Going zero net energy and loving it

Zero-net-energy (ZNE) homes are not for everybody, but those who try love what they can achieve, explains Perry Sioshansi in his latest *Letter from America.*

Trail blazers

When the commissioners at the California Energy Commission (CEC) unanimously approved a controversial building code that requires virtually all new residential buildings to meet zero net energy rating in California starting in 2020, the naysayers said it would be too expensive, couldn't be done, nobody would want to buy or live in one, etc., etc.

But homebuilders around the state have in fact already been building and selling them and – so far – there have not been any riots. The new code adds roughly 2% to the cost of the average. new home – true – but this extra upfront cost will be more than fully recovered over the long life of typical buildings. The code is not dissimilar to mandating more efficient refrigerators, TVs, cars, or virtually anything else that uses energy.

The good news is that ZNE phenomenon is spreading in other states in the US, in Europe and elsewhere – even in the absence of a regulatory mandate. While still a niche market appealing to the environmentally minded and upper end of the new housing market, it is taking root as more homebuyers demand it and more architects and builders learn how to build them.

First movers

A case in point is a new ZNE home recently completed by Ben and Joyce Schlesinger in St. Michaels, Maryland (photo above). In building the customized ZNE, the couple had three main goals – beauty, functionality, and environmental compatibility, in that order.

Schlesinger's ZNE home has a number of design features few homeowners or homebuilders have heard of. To start off, they drilled eight geothermal wells 220 feet deep into the ground to extract heat from the ground. The house also incorporates ground-source heat pumps, SEER 45 – as efficient as you can buy on the market today.

The house has rooftop solar PVs – 50 Sunpower high-efficiency 360W panels, providing 18kW of generation capacity. They are awaiting the installation of not one or two, but three Tesla Powerwall batteries, enough to power the home through the night and, together with the solar panels, hopefully beyond, in emergencies.

Not surprisingly, the Schlesingers are early EV adopters, with not one but two Teslas, a Model S and a new Model 3, which they intend to charge from their own solar panels to the extent possible. They intend to rely as little on the grid or the fossil fuel industry as possible.

Getting going

For over a year, Ben has been posting periodic updates on the house as it moved towards completion. His November 2018 posting reads, in part, "Rains have severely reduced solar energy production, but on even partly sunny days, energy use has been balancing out this fall – and that's with HVAC and hot water systems, the kitchen, and lighting all up and running!"

Pointing out that the house is *not* off-grid, Ben said "This house is on-grid … but … we've sized our battery storage large enough to let us use all excess solar energy during evening peak periods and at night […]. Also, together with the solar panels, the Powerwalls will serve as our emergency back-up generator in case the house loses power."

Knowing the electricity business in-and-out, Ben explains that his intention is to run the EVs on solar-generated power when and if possible. He said "We will charge them during daylight hours so they'll be running on solar energy, versus PJM's coal-dominated daytime energy mix. Then, on evenings after charging the cars, what happens depends on season – on winter nights, the house will probably need to use electricity from the grid, which at that point relies mostly on high-efficiency natural gas turbines; on summer nights after charging the EVs, we expect the Powerwalls will

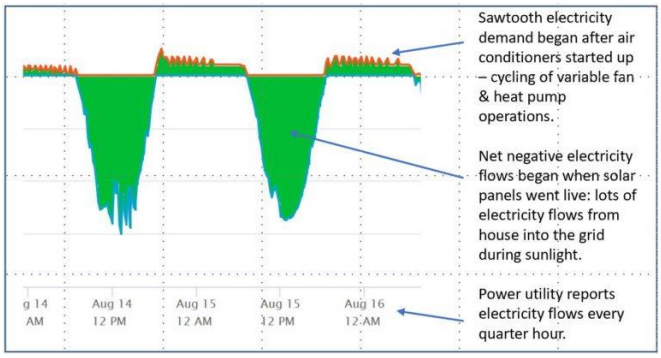
Source: http://bsaenergy.com/wordpress1/

hold enough solar-generated electricity to make it till dawn without buying electricity."

Moving in

In late Dec 2018, Ben reported "We've moved into our new home … just paid an $11 electric bill … very low because we're … roughly matching solar and geothermal production to demand - this includes all HVAC, lighting, refrigeration and three EV car chargers. Could rise, however, with more intensive use and colder outdoor temperatures."

Figure 1: The house produces far more than it uses on sunny days



Source: http://bsaenergy.com/wordpress1/

Clearly Ben is a pioneer and an early adopter with the aim of experimenting, recording and reporting his findings. He has set up his house as a laboratory. On the website he asks: "What did all this cost, and will it ever pay back? How much carbon are we preventing from entering the atmosphere, and what's our per-unit avoided cost of carbon? Will we actually be carbon neutral? Stay tuned. We'll know once we've gotten a full year of operations under our belt."

Obviously, what Ben has done, or is attempting to do, is not for everyone. And not everyone has his knowledge or the financial resources that he has put into the project. But there are probably many Schlesingers elsewhere in the world who would like to accomplish similar feats once pioneers like Ben show the way and many of the technologies employed move mainstream over time.

Coincidentally, at a cocktail party over the holidays, your writer ran into a couple who have purchased a large plot of land in a rural part of California with the idea of developing it into an off-grid community. The idea is to lease or sell cabins on the property to other like-minded retirees who wish to get away from it all – utility bills and much more. The community may have shared spaces such as lounge and entertainment facilities with private cabins spread around the property.

I encouraged them to look up the Schlesinger website to get ideas on building highly efficient buildings. Eco-friendly living may appeal to many as the technology improves and the costs decline.

Further details on the performance of the Schlesinger house as data becomes available over time. Information may be found online at: www.bsaenergy.com/wordpress1.

Down your way

Probably the best-known example of a GB project along these lines in the UK is the Solcer House in South Wales – the UK's first replicable, energy positive, low-cost home. This also utilises technologies such as solar PV paired with battery storage to provide an off-grid alternative to centralised power generation. The highly-insulated construction, which was completed in 2015, also utilises an air source heat pump to heat the building.

As an electric-only model, the construction has an estimated electricity consumption of 4,000kWh/year, a 20% increase on the typical household consumption of 3,100kWh/year. As on-site renewables have eliminated the need for gas, it has greater efficiency through allowing for export and reducing electricity requirements from the local network.

Interestingly, the Solcer House costs approximately £1,200/m^2 to build – a price well within the proposed budget for social housing. Since it produces 1.12 times more energy than it uses, the Solcer House helps to keep energy bills very low at around £7.50 per year.

Another domestic house that demonstrates a similar model is the ZEB Pilot House in Norway, which produces enough surplus energy to power an electric car year-round. Completed in 2014, the home serves as a demonstration project to facilitate learning and is powered by rooftop solar energy and geothermal energy.

Elsewhere, in Australia, the Carbon Positive House, which prototyped in 2015, was heralded as the country's "first carbon-positive prefab home." The solar panel-topped house, which is designed to absorb generous amounts of light, also produces more energy than it consumes.

Perry Sioshansi is founder and president of Menlo Energy Economics and is the editor and publisher of *EEnergy Informer*, from which we have sourced this article, and which we commend.