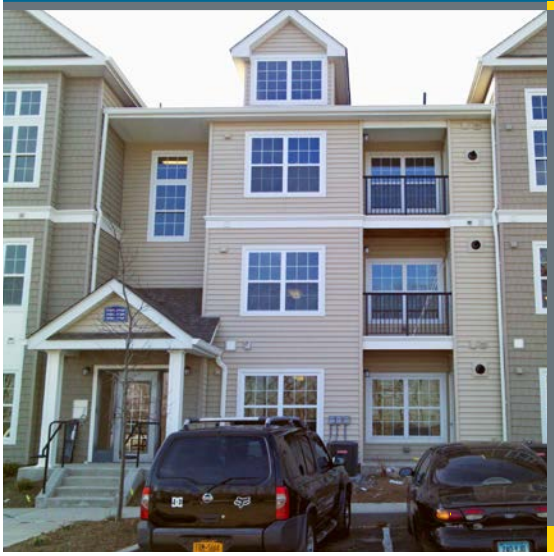


Building America Case Study

Multifamily Zero Energy Ready Home Analysis

Elmsford, New York

PROJECT INFORMATION

Project Name: Avalon Green III

Location: Elmsford, NY

Partners:

AvalonBay Communities
avaloncommunities.com

Advanced Residential Integrated Solutions Collaborative (ARIES)

Building Components: Whole building

Application: New construction, multifamily

Year Tested: 2015

Applicable Climate Zone: 4

PERFORMANCE DATA

Cost of energy-efficiency measure (including labor): $1,000–$1,300 per unit

Projected source energy savings: 2%–5%

Projected annual energy cost savings: $17 per apartment and $95 per townhome

AvalonBay Communities, which is a large multifamily developer, was developing a three-building complex in Elmsford, New York. The buildings were planned to be certified to the ENERGY STAR® Homes Version 3 program. This plan led to AvalonBay partnering with the Advanced Residential Integrated Solutions (ARIES) collaborative, which is a U.S. Department of Energy Building America team. ARIES worked with AvalonBay to redesign the project to comply with Zero Energy Ready Home (ZERH) criteria. The team determined what changes would be necessary and the relative costs and benefits that would arise. ZERH is a U.S. Department of Energy recognition program that builds upon the building science requirements of ENERGY STAR and incorporates best practices demonstrated by the Building America program. ZERH has higher thermal insulation requirements than ENERGY STAR and incorporates a series of additional mandatory provisions related to indoor air quality, domestic hot water conservation, and renewables, among others.

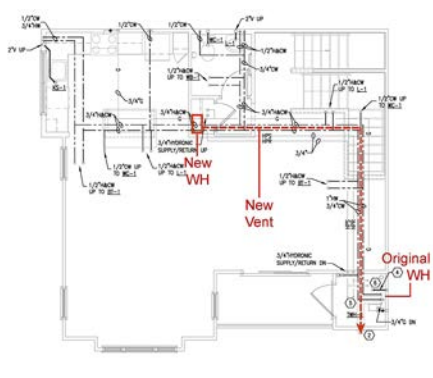
ARIES reviewed the planned specifications, conducted energy modeling, and obtained cost data. The upgrades required for ZERH compliance included the following:

- Increasing the exterior rigid insulation thickness from ½ in. to 1 in. (R-3 to R-6)
- Relocating the water heaters to more central locations to shorten pipe runs
- Bringing top floor ducts into a dropped soffit in townhome units
- Upgrading to MERV 8 filters from MERV 6
- Adding rodent screens to vents
- Protecting ducts during construction and cleaning them afterward
- Installing exhaust fans in the townhomes' attached garages.

Building America® U.S. Department of Energy

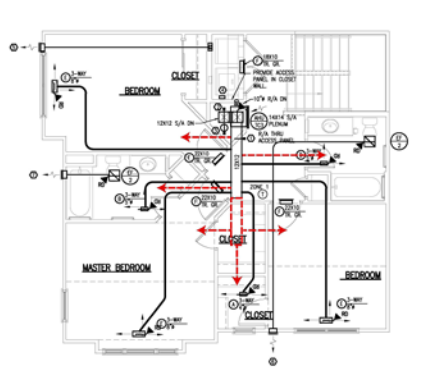
WATER HEATER AND DUCT LOCATION DESIGN MEASURES

Relocating the water heaters reduced pipe length and the wait time for hot water considerably.



Townhome unit domestic hot water revisions

Bringing ducts into conditioned space required a soffit in a second-floor hall but also considerably reduced duct runs. One potential tradeoff: moving registers away from their traditional locations near windows is recommended only if the windows have a high thermal integrity—otherwise comfort could be compromised.



Townhome unit duct revisions

For more information see the Building America report *Zero Energy Ready Home Multifamily Case Study Analysis* at *buildingamerica.gov*.

For more information about ZERH visit *energy.gov/eere/buildings/zero-energy-ready-home*.

Image credit: All images were created by the ARIES team.

The most significant change was increasing insulated sheathing thickness from R-3 to R-6. The additional ½ in. would not introduce many construction complications, but the added cost was the largest of all changes—$1.04/ft^2 of wall area.

Relocating the water heaters from exterior mechanical rooms to closets in the centers of the homes would reduce wait time for hot water at most fixtures; it would also save water heating energy and water. Based on annual water draw profiles generated by a National Renewable Energy Laboratory draw generator tool, water savings were estimated to range from 600 to 1,000 gallons per apartment per year; site energy savings estimates ranged from 300 to 400 kBtu per year. After accounting for savings in piping, net costs for this change were modest (about $50 per apartment or less).

Three of the changes are intended to improve indoor air quality by avoiding dust in ductwork, increasing filtration, and preventing garage contaminants from infiltrating the home. Costs for these changes were estimated at $50 per apartment and $170 per townhome.

Moving ducts into conditioned space reduced designed ceiling height in the townhome second-floor hallway and closet. However, costs were negligible because the increased framing costs were largely offset by reduced ductwork. Heating and cooling equipment capacity was reduced in the larger unit, which saved about $300.

Lessons Learned

- Only seven changes were required to upgrade from ENERGY STAR to ZERH; the total costs for these changes were relatively modest: $1,000–$1,200 per unit.
- The projected source energy savings of upgrading from ENERGY STAR to ZERH were about 2%–5%.
- Many of the changes would result in nonenergy benefits such as improved indoor air quality and superior domestic hot water service.
- A number of the changes, which included relocating the water heater and ductwork, resulted in little to no added construction costs.

Looking Ahead

Comparing these projected costs and savings to measurements from a completed project would be a natural next step.

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For more information visit
buildingamerica.gov

The U.S. Department of Energy Building America Program is engineering the American home for energy performance, durability, quality, affordability, and comfort.

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