

Building Deconstruction and Design for Reuse

The Environmental Protection Agency's Office of Solid Waste and Emergency Response initiated a series of innovative pilot projects to test ideas and strategies for improved environmental and public health results. This series of fact sheets highlights the innovative approaches, results, and environmental and economic benefits from the pilot projects that may be replicated across various sectors, industries, communities, and regions.



PROJECT DESCRIPTION/INNOVATION

EPA awarded an Innovation grant to the University of Florida's Powell Center for Construction and the Environment to demonstrate the environmental and economic value of deconstruction and design for reuse principles in construction projects. The project was innovative because it simultaneously focused on the front and back end of the building lifecycle. This approach addressed how to manage the enormous stock of existing buildings at the end of their lifecycle and new building design by integrating deconstruction and reconstruction in a single project.

BACKGROUND

In 2002, the U.S. Geological Survey estimated that the construction industry consumed 60 percent of the materials flow in the U.S. economy (excluding food and fuel). As of 2004, the amount of construction space in the U.S. was expected to grow to nearly 430 billion square feet by 2030—which included the replacement of more than 25 percent of structures that existed in 2000. Preliminary estimates from the EPA showed that building-related projects in the U.S. alone generated an estimated 160 million tons of construction and demolition (C&D) materials every year. In 2003, approximately 40 percent of this material was reused, recycled, or sent to waste-to-energy facilities, while 60 percent was sent to C&D landfills. The continued use of virgin materials for construction consumes enormous amounts of materials and energy, while continued disposal of building materials uses landfill space and buries potential resources rather than extracting their value for productive reuse. Both the upstream and downstream impacts of these practices increase the emissions of greenhouse gases—from the loss of forests as carbon sinks, the burning of fossil fuels from virgin material extraction and manufacturing, and the release of methane from landfills.

In response to these issues, a deconstruction industry has emerged. Deconstruction is “the disassembly of buildings so as to safely and efficiently maximize the reuse and recycling of their materials.” While cherry-picking the highest-value materials is standard demolition practice, deconstruction aims to increase

Project Highlights

- 44 percent of the total mass of the Wesley House was recovered by deconstruction, 20 percent of which was reused in the construction of the Reichert House.
- 8.84 tons of materials were diverted from landfills.
- By reusing recovered materials, this project minimized energy use and greenhouse gas emissions, avoiding 9.83 Metric Tons of CO₂ Equivalents (MTCO₂E) of greenhouse gas emissions.
- GRU distributed a project flyer to 53,000 households educating its customers about the energy benefits of recycling and reuse.

reuse options by pushing materials salvage beyond the usual windows, doors and light fixtures to include flooring, siding, roofing and framing. In some cases, deconstruction can yield items that are no longer commercially available, such as the old-growth Douglas fir and redwood lumber recovered from closing military bases.

To succeed, deconstruction needed to be developed to the point at which industry and policy makers recognized it as an intelligent and economically viable alternative to demolition. Innovative demonstration projects were needed to prove the value and feasibility of deconstruction and building material reuse.

PROJECT SUMMARY

The Wesley House in Gainesville, Florida was a 1,933 square foot single-family residence built in 1930. Its abandoned and deteriorating condition threatened to attract negative elements to the community. The Gainesville Regional Utility (GRU), whose offices and main parking lot were located on either side of the Wesley property, bought the abandoned home so that they could remove it and make room for a planned office facility expansion.

At the same time GRU was considering demolishing the Wesley House, Gainesville's Black-on-Black Crime Task Force was preparing to design and build the Reichert House, a new facility

for at-risk youth, and was greatly in need of support. Members of University of Florida's Powell Center for Construction and Environment (PCCE) saw an opportunity to serve the needs of both of these projects by linking them together.

In March 2003, PCCE members deconstructed the Wesley House. Material recovery and disposal were recorded and incorporated into a comprehensive study documenting the environmental and economic value of deconstruction and design for reuse principles. The reusable materials recovered from the Wesley House were incorporated into the construction of the Reichert House.

RESULTS

Deconstruction of the Wesley House proved five percent less expensive than the conventional demolition estimate. Aside from that specific cost savings, 44 percent of the total mass of the Wesley House was salvaged for reuse, 20 percent of which was used to construct the new Reichert House—diverting 8.84 tons of material from landfills. Overall, the project avoided 41.77 Million British Thermal Units (MMBTU) of energy use, 2.68 Metric Tons of Carbon Equivalent (MTCE) of greenhouse gas emissions, and 9.83 Metric Tons of CO₂ Equivalents (MTCO₂E) of greenhouse gas emissions. When applying the pilot findings to the approximately 258,715,000 square feet of single-family residential units demolished each year, it was estimated that deconstruction could result in the avoidance of 546,000 metric tons of GHG carbon equivalent, 2.054 million metric tons of GHG carbon dioxide equivalent, and 8.71 million MMBTUs of energy use per year.

As part of the educational component of this project, PCCE conducted a training workshop for students interested in learning about deconstruction. The pilot also showcased lessons learned and highlighted issues common to deconstruction and salvaged materials reuse, in the hopes of helping communities and public and private organizations replicate its efforts. Some of those issues and lessons learned included:

- While higher-quality wood materials from older buildings are preferred, they have inherent problems of decay and insect damage, particularly in the Southeastern U.S.
- Older wood-framed and clad buildings built before 1978 are likely to contain lead-based paint, the reuse of which is less cost-effective due to the cost of paint removal.
- Although there may be a perception that the goals of deconstruction are not compatible with the goals of historical preservation, they can be complementary because the value of an aging house can be realized in new ways.
- Problems to overcome include aesthetic concerns over

Innovation Pilot Partners

Lead: University of Florida's Powell Center for Construction and the Environment

Sponsors: U.S. EPA Office of Resource Conservation and Recovery and U.S. EPA Region 4

Other Partners:

- Black-on-Black Crime Task Force
- Gainesville Police Department
- Gainesville Regional Utilities

Additional Information

OSWER Innovation Projects:

www.epa.gov/oswer/iwg/pilots/

OSWER Innovation Deconstruction Success Story:

www.epa.gov/oswer/iwg/

EPA Construction and Demolition Material – Deconstruction and Reuse:

www.epa.gov/osw/conserve/rrr/imr/cdm/reuse.htm

EPA Region 4 Construction and Demolition Debris:

www.epa.gov/region4/waste/rcra/cdhome.htm

Lifecycle Building Challenge – Resources:

www.lifecyclebuilding.org/resources.php

mixing old and new materials and ensuring an adequate supply of salvaged materials to enable their reuse.

- Design for reuse can reduce the use of raw materials, reduce C&D waste disposal, and result in creative approaches to reusing salvaged materials.

2010 UPDATE

This pilot and other deconstruction-related projects in EPA Region 4 built the foundation for the Construction and Demolition (C&D) initiative within U.S. EPA's Office of Resource Conservation and Recovery. The deconstruction and building material reuse practices documented by the pilot became a model for the State of Florida, and the pilot continues to be one of the most frequently requested studies from stakeholders seeking to initiate a deconstruction project. It also served as a primary body of knowledge for the Lifecycle Construction Resource Guide developed by EPA, a document that advances the concept of deconstruction by demonstrating the economic and technical feasibility of such practices.