



## Building America Best Practices Series

Volume 16. 40% Whole-House Energy Savings in the Mixed-Humid Climate

# Case Study: Tindall Homes

The Legends at Mansfield | Columbus, NJ

Tindall Homes' energy-efficient Morgan model in The Legends at Mansfield community uses 49% less energy than the Building America benchmark (2008).

### BUILDER PROFILE

**Builder:** Tindall Homes

**Contact:** Mark Bergman (former owner, the company has been sold)

**Founded:** 1986

**Where:** Princeton, New Jersey

**Employees:** 10

**Number of homes per year:** 20 to 30

**Development:** Legends at Mansfield, Columbus, New Jersey

**Size:** 20 homes, 3,800 to 6,000 ft<sup>2</sup>, 4 to 5 bedrooms, 3 to 4.5 baths

**Price Range:** \$700,000 to \$900,000

Swedish native Mark Bergman launched Tindall Homes in Columbus, New Jersey, in 1986 with a mission to build homes with greater durability and energy efficiency than other houses on the market.

Bergman found an ally in Integrated Building and Construction Solutions (IBACOS), a research team in the U.S. Department of Energy's Building America program. With design analysis and advice from IBACOS, Bergman built 20 luxury homes at The Legends at Mansfield community in Columbus, New Jersey. These homes use 40% to 49% less energy than a code-built home and achieve an average HERS score of 58. (A typical new American home has a score of 100—lower scores indicate greater energy efficiency). For the buyers of Tindall Homes' Morgan design, for example, this translates into calculated annual energy savings of \$1,541. With the addition of a solar photovoltaic system, the energy efficiency increases another 5% to 8%.

“Over their lifetimes,” Bergman predicted, “our houses will save more in energy costs than the purchase price.” Bergman said greater durability is another benefit of applying Building America recommendations.

## Energy-Efficiency Features

Tindall Homes targeted move-up homebuyers in the luxury housing market by offering large floor plans with two-story spaces and high-end finishes. During the design phase of The Legends of Mansfield houses, IBACOS recommended several above-code options that would work together to create a high-performance home. These included advanced



Tindall Homes installed their optional grid-tied solar photovoltaic systems on backyard garden sheds, situated for maximum solar gain. Wiring for the systems runs underground from the shed to the home's basement.

wood framing, spray foam wall insulation, precast insulated foundation walls, increased attic insulation, a heat recovery ventilator, a tankless gas water heater, and energy-efficient HVAC and lighting.

Advanced framing conserves lumber and provides more space for insulation. By upgrading from the 2" x 4" conventional stud walls located 16" on center to 2" x 6" studs placed 24" on center, the builder was able to significantly decrease conductive heat loss through exterior walls. Three inches of closed-cell polyurethane spray foam within the walls increased the insulation to R-18, sealed penetrations, and improved air tightness.

The precast concrete foundation system with integral R-12.5 insulation board within the wall cavity provides an airtight basement and a more comfortable home year-round than a traditional block or site-poured concrete foundation.

The builder insulated the vented attic to R-49 with a combination of R-30 kraft-faced fiberglass batts and R-19 blown cellulose. The overhanging floors contain 2" of urethane foam (R-12) and R-30 kraft-faced fiberglass batts to equal R-42.

A direct-vent tankless gas water heater provides hot water instantly as needed, which is more energy-efficient than continuously heating a large tank of water.

Since IBACOS' recommendations reduced the houses' energy needs, Tindall Homes was able to reduce the size of the heating and cooling equipment. The two optimally sized 92% AFUE direct vent natural gas furnaces and two 13.5 SEER air conditioners are of smaller capacity than standard, reducing the cost to the builder by \$800 and contributing additional energy savings for the homeowner. Due to the large size of the homes, one HVAC unit was located in the conditioned basement and the other was placed on the second floor. There are four thermostats in the homes that control the temperature for four independent zones. This



Insulated precast concrete foundation walls, spray foam-filled frame walls, and R-49 of attic insulation keep the Tindall homes in Columbus, New Jersey, warm in winter and cool in summer.

option gives the homeowner more control of the comfort levels in the home, where needed, and provides opportunities to use less energy. All of the ductwork is located within conditioned space.

## Innovation

Fourteen of the 20 Legends of Mansfield homes are equipped with a 2.64-kilowatt solar photovoltaic (PV) system that is tied to the grid. Since some of the houses with solar systems could not be oriented for optimal solar collection, Tindall used an innovative solution. They built specially designed garden sheds in the back yards of those homes and mounted the PV panels on the shed roofs. The sheds have a short pitched roof in the front and a long, 40-degree sloped back roof oriented to the south for the PV panels. Wiring for the system runs underground from the shed to the house, and the inverter is in the basement.

## Health, Durability, Sustainability

To improve indoor air quality, Tindall Homes replaced the standard ventilation system with a heat recovery ventilator (HRV), connecting it to the return plenum on both furnaces. This upgrade provides a way to bring in fresh air and capture much of the heat contained in outgoing air before it exhausts to the outside.

“Incoming air in the winter may be only 30 degrees. If you warm it 20 degrees with exhaust air, then you are enjoying this heat virtually free,” said John Clark, construction supervisor for The Legends at Mansfield. The HRV system provides improved ventilation, better air quality, and enhanced occupant comfort.

## Dollars and Sense

Tindall Homes had planned to build 39 houses in The Legends of Mansfield community, but due to the downturn in the market for luxury homes, only 20 houses were completed. The houses are two-story, single-family dwellings ranging in size from 3,800 to 6,000 ft<sup>2</sup>, with 3 to 5 bedrooms and 2.5 to 3.5 bathrooms. Prices ranged from \$700,000 to \$900,000.

The representative model for this case study, the 4,700 ft<sup>2</sup> Morgan, has 4 bedrooms and 3.5 baths. Analysis by IBACOS showed the Morgan model used 49.2% less energy than the 2008 Building America Benchmark without PV, and 55.9% less energy when PV is included. The energy efficiency upgrades (not including PV) cost nearly \$18,000 per house, which adds \$1,699 a year to a mortgage (based on a 30-year term and 7% interest). But the homeowner enjoys an estimated \$3,240 a year in energy savings, for a net annual gain of \$1,541.

## Key Features

- Basement insulation: Integral R-12-5 insulation board
- Advanced framing, 2 x 6, 24-inch o.c. walls
- Wall insulation: R-18 closed-cell spray polyurethane insulation
- Windows: U-value=0.36, SHGC=0.33
- Attic: Vented, R-30 fiberglass batt and R-19 blown cellulose insulation
- Blower door test: 3.2 ACH50
- Ventilation: 50 cfm heat recovery ventilator
- Two 92% AFUE natural gas furnaces
- 13.5 SEER air-conditioner
- Ducts in conditioned space
- Duct blaster test: <6% total leakage
- Two tankless gas water heaters, 85 EF
- 95% CFLs
- 2.64 kW grid-connected photovoltaic system available
- Average HERS score: 58

Table 1. Added Costs and Savings of Energy-Efficiency Measures for Tindall Homes

Total Energy Savings*	49%
Total Added Builder Costs**	\$17,630
Annual Mortgage Payment Increase***	\$1,699
Annual Utility Savings	\$3,240
Annual Net Cash Flow to the Homeowner	\$1,541

\* Compared to the Building America benchmark.

\*\* Costs are based on builder estimates and manufacturers' data. These costs do not include solar photovoltaic systems and do not reflect rebates, incentives, and subsidies.

\*\*\*The annual mortgage payment is an estimate calculated by CARB and is based on a 30-year mortgage with a 7% fixed interest rate.

## The Bottom Line

“If all builders built to save 50% on energy use, we could make a big difference,” Bergman said. “We all want to make money, but at some point, as a society, we have to evaluate what we are doing. We take seriously our responsibility to the surrounding community, to the environment, and most importantly to our buyers.”

“It’s important to recognize that many of the things that make our houses more energy efficient will also make them last longer,” said Bergman, who noted that features like aggressive air sealing help keep out humidity and dampness.

### For More Information

www.buildingamerica.gov  
 EERE Information Center  
 1-877-EERE-INF (1-877-337-3463)  
 eere.energy.gov/informationcenter

