

VERMONT ZERO-ENERGY OFFICE BUILDING COMBINES NEW WITH THE OLD

ENERGY FUTURES GROUP CONSTRUCTS GREEN AND SUSTAINABLE WORK SPACE

By Richard Faesy, Energy Futures Group



Energy Futures Group building from the south. All photos courtesy of Richard Faesy.

Energy Futures Group (EFG), a seven-person clean energy consulting firm based in Hinesburg, Vermont, recently completed construction of their new zero-energy office building and moved in the end of September 2017. The 1850s-era farmhouse was renovated, and a new addition was constructed with an eye to maintaining the historic character of the building, becoming an energy efficiency showcase and installing enough solar photovoltaic panels on the roof to provide 100% of the annual all-electric building's heating, cooling, hot water, lights and appliance energy needs.

EFG began working with the Town of Hinesburg in mid-2015 to purchase what was their old police station and a cape-style farmhouse for 150 years before that. After completing Hinesburg's regulatory process for subdividing the building and the land on which it sits from the remaining town green, as well as Vermont's land use development, storm water and wastewater, development review and permitting processes, EFG purchased the property with the help of Greentree Real Estate and Four Seasons Sotheby's International



Retail/office rental space in the EFG building.

Realty in October 2016.

EFG simultaneously worked closely with Pill-Maharam Architects, Reiss Building and Renovation and Energy Balance on an integrated design process that would ensure achieving the project's goals.

The final building would maintain the footprint, look and key structural elements of the old farm house while adding a new two-story, 1,200 square foot addition

off the back, providing EFG its office of the future as well as several desirable rental spaces. The design and construction would emphasize use of local and green materials and finishes as well as a state-of-the-art, net-zero energy package. As advocates for a clean fossil-fuel-free energy future, EFG wanted to demonstrate that a net-zero energy commercial building can be constructed – without heroic measures – even for a winter climate as harsh as Vermont's. The result integrates building science, technology, renewable energy and smart design into a package that is beautiful, inviting, healthy and self-sufficient.

EFG enrolled in Efficiency Vermont's Commercial New Construction Net Zero program to receive technical assistance and incentives worth more than \$10,000. They also worked with the local Merchants Bank (that became Community Bank during the construction process) to secure a loan for 80% of the project costs. Without many zero-energy "comparables" in the market, EFG had to work diligently to identify an appraiser sufficiently competent in valuing the solar and efficiency of the building. EFG completed the Appraisal Institute's Green and Energy Efficient Addendum (available at www.appraisal-institute.org) to help the appraiser understand the special features and benefits of the project. Providing this assistance to the appraiser and lender helped secure the loan for the \$600,000 project.

De-construction and re-building began shortly after the closing in late 2016 and ran through the summer of 2017. Working with a 150+ year old structure posed its challenges. The Reiss Building crew spent the better part of two months excavating by hand and trolley system the perennial

wet basement, fixing the stone foundation, removing the old cistern, and replacing the sills. While it would have been less expensive to dismantle the building, save all of the old wood, and reuse it in a new structure with the same look and lines of the old building, part of the deal with the Town was to "preserve the frame" of the original building, which meant keeping as much of it intact as possible. The original round spruce log rafters spaced three feet or so apart were replaced with deep scissor trusses to allow for full insulation and a new straight ridge line. However, the rest of the original frame was preserved.

Many of the old rafters, posts, beams, sheathing and decking that were removed were used as trim, posts, caps and accents throughout the building to blend the old with the new. All of the 12-inch window sills feature a piece of the beautiful old sheathing, and all the baseboard and

insulation for R-20, Paradigm R-5 triple-glazed windows, and meticulous attention to air-sealing throughout. While the original farmhouse had 14,000 CFM50 of air leakage, the finished building had just 156 CFM50 (0.45 ACH50) – a nearly 99% reduction to a level lower than the German Passive House air tightness standard (0.60 ACH50). This is one of the most airtight buildings around.

With a well-insulated and tight envelope, it became possible to heat and cool the structure with two Mitsubishi 24,000 Btu per hour cold climate heat pumps serving five zones, installed by E&M Mechanical. Heating and cooling is distributed into individual offices when doors are closed with Panasonic fans on thermostat controls in order to minimize the number of heat pump indoor heads. Water heating is provided with a Rheem

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Old Hinesburg police station before transformation into Energy Futures Group building.

interior window and door trim also shows off the character of repurposed old wood. The original wide pine floor was preserved upstairs in the old building, and new pre-finished brown maple was sourced locally from Exclusively Vermont Wood Products in Bristol for the rest of the wood floors.

Energy efficiency was a central focus. This includes 18 inches of cellulose in the ceilings for R-60, walls with 12 inches of cellulose in the new addition section and a combination of foam sheathing, low-GHG spray foam and cellulose in the walls of the old farmhouse for R-40, spray foam basement walls for R-20, continuous sub-slab and edge expanded polystyrene

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ENERGY-EFFICIENCY IS A KEY DRIVER OF SUCCESSFUL BUSINESS OUTCOMES

From The Energy Alliance Group of Michigan

When the relationship of a strong energy strategy and successful business outcome is clearly understood, energy will never be ignored or overlooked as "just another cost of doing business."

"...a small group of leading edge companies report they now see energy as a key business value driver, and are deploying new technologies and strategies to turn energy into competitive advantage." — Harvard Business Review

An awareness of the benefits associated with a business energy strategy is on the rise as noted by Harvard Business Review. Listed below is a small sample of the many benefits:

1. Productivity increase - a small increase in overall staff productivity from improved comfort¹, reduced noise or better lighting often generates revenue that dwarfs the marginal benefit of efficiency upgrades.

2. Reduced maintenance - accounting benchmarks often take into consideration only the "first costs" of efficiency projects. A reduction in maintenance is ignored even though it yields dramatic dividends via a long term expense reduction and increased production uptime.

3. Building value - According to the U.S. Department of Energy², "The average commercial building wastes 30% of the energy it consumes." Reducing waste

increases Net Operating Income (NOI) which drives a building's market value.

4. Increased occupancy - "Environmentally friendly office buildings have higher rents and occupancy rates as well as more satisfied tenants." Professor Avis Devine³

5. Competitive advantage - anything a business can do to reduce costs and improve efficiency typically builds a competitive advantage. "The choices a company makes about its energy sourcing and consumption can profoundly influence its cost structure." Harvard Business Review⁴

6. Improved cash flow - wasted energy represents money that is already being spent. Reducing wasted energy improves cash flow and the savings, along with energy specific financing⁵, can then be used to pay for the upgrades with no additional expense. Since in many cases the energy savings are greater than the entire cost of the project, essentially it is a "free" upgrade.

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ZERO-ENERGY OFFICE BUILDING

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Prestige heat pump water heater. All lights are LED, and appliances are rated ENERGY STAR. Mechanical ventilation is provided to each office by two Venmar E15 Energy Recovery Ventilators installed by Memphremagog Heat Exchangers. All of the energy for the building comes from 34 roof-mounted 320 watt LG photovoltaic panels, situated on the east-, south- and west-facing roofs for a total of 11 kW, installed by Scott Johnson Electrical. This array will generate approximately 13,000 kWh per year, enough to serve the building's entire annual energy needs. Using an eGauge monitor, each major energy end-use in the building is tracked, recorded and displayed in real-time to encourage occupant interaction with the building. EFG is extremely pleased with the

outcome of the project. It is functional, comfortable, beautiful, fun and will serve as an enduring beacon of what our energy future can be.

For more information, visit <https://www.energyfuturesgroup.com/zero-energy-project/> to view a video of the construction process and final result, including a time-lapse sequence from a camera that was set up in the building next door to take a picture every hour during construction.

Richard Faesy is co-founder and principal of Energy Futures Group (EFG). EFG provides expert consulting services informed by national and international experience in the design and evaluation of energy efficiency and renewable energy programs and policies. For more information visit <https://www.energyfuturesgroup.com/>

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