

Energy Balance

Energy Balance guides team decisions in every category of the Solar Decathlon. The house earns full points for producing at least as much energy as it consumes during the duration of the contest.

This factors into every single other contest:

- **Architecture:** Does the design of the house and its lighting allow for maximal use of the sun's ability to heat, illuminate, and provide power?
- **Market Appeal:** Can our house have sustainable features and still be desirable?
- **Engineering:** How can we reduce energy use through technology?
- **Communications:** How can we demonstrate the promise of renewable energy to visitors, judges, and the larger community?
- **Affordability:** How can we choose construction features that are both sustainable and affordable?
- **Comfort Zone:** How can we save energy in the heating and cooling of the home?
- **Hot Water:** What available technologies can heat water quickly and efficiently?
- **Appliances:** How do we ensure the appliances do not adversely affect energy use?
- **Home Entertainment:** What kind of entertainment system will use the least power while still providing a welcoming environment for guests?

Many of these issues have been discussed in previous write-ups. The purpose of this segment is to focus on how the house balances energy generation through photovoltaic power with energy savings through design choices.

Radiant House features 28 Bosch photovoltaic panels, estimated to produce 308.7 kWh during the competition. This exceeds the team's predicted energy budget (due to HVAC, water,

appliances, lighting, controls, and home entertainment) of 230.1 kWh. Should these estimates prove accurate, the house will generate 80 kWh of surplus energy.

What is most astonishing is how little energy the house will use. The US Energy Information Administration found that the average American home in 2009 used 89.6 million Btu's, which is equivalent to 1000 kWh over the course of two weeks. This means the solar house uses less than a quarter of the energy of a typical home.

This impressive statistic is made possible by the dozens of energy-saving choices made by the team. The appliances are all known for their high efficiency. Solar thermal heating reduces the heating load on the hot water pump. The LED lights use very little energy, and they rarely need to be used during the daytime because of the large windows that let in natural light. Radiant heating and cooling requires less energy than traditional forced-air systems. The insulation of the home will reduce thermal losses. All of these factors together have resulted in very low energy usage. Coupled with the energy generation by the solar panels, the team is confident in the house's ability to achieve energy balance.

The Energy Balance competition does raise the question of whether solar power is the best source of energy. There are compelling arguments for and against photovoltaic panels. Solar power, when compared to other renewable alternatives like wind and hydroelectric power, is really the only option for communities with established infrastructure. Solar panels can be retrofitted onto existing structures and do not require a power plant or miles of available land to install turbines and equipment. In a similar way, solar power has incredible promise for the developing world, allowing individuals to generate their own free electricity without having to wait for the community to garner enough resources to develop an electrical grid. Solar-powered

lamps, incubators, and cell phone chargers have already provided crucial and often lifesaving technology to impoverished people.

However, this does not mean that solar power is the best option for large-scale residential implementation. There are still many technological drawbacks, including low efficiency and that annoying problem of nighttime. The cost is also more expensive per kWh than wind, geothermal, hydroelectric, coal, or natural gas. Solar panels require lots of space and specialized roof construction to be most effective, which is why they are not an immediate solution for crowded slums. In order for solar panels to be able to provide adequate energy, the house must also consume less energy than the average American home. As shown by the Solar Decathlon houses, solar power works best when paired with energy-efficient technologies and a sincere desire to reduce waste and live sustainably.

Nevertheless, the future of renewable energy looks bright. A study by the National Renewable Energy Laboratory estimated that by 2050, [80% of the US's energy needs could be met by renewable sources.](#) The key is that these technologies must work together for this to happen. The Solar Decathlon competition shows it is possible to build an entirely solar-powered home, but realistically, an entirely solar-powered community would be very difficult to create. This will require a paradigm shift, from relying entirely on one set of fuels and one set of technologies, to looking for an integrative and individualized solution that best takes advantage of the available resources within each community.

The Solar Decathlon is an important effort to bring attention to solar energy and to demonstrate that it is possible to build a home with an energy balance in favor of the environment. Still, it is important to remember that global energy balance will require more than PV panels.