**Overview:** This project is a much-needed case study of least-cost passive house vernacular design and local constructability. While adhering to strict budgetary constraints for this single-family home, the North River Architecture design team met the energy performance goals of PHIUS+ Passive House Certification and Net Zero Energy while also embracing a farm building type design concept that complements the region's Dutch farming history. Simplicity and durability were prioritized with long-term use in mind: the structural span design allows for future renovations and interior expansions for multiple future configurations.

**Design Challenges:** A significant challenge in mid-market Passive House design is to find a workable ‘sweet spot’ between investments in high performance building design and emotional aliveness in the experience of personal shelter. To accomplish this for a mainstream U.S. market that still resists the reality of the energy crisis that it has created is even more difficult. More demonstration projects are needed to make the case for affordable, alive, zero energy housing.

---

| **Location:** | Accord, NY, USA |
| **Climate Zone:** | 6 |
| **Size:** | 2,755 s.f. |
| **Levels:** | 2 |
| **Construction:** | Timber |

| **Walls:** | Vented rain screen, 4” John Manfield foiled-faced polyisocyanurate fully taped (WRB), Zip sheathing w/ Zip tape (air barrier), 2x6 Stud wall w/ Nuwool dense-pack insulation, Gypsum wall board (R-42 Total) |
| **Roof:** | Engineered roof truss system w, 24” Nuwool cellulose insulation, Zip sheathing at ceiling (air barrier), 2x2 furred electrical chase, Gypsum wall board. Unconditioned attic. (R-67 Total) |
| **Floors:** | Insulfoam type IX EPS insulation, 8” compacted gravel (sewer chase), 5” concrete slab (R-37 Total) |
| **Mechanicals:** | Ventilation: Zehnder CA350 HRV |
| **Windows:** | Window Frame: Zola Classic Clad, U=.23 Uinstall=.015v Window Glazing: Zola Legacy Glass, U=.111 |
Design Solutions - Site: The site is a shale bank, otherwise undesirable for residential use. This project restored and made use of a compromised site and as a result is regenerative for the landscape. The building is oriented to maximize solar exposure, and its architectural elements and elevation are tuned to provide solar heat gains in heating periods while reducing gains in cooling periods.

Design Solutions - Envelope: North River used a simple assembly familiar to conventional contractors. The 2x6 sheathed construction is a standard, easy to build air-tight membrane with simple, well executed details. The continuous insulation is also simple, with no additional sheet membranes needed.

Design Solutions - MEP Systems: The centralized and efficient layout makes for shorter runs & simple detailing. The open space planning contributes to balanced conditioning. Ductless heat pump units are a least cost solution and are architecturally integrated into the finishes and surfaces where possible.
Lessons Learned:

“We found great success in our foundational concept of designing the simplest possible house so that the Passive House premium could be accommodated within strict budget constraints.”

By designing a simple gabled volume and using conventional building materials and techniques, we were able to work with lower cost contractors and subcontractors, train them on the job, and achieve remarkable airtightness and construction quality.

We didn’t have to sell PH to the client, who is Senior Designer at North River Architecture – he was an advocate already for the energy cost and comfort advantages of PH. In order to push this building beyond PH performance and into a truly cost-positive reality, the installation of a 9kW rooftop photovoltaic array brought the project to Net Zero energy performance on an annualized basis.

This is inclusive of maintaining a car charge station for his electric hybrid vehicle, so his annual transportation expenses have also been positively affected by this PH project.

Using Zip sheathing products and SIGA tapes was a huge success in simplicity and airtightness. The carpenters and subcontractors had no issues with following airtightness protocols on the jobsite. Final blower door test results were .042 cfm/sf.

Would do again: Use large scale windows on south façade along with thermal mass floor, building shading devices and adjacent deciduous tree shading. Aside from energy-driven design, the architectural and emotional impact of expansive glass areas has been an enormous design success.

Wouldn’t do again: We love the simplicity and low cost of frost-protected shallow foundations, but we would not design a haunched slab on grade again on a site that isn’t close to level. We had a 6 foot drop at one building corner that proved to require a significant amount of site work to bring to level.

THE TEAM

Architect: North River Architecture & Planning, PC
nriverarchitecture.com

Client/Owner: Peter Reynolds

Builder: Reynolds Design Associates, Inc.

CPHC: John Loercher, Northeast Projects
www.ne-projects.com
Stephanie Bassler, North River Architecture & Planning
nriverarchitecture.com

PHIUS+ Rater: Troy Hodas
facebook.com/SpruceMountaininc

Mechanical Systems Designer: Baukraft Engineering
baukraft.com

Structural Engineer: Kaaterskill Associates
keaeng.com

Photographer: Deborah DeGraffenreid
deborahdegraffenreid.com