STEM

Evaluation of an Energy-Efficient House in Lafayette, Indiana

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By definition, a net-zero energy house produces as much energy as it consumes on an annual basis. A team of Purdue students built the INhome in 2011 as a highly efficient net-zero energy building. It has a footprint of 984 ft² and had a cost of \$258,000 to construct. The INhome was constructed for the 2011 Solar Decathlon, an annual worldwide competition in which university students compete to design, build, and test energy-efficient homes.

Once the competition was completed, the INhome was disassembled, transported to Lafayette, Indiana, and reconstructed, including all sensor and measurement devices. In 2013, a couple purchased the house and moved in. The sampled data from January 2013 to July 2014 were used to evaluate the INhome performance.

The INhome is equipped with 36 roof-mounted photovoltaic panels with an area of 13.4 ft² each. Data from the house confirmed that the panels had an average conversion efficiency of 16.8% without any maintenance during the relevant months. In terms of net-zero energy, the production of solar electricity was 43% higher than the consumption for the measurement period, which includes the snowy winter months of 2013–2014. This makes the house more than net-zero for its current location.

Further analysis of the energy data for the INhome showed that the control system for monitoring net-zero

performance required one quarter of the total energy consumption. Since this would not be necessary for home applications, it would be even easier for a typical homeowner to achieve net-zero energy. Furthermore, other installed energy-efficient technologies, such as the energy recovery ventilator, showed a satisfying performance and confirmed the INhome's status as a high-efficiency building.

Research advisor William Hutzler writes, "Reinhard Mietusch was an exchange student from Dresden University of Technology in Germany. He was very productive during his short 6-month stay at Purdue. He built a test apparatus to improve the design of the Biowall, a living plant filter that improves indoor air quality in buildings, and also assisted in evaluating the performance of the INhome, a net-zero energy home built by Purdue students in 2011."

The INhome at its current location in Lafayette, Indiana.