COBB HILL CO-HOUSING PROJECT

Pulling Together a Plan for Sustainable Living

Project Snapshot

PROJECT
22-unit co-housing community in Vermont

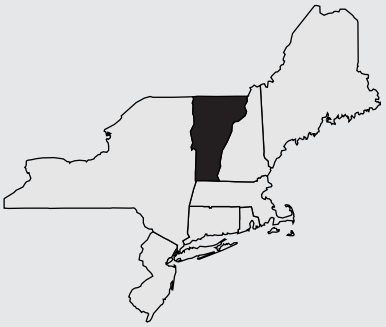
TECHNOLOGY
Sustainable building design; passive solar heat; high- efficiency windows, insulation and appliances; wood-fired district heating and other innovative technologies

CO_2 EMISSION REDUCTIONS
Roughly 170 tons a year as a result of the wood-fired heating system

INVESTMENT
Estimated total cost of $5.7 million

LESSONS LEARNED
- Going beyond standard building codes and practices adds time and costs to a construction project—especially at the residential level.
- A sustainable construction process (e.g., excavation and building) is difficult to maintain.
- To keep costs down and the project on schedule, it is a good idea to hire a general contractor.

FUNDING SOURCES
Private and institutional loans; sale of homes



INTRODUCTION

Residential life as practiced in the United States places significant obstacles in front of anyone who seeks to reduce air pollution and solid waste from the comfort of his or her own living room. For the most part, we reside in large, discrete structures, served by their own heating, lighting and plumbing systems. This is an organizational format capable of delivering only limited efficiencies. The Cobb Hill Co-housing community in Hartland, Vermont, is one of a growing number of settlements across the country that are exploring alternatives to America's dominant domestic paradigm.

PROJECT DESCRIPTION

"Co-housing" is an alternative to the modern "one-family-to-one-house" mode of living in which people share costs and resources and cultivate a greater sense of community. There are hundreds of co-housing projects across the U.S., with some placing more emphasis on creating community and others on minimizing environmental impacts. Residents may jointly own common property and share certain community buildings, while at the same time living in their own homes or apartments. The 270-acre Cobb Hill community is located in the Connecticut River's Upper Valley region, about 20 minutes south of Hanover, New Hampshire, and White River Junction, Vermont. When completed, Cobb Hill will be a cluster of 14 new structures situated on the side of a hill. Although building on flat acreage is much less expensive, the group chose this location so that it could preserve the "bottom land" for farming and other agricultural pursuits. Indeed, the community has protected its open land with permanent conservation easements. It plans to engage in farming and forestry – both for its own consumption and as businesses for some of the residents. With a dairy herd of ten cows, a new cheese operation, and a flock of chickens, the agricultural land already is producing dairy products and eggs for sale. All production is organic.

A maple sugaring operation includes over 1,000 taps and is marketing about 200 gallons of syrup in 2001.

The total cost of the Cobb Hill project is expected to approach $5.7 million. The group has tried to keep interest payments low by drawing as much as possible on private funds before applying for construction loans, which often carry interest rates of ten percent or more. Initial funding arrived in the form of two grants totaling $200,000, one from an individual and the other, a foundation. These were followed by a $300,000 interest-free loan from other friends of the project. Large down-payments on several of the homes provided additional capital. In addition to "friendly" capital and self-financing, a bank has issued a construction line of credit of up to $1.2 million.

The homes at Cobb Hill have been designed with efficiency in mind – to minimize resource use and waste. Energy-efficient features include:

- Clustered placement of buildings to minimize land impact and realize savings from community-level water and sewage systems.
- Building orientations that allow for passive solar heat and, eventually, other solar applications like solar hot water and photovoltaics.
- A forced hot water "district heating" system for all units, powered by a central wood-gasifying furnace, with propane fuel as backup.
- High levels of insulation, efficient windows and wastewater heat recovery.
- Vermont Energy Star appliances and low-flow fixtures.
- Composting toilets and a gray water system.
- An innovative energy monitoring system to collect data and provide immediate feedback to occupants on the flow of electricity, heat and water to homes and appliances.

In selecting design features, the Cobb Hill community, like all developers, has had to weigh higher up-front costs against long-term life-cycle savings. Although efficient appliances and building materials tend to cost more "off the shelf" than standard options, in the longer term they reduce the owner's energy bills and pay back the price premium in energy savings – sometimes in a matter of a year or two. Other features the community considered but rejected, at least for now, included solar hot water, photovoltaics and a fuel cell to provide electricity and heat. The full cost of the chosen efficiency features is not yet known, although when the project is finished the community plans to calculate the "sustainability premium" it has paid up front, and then carefully track energy costs over time. In this way it will be able to determine the payback periods for many of its efficiency investments.

In addition to efficient design, Cobb Hill has incorporated environmentally benign building materials and practices wherever possible. This task has proven to be more difficult than initially thought. While the community feels that it succeeded in cost-effectively incorporating features like non-toxic indoor finishes, composting toilets and a simple greywater leach field, the use of toxic building materials like outdoor finishes, polyvinyl chloride (PVC), particleboard and other treated wood products could not be avoided. In some cases, substitutes simply were too expensive, and in others, time constraints and similar logistical issues presented insurmountable barriers. The "Lessons Learned" section below summarizes other challenges. Architect Jeff Schoellkopf of Warren, Vermont, designed the Cobb Hill project. Marc Rosenbaum, of Plainfield, New Hampshire, serves as its energy systems consultant. Albee-Ohara of South Royalton, Vermont, is the builder.

THE RESULTS

Several uncertainties make it very difficult to estimate the energy savings that will be achieved by Cobb Hill's new buildings. Key unknowns include the level of occupancy, and the occupants' unique patterns of energy use. The fact that the houses at Cobb Hill have not yet been finished, and thus total square footage remains uncertain, makes projection even more problematic. But the community does plan to monitor energy use carefully, and keep an eye out for adjustments that could increase overall efficiency. Here is a rough estimate of the emissions likely to be avoided by the construction of Cobb Hill and by its heating system, assuming it consists of 14 new buildings including the following residences:

- A common house of roughly 5,000 square feet, including three apartments.
- 12 duplex residences (six buildings) of varying sizes.
- Seven single-family homes of 1,200 to 1,500 square feet each.

The total area of the buildings is likely to be in the range of 23,050 square feet. As noted, a single wood gasifying system will heat all of them. The group plans to obtain as much of its fuel as possible from its own land, using sustainable forestry techniques. The balance will be waste from the Vermont wood-products industry. Both of these fuel sources are CO_2 neutral, because the carbon sequestered in growing trees will offset the carbon released by the wood combustion. Several recent studies of Vermont's forests show that wood mass is steadily increasing, which indicates that the state's forestry practices are sequestering more carbon than they are releasing. Over time, however, this could change, and the Cobb Hill group expects to monitor its wood supplies to ensure carbon neutrality.

Based on current codes and standards, estimated heating-season energy use of an average new home in Vermont is 50,000 British thermal units (Btu) delivered per square foot for heat, and an additional 30,000 Btu delivered per square foot for hot water. This translates into a total heating load for Cobb Hill's 23,050 square feet of roughly 2,305 million Btu input per heating season (assuming an 80 percent-efficient furnace).[1] If conventional oil-fired furnaces generated this amount of heat, roughly 180 tons of CO_2 would be emitted each year along with some 700 pounds of SO_2 and 300 pounds of NO_x.[2] By burning only carbon-neutral wood for all of its heat, the Cobb Hill community will avoid all of this CO_2 and SO_2, and about a third of the NO_x.[3] However, the community will likely burn propane during a small percentage of the year – for example on fall or spring days when it is chilly but not cold enough to fire up the wood gasifier. Assuming that ten percent of its annual heating needs are met with propane, the community will avoid emitting roughly 170 tons of CO_2, 660 pounds of SO_2 and 100 pounds of NO_x. For CO_2, this means reducing oil consumption in Vermont by some 315 barrels a year, or taking 24 typical passenger cars off the road. Again, this projection is based on rough estimates of energy use by an average new home in Vermont and an average one at Cobb Hill. Only when the Cobb Hill residents move in will we get a more accurate sense of their energy use.

The Cobb Hill community also will reduce its contribution to climate change in other ways that are even more difficult to measure. For example, by organically growing much of its own food and selling locally grown food to neighbors, it will reduce the CO_2 emissions associated with fertilizer and pesticide production, as well as long-distance transportation. Over time, the group plans to seek ways to measure these benefits as well.

LESSONS LEARNED

The path to sustainability has not been easy for the Cobb Hill project. Donella Meadows, the noted environmental activist and scientist, planned to become a charter resident of Cobb Hill. Before her untimely death on February 20, 2001, she observed that overcoming the "inertia of the status quo" within the

construction industry and state agencies had presented challenges at virtually every step in the planning and construction process. "While Vermont has some of the nation's more progressive energy efficiency codes and standards, they remain well below what is needed to build a truly sustainable and carbon neutral home," she said. "Asking architects and builders to go beyond codes adds time and costs to the process."

Another lesson that the Cobb Hill project has taught is the importance of hiring a contractor to manage the construction effort. In an effort to save money, the group decided to perform the task of managing carpenters, plumbers, electricians and other trades people on its own. In retrospect, the community believes that a contractor could have supervised the project more effectively, saving time and money.

THE PARTNERSHIP

The idea for the Cobb Hill community emerged in 1996, when two adjacent dairy farms in Hartland were put up for sale. A year later, a group of friends who had been contemplating co-housing established a non-profit organization, the Sustainability Institute, to buy the land. Since then, the group has refined its vision for the community, drafted a statement of purpose and bylaws, designed additional structures for the property and started construction. The first of Cobb Hill's new residents hope to move in June 2001.

Individuals and families have joined the Cobb Hill community by purchasing an apartment or home, as well as a collective interest in the 270-acre site and several common buildings. The buy-in prices ranged from $125,000 (for a 500-square foot apartment) to $240,000-$270,000 (for a 1400-square-foot house). Cobb Hill is incorporated as a common interest community, with ownership and governance similar to a condominium.

Although resource efficiency is a vital part of the Cobb experience, the community's vision extends well beyond this, embracing principles of community, aesthetics, equity and sustainability. Its statement of purpose identifies specific ways in which it will strive to succeed in each of these areas.

FUTURE COMMITMENTS

Cobb Hill's immediate goal is to finish construction so people can move into their units. Over the longer term, the co-housing community will continue seeking ways to make life at Cobb Hill more sustainable. One hope is that it can become independent of the electricity grid. The Sustainability Institute, with which the community will maintain its relationship, intends to continue developing a website and other resources for those interested in residential sustainability.

CONTACTS

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[1] Note that the figures for average Btus per square foot are expressed as "delivered" energy, while the energy needed to provide these services as "input" energy. Because typical residential furnaces are roughly 80 percent- efficient, it is necessary to "input" 100 Btu of energy to the furnace to "deliver" 80 Btu of heat to the home.

[2] The NO_x and SO_2 emission factors used to calculates these numbers are from EPA's Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, available at: www.epa.gov/ttn/chief/ap42/index.html. The CO_2 factor is from EPA's Inventory of Greenhouse Gas Emissions and Sinks: 1990-93, U.S. EPA, Washington D.C. 1994.

[3] Even though growing this wood requires large amounts of nitrogen, the NO_x cycle is not sustainable in the same way that the carbon dioxide cycle is. Nitrogen for biomass growth is drawn from the soil, not the air; hence, it does not mitigate a major environmental problem to which NO_x is an important contributor: formation of ground-level ozone smog on hot summer days. The reason NO_x emissions are lower for Cobb Hill's wood-fired system is that it is more efficient and cleaner than the average utility generating unit (see footnote 2, above).

CLEAN AIR-COOL PLANET CASE STUDY RATING

This case study reduces CO_2 emissions equivalent to the following:

Avoiding the consumption of 311 barrels of oil per day. (1 barrel = 50 barrels of oil)

OR Taking 24 vehicles off the road per year. (1 car = 2 vehicles)

Assumptions: 1,093 lbs of CO_2 per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO_2 per gallon of gasoline - 22.5 miles per gallon, averaging 16,000 miles per year)