

SOCIETY FOR THE PROTECTION OF NEW HAMPSHIRE FORESTS

A High-Tech Center to Showcase Conservation

PROJECT SNAPSHOT

PROJECTS

Installation of photovoltaic (PV) panels and wood chip gasifier; construction of French Wing addition

TECHNOLOGIES

32 120-watt AstroPower PV modules (4 kW total); ChipTec wood chip gasifier; state-of-the-art, 11,400-square foot French Wing addition

CO₂ EMISSION REDUCTIONS

PV System: 2.75 tons a year

Wood Chip Gasifier: 32 tons a year

French Wing: 24.5 tons a year (projected)

INVESTMENT

PV System: \$30,000

Wood Chip Gasifier: \$110,000

French Wing addition: \$1.7 million

LESSONS LEARNED

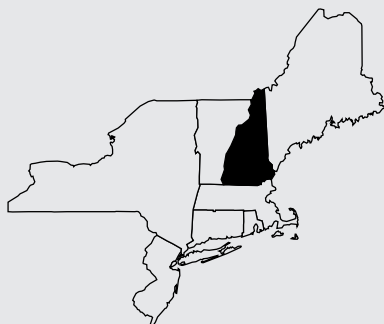
Installation of state-of-the-art energy efficiency and renewable technologies is feasible if the project is properly coordinated, and if participants receive the necessary training.

FUNDING SOURCES

PV System: Advanced Energy Systems, AstroPower, New Hampshire Energy Office, Public Service of New Hampshire, Stonyfield Farms, Inc.

Wood Chip Gasifier: New Hampshire Governor's Office of Energy and Community Services

French Wing: Robert L.V. French and Jameson French, SPNHF fundraising, and the Kresge Foundation



INTRODUCTION

In 1998, the Society for the Protection of New Hampshire Forests (SPNHF) faced a major space crunch at its Concord, NH, headquarters. So it decided to look to its 100-year history of environmental stewardship for guidance on how to expand and revamp its two-decade-old Concord Conservation Center. For inspiration, the planning committee studied existing examples of the successful integration of green technologies and renewable forest products. The result is the new – and renewable – French Wing.

THE PROJECTS

Back in the early 1980's when the Society constructed the 7,000-square-foot Conservation Center, which serves as its headquarters, the architectural challenge was to make passive solar design work in northern New England, and the construction challenge was to rely as much as possible on regional forest products. Passive solar was expected to furnish 40-60 percent of the heat, with state-of-the-art wood-burning technology providing the rest.

Improving upon an already impressive building, in 1998 the Society installed an active solar component – a \$30,000 photovoltaics (PV) system from Advanced Energy Systems – and a \$110,000 Chiptec renewable wood chip gasifier.

The Society also recently completed building a \$1.7 million addition – the 11,400 square-foot French Wing, completed in March 2001. Funding in large part from the French Family (primarily former trustee Robert French and immediate past chairman, Jameson French as well as other family members). The Kresge Foundation and several other generous contributors financed construction. The French Wing features a design that takes advantage of natural lighting, and incorporates state-of-the-art building materials, a number of energy conservation measures, low-impact plumbing, and a central wood chip gasifier to supply heat. For lumber, the addition used trees

harvested on site – particularly some white pines that had to make way for construction – timber harvested under the principles and criteria of the Forest Stewardship Council (FSC). The Society is in the process of documenting the environmental characteristics of the French Wing, and submitting a report on them to the U.S. Green Building Council.¹ The Society's headquarters now houses six other nonprofit organizations – from the New Hampshire Timberland Owners Association to the New Hampshire Wildlife Federation.

This case study quantifies the emission reduction benefits from the PV system and wood chip gasifier prior to the 2001 completion of the French Wing. In addition, it estimates the future benefits of the French Wing, using as a baseline a comparable building conforming to the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) Energy Efficient Design of New Buildings Standards.²

THE RESULTS

The PV and wood chip gasifier systems have reduced electricity demand, propane use and energy costs at the Concord Conservation Center since their installation in 1998. The AstroPower PV system is tied to the grid, and – during weekends and holidays, when its output is not needed in SPNHF's office – the electricity it produces flows back into the grid.³ Its 32 120-watt panels, installed in October 1998, generate more than 3,500 kWhs a year – five to six percent of the building's electricity needs. To date, the system has produced approximately 9,000 kWhs.

The PV system avoids about 2.75 tons of CO₂ annually. By early 2001, that added up to 5.5 tons since it had been installed. This is equivalent to the CO₂ emissions associated with driving about 12,000 miles in a typical passenger car. The PV system also cuts NO_x by an estimated nine pounds a year, and SO₂ by 22 pounds.

The Conservation Center's wood chip gasifier, also added in 1998, burns chips derived from mill waste. Before the

French Wing came on line, the gasifier consumed about 65 tons of wood chips each year to generate 567.67 mmBTU of energy. The gasifier has reduced propane use by 84 percent, and that translates into annual CO₂ reductions of 32 tons. This is the same as removing about five typical passenger cars from the road each year. Unlike fossil fuels, such as propane, the wood chip gasifier does not increase atmospheric CO₂. Sustainable biomass fuel is carbon neutral, which means that carbon emissions from combustion of the wood chips are offset by carbon removed from the atmosphere as reforestation occurs. The gasifier produces four pounds of non-toxic ash for every ton of wood chips combusted. The ash is spread on the grounds at SPNHF headquarters.

The new PV system and wood chip gasifier cut annual energy costs by 23 percent (down to \$9,862 from an average of \$12,875) compared to the projected cost of the same amount of energy from more typical sources – electricity from the grid and propane. The wood chip gasifier and PV system are projected to pay for themselves out of their savings in 30 and 70 years, respectively.

To project the benefits of the new French Wing, analysts looked to Section 90.1 of the American Society of Heating, Refrigerating and Air-Conditioning Engineers' (ASHRAE) Energy Efficient Design of New Buildings Standards. Although the addition of the new wing will increase available space as well as energy consumption, if SPNHF had not incorporated so many energy-saving features into its design, projected annual energy costs would be 44.3 percent greater than those of a typical building of comparable size. The French Wing is far more efficient than the ASHRAE 90.1 standard, and it will significantly cut the use of electricity and other, non-renewable energy sources – as well as their associated emissions. To put it another way, if the French Wing were like most ordinary buildings, its yearly energy bill would be \$7,530 a year, rather than \$4,200.

The new wing will avoid 8,681 kWhs of electricity and 256 mmBTU of propane annually, compared to buildings conforming only to the ASHRAE 90.1 standards. The Society decided to heat the wing with a wood chip gasifier rather than the lower-cost option, propane boilers. This creates the need for another 35 tons of wood chips a year.

Engineers project that the new French Wing will avoid about 24.5 tons of CO₂ a year – 13,400 pounds from diminished electricity use, and 35,600 pounds from the elimination of propane – compared to a similar building meeting ASHRAE's 90.1 standards. This is equivalent to the CO₂ emissions associated with driving approximately 55,000 miles in a typical passenger car. Compared to ASHRAE standards, each year the new wing will avoid about 18 pounds of NO_x and 54 pounds of SO₂ that otherwise would be emitted by power plants connected to the regional grid.

LESSONS LEARNED

Contractor inexperience has been the largest obstacle to efficient construction of the new French Wing. Concord Conservation Center Property Manager Paul Leveille invested a great deal of effort facilitating communications among the contractors. This became especially important for recycling. Waste – plumbing fixtures, wood, nails and other construction materials – accumulates at construction sites. Leveille established a recycling program, using recycling bins keyed to the mix of refuse expected from the work of a given day's contractors. To make it a success, however, Leveille had to coordinate closely with the contractors, many of whom had little experience with tightly designed, on-site materials-recycling programs.

FUTURE COMMITMENTS

The SPNHF is committed to minimizing the impacts of climate change on New Hampshire. The Society is therefore considering the expansion of the PV system, and installation of bicycle storage facilities and conduits to the parking lot to support

charging stations for electric vehicles.

Charles Niebling, SPNHF's senior director of policy and land management, notes that "a growing body of scientific evidence suggests that global warming will have long-term impacts on forest health in New Hampshire. Our greatest concern is for northern tree species and forest types at the southern edge of their natural ranges. The northern hardwood and spruce-fir forests could come under increasing stress, with profound ecological and economic consequences for the Granite State. That is why SPNHF is working to promote state and federal policies that will curb greenhouse gases like CO₂, including emissions reductions and incentives for carbon sequestration."

The SPNHF's Conservation Center serves as a focal point of its efforts to promote sustainable use of the Granite State's forests and its environment. More than 10,000 people visit the Center each year. The Society offers both staff- and self-guided tours of the building.

ORGANIZATIONAL PROFILE

Founded in 1901, the Society for the Protection of New Hampshire Forests is the oldest and largest nonprofit conservation organization in New Hampshire, and one of the oldest in the nation. The Society will celebrate its 100th anniversary in 2001 and is currently supported by more than 10,000 members. The mission of the Society is to conserve land and natural resources, with special emphasis on forests. The Society pursues its mission through initiatives on two complementary tracks: establishing public reservations and other permanent conservation areas; and promoting responsible use of renewable natural resources. Primary program areas are land protection, education, advocacy and forestry.

To date, the Society has spearheaded the protection of more than one million acres throughout New Hampshire. They encompass hundreds of parks and forests, and include the White Mountain National Forest, Mount Monadnock and Franconia Notch; miles of river and lake shoreline; and wildlife reserves, hiking trails and scenic vistas.

CONTACTS

Self-guided tours of SPNHF's building may be taken Monday through Friday (excluding holidays), 8:30 a.m. to 4:30 p.m. Call 603-224-9945 for details.

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Forest Stewardship Council

www.fscus.org

¹ Certification would be sought under the Council's Leadership in Energy and Environmental Design program (LEED), a self-evaluation that helps owners rate the environmental components of their new and existing commercial, institutional and high-rise residential buildings. The program assesses environmental performance from a "whole building" perspective – that is, over the building's entire projected life cycle.

² This standard sets minimum requirements for the energy-efficient design of new buildings. In general, they must be constructed, operated and maintained in a manner that minimizes energy use without constraining the building's function, or the comfort or productivity of its occupants, productivity of its occupants.

³ The physical ability and legal right to feed electricity generated on-site back into the grid is known as "net metering." When this happens, the Society's electricity meter literally runs backwards.