



## Case Study:

### LEED Gold Certified Single Family Home

Habitat for Humanity, Worcester

#### Summary

Habitat for Humanity Metro West/ Greater Worcester conducted a highly-efficient remodel for a home at 79 Kendig Street in Worcester. This Habitat affiliate contracted The Center for EcoTechnology (CET) to provide high-performance building expertise and certification services to assist in ensuring that this project reached its lofty efficiency goals. “We chose to partner with CET because of their experience with both deep energy retrofits and LEED for Homes. That decision turned out to be the most crucial for the success of the project”, said Jon Bram of Habitat. With dedication from Habitat and guidance from CET, this home received a Home Energy Rating System (HERS) index of 8, ENERGY STAR Certification, and is on track to receive LEED Gold Certification.

#### Decision to Build Green

Much of the drive to renovate the home to such high energy-efficiency standards came from Habitat for Humanity’s ambitious goals. Most Habitat projects attempt to make efficiency-driven decisions wherever they can because they understand that the more efficient a house is, the more cost effective it is for the resident. However, because efficiency to this degree is groundbreaking work for this Habitat affiliate group, they worked closely with CET experts to strategize and construct this high performance house. Jon Bram, construction manager for this project, commented, “Habitat for Humanity MetroWest/Greater Worcester has always strived to build energy-efficient homes. Delivering durable, low maintenance, healthy homes with low energy costs to the low and moderate income families we serve is critical to their success as first-time home owners. The stars aligned at our project at 79 Kendig Street for us to up our game and attempt our first deep energy retrofit and first LEED certified home.”

#### Construction Plan and Process

Before construction began, CET’s building scientist, Mark Newey, met with Habitat staff to review building plans and discuss efficiency measures that would be incorporated throughout the process to ensure they would accomplish their ENERGY STAR and LEED certification goals. Throughout construction, Mark visited the site to make sure that all energy-efficiency measures were proceeding smoothly and to conduct necessary testing for all certifications and ratings. In this case, due to the ambitious efficiency goals of this project, Mark conducted a blower door test prior to the installation of the cellulous insulation to guarantee the air tightness of the house’s envelope. Finally, after construction, Mark held a meeting with Habitat to go through all documentation necessary for LEED certification. Throughout the project, Habitat appreciated Mark’s vast knowledge of building science and the complex certification programs as well as “his ability to patiently communicate what needed to be



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#### At a glance:

- Single family home in Worcester, MA
- Habitat for Humanity Metro West/ Greater Worcester
- HERS Index: 8
- On track for LEED Gold Certification
- ENERGY STAR Certification
- Estimated annual energy costs: \$215

done in a way that was easy to understand. And when ‘surprises’ occurred during construction (as they always do in remodeling) Mark was very accessible and engineered practical solutions quickly.”



Mark also calculated the Home Energy Rating System (HERS) index for the home, which is necessary to ensure that the building meets the Massachusetts Energy Code, as well as for ENERGY STAR and LEED certifications. Calculating the HERS index is a process that runs throughout construction and takes into consideration the heating system, insulation, square footage, ventilation, air leakage, and much more. The final HERS index is determined by comparing the energy efficiency of the home to that of a similarly sized home that complies with the 2006 International Energy Conservation Code; a lower index signifies greater efficiency. This project received an impressive HERS index of 8 out of 100, showing that it is much more efficient than the average home built today.

### **Energy Efficiency Plan**

Due to the high efficiency goals of this project, there were many measures taken at each step of construction to increase the house’s energy efficiency. Habitat worked closely with CET’s experts to plan and execute efficiency measures that would help them reach those goals.

To conduct a deep energy retrofit, Habitat took a pre-existing home, reused the existing frame, flooring, and foundation, but deconstructed and renovated everything else to be more energy efficient. This approach vastly decreased the energy consumption and waste from the construction process because they were able to reuse large structural aspects of the home.

A lot of attention was paid to the creation of an efficient heating and cooling system within the home. The heating system chosen was a dual fuel heat pump, which is an innovative pilot project that uses electric energy most of the time; when outside air temperature drops, the system switches to gas. This heating system could potentially operate more efficiently than heating and cooling with gas alone. Additionally, to ensure that the ductwork could do its intended job of delivering hot or cool air, all of the ductwork was built inside of the thermal envelope of the house. An Energy Recovery Ventilator (ERV) was also installed to decrease heat loss during ventilation and improve indoor air quality by bringing in fresh air while transferring the heat or humidity level from the outgoing air to the incoming air.

### **Energy Efficiency Measures**

- Solar panels
- Dual fuel heating system, gas and electric
- Programmable thermostat
- Electric heat pump
- All of the ductwork is inside the thermal envelope of the house
- Energy Recovery Ventilator (ERV) used for ventilation system
- Vaulted ceilings insulated with rigid foam board and cellulose packed into framing cavities (R-68.6)
- Above grade walls insulated with rigid foam boards and cellulose (R-44.0)
- Foundation Walls (R-28.6)
- Triple glazed windows (R-5)
- 100% efficient lighting

The insulation and thermal envelope of the house were monitored closely throughout the building process to ensure the highest efficiency. Mark conducted air leakage testing prior to the installation of insulation to ensure the air tightness of the thermal envelope. For insulation, both the exterior walls (insulated to R-44) and ceiling (insulated to R-68.5) received rigid foam board on the outside, and cellulose insulation packed into the wall and ceiling cavities. Finally, triple-glazed windows were used, which have an R-Value of 5. All of these factors came together to produce a highly efficient home.

Ultimately with the guidance of CET’s experts, this home received ENERGY STAR certification and is expected to receive LEED Gold certification. It is also expected to have an annual energy cost of only \$215. At the completion of this project, Jon Bram stated, “79 Kendig St is a home that our organization is very proud of. We learned a great deal through the experience that we now apply to all our rehab and new construction builds.”

If you are interested in learning more about how CET’s High Performance Building Services can help you meet the new energy codes and save energy and money on your next project, contact us at 413-586-7350 ext. 242.