STRIVING FOR NET ZERO WITH SOLAR AND HEAT PUMPS

Josef and Linda Mueller have been making improvements to their home since 2010 with a goal of achieving net zero energy.

Homeowner: Josef and Linda Mueller
Year Built: 1976
Style: 2-story contemporary
Size: 2,900 square feet
Electric home features:

- Air-source heat pumps
- Electric vehicle charging
- Insulation in attic cielings
- Pipe insulation
- Weather sealing of door seals
- Heat shield in attic
- Rooftop solar PV

Josef and Linda moved to Concord in 2010. They studied their energy needs for their new home for the first year and developed a goal to try to make their home net zero energy. In 2011 they started to making energy improvements.

Motivation for going electric

In 2010 after they moved back to the US from China and had purchased their new home in Concord, Josef and Linda Meuller decided to set a goal of net zero energy for their new home. They wanted to save on energy costs and were attracted to solar PV due to the incentives and rebates at the time that reduced the simple payment to under 7 years. In China, everybody used heat pumps so it seemed very natural for the Muellers to use a heat pump system. Also, going to a heat pump system seemed like a logical transition when replacing their primary home AC unit.

Journey to net zero

The Muellers began their journey to a net zero energy home by making energy efficiency improvements. In 2011, they installed ceiling insulation throughout their home and also installed a 8.7 KW solar PV system on the southwest facing roof.

In 2013, they moved on to replacing some of the natural gas heating equipment with more efficient equipment. They also decided to replace their aging air-conditioning unit and selected a heat pump instead of a conventional fossil fuel air conditioner. The heat pump option was only $100 more and made sense because it could be used not only for AC, but also for heating the home in the fall and spring months. The heat pump they installed in 2013 was designed to operate efficiently for heating when the outdoor temperature is above 38 degrees. (Newer heat pumps have a higher efficiency rating and can operate at much colder temperatures.)

More recently, the Muellers have continued their journey by transitioning to electric vehicles. They replaced two hybrid vehicles with electric vehicles in 2018 and installed a 240V Level 2 charger in their home.

The Muellers chose heat pump installer based on cost and reliability. Brian Foulds, a Concord resident, was extremely helpful, since he was one of the pioneers in Concord with solar PV in Concord. The Mueller house was the 8th in town to add solar PV.

$1,500

Annual cost savings from solar PV

8.7 KW

Solar PV system installed in 2011

2

Electric vehicles purchased in 2018 and charged at home

A comfortable and cost-effective home

Overall the Muellers are very satisfied with the improvements they have made to their home. They are very happy with the insulation, solar PV, and heat pumps. Their heat pump systems work great but they do still need the backup furnace for heating during extreme cold days. They could improve this by updating their heat pump with a newer cold-weather heat pump. The on-demand hot water has taken some time to get used to because hot water is not available immediately like with a water tank. Their home is very comfortable and they love driving their electric vehicles.

Challenges to getting to net zero

Josef and Linda are disappointed they haven't been able to get to net zero energy yet. One of the challenges is limited solar PV generation. As an early adopter, the process of getting solar was not as smooth as they would have liked. Their solar system has worked well over the 10 years, although the financial benefits have been variable with changes to the SREC program and CMLP policies over the years. Another challenge is the system now requires some maintenance and the original installers are no longer in business.

The Muellers also wish they had known more about the tradeoffs between gas and electricity. In retrofitting their heating systems and adding solar, they sought to find a balance between the cost savings from having their own solar PV array and the costs of electricity for the heat pump and for natural gas heating fuel they would need. Finding the balance they sought has proven to be challenging and may require monitoring and data collection over the years.

Advice for others

The Muellers' advice for others is Getting a Solar PVs to generate your own electricity is a prerequisite for net zero. They suggest looking at four big areas for energy saving, in the following order – insulation, solar PV, heat pumps, electric vehicles.

Interested in how heat pumps can make your home more comfortable and sustainable?
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