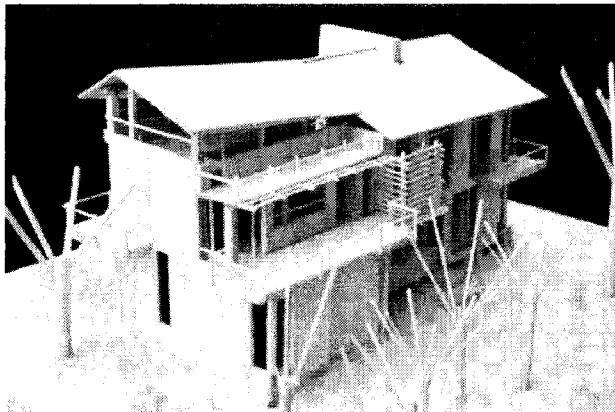
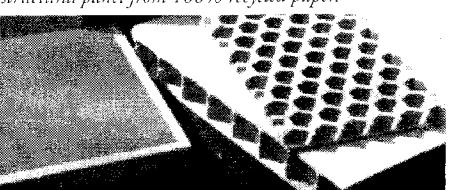


Fig. 6 Design model of The Farmhouse, south elevation, showing the home's photovoltaic system. The Farmhouse uses a 1.5 kW solar electric system. The project recently won a Colorado Renewable Energy in Building Award.

IAA BUILDING MATERIALS, ENERGY SYSTEMS, CONSTRUCTION METHODS & DEMONSTRATION OF IAA

Materials for IAA offer construction ease, cost effectiveness, and new aesthetic possibilities. IAA materials for The Farmhouse prototype include:

- 1. bio-based
- 2. energy-efficient
- 3. recycled content
- 4. re-used
- 5. low- to no-toxin paints and sealants
- 6. give-away materials from local businesses

Energy Systems for IAA are from renewable geothermal and solar energy.

In The Farmhouse, photovoltaic, or solar electric, and geothermal combine to condition the home in a simple, clean, energy-efficient, cost-effective manner referred to as Geo-Solar by the author. Plumbing and lighting for The Farmhouse are from off-the-shelf energy and resource efficient systems compatible with the bio-based, recycled, engineered, and re-used material palette. The energy system categories of IAA are:

- 1. photovoltaics or solar electric power
- 2. geothermal heating and cooling
- 3. high-tech plumbing methods & materials
- 4. energy-efficient lighting

Construction of The Farmhouse provides a full-scale testing laboratory for materials and energy systems.

The author and students have developed the Farmhouse construction by specifying modular environmental counterparts to standard wood frame residential construction. These materials integrate easily with the energy systems equipment. The majority of IAA materials and energy systems in The Farmhouse can be worked and installed with traditional methods and tools to provide a complete building package. The Farmhouse will be completed in the spring of 2002. During the first year of occupancy, The Farmhouse will be analyzed for thermal, energy and material performance with data and costs posted on the website.

Demonstration of IAA methods and systems is an integral part of The Farmhouse project. This is being achieved by opening the house to the public. Tours of The Farmhouse will be held through November 2002. thefarmhouse.org