

# Delft Outlook

MAGAZINE OF DELFT UNIVERSITY OF TECHNOLOGY 2013 • 4

## Concept House

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# Trying not to save energy

*The Concept House Prototype may well be the first energy-neutral apartment in the world. Delft Outlook editor Tomas van Dijk stayed there with friends and tried to overload the electricity meter.*

*Tomas van Dijk*



Spring was barely in the air and it was ten degrees Celsius outside when we moved into the Concept House in Heijplaat, a district in Rotterdam, with bags full of energy-hungry devices including an iron, an electric kettle and a hair dryer. The three-bedroom apartment is built on a five-metre-high steel frame so that everybody can see that this is no ground-floor villa, but rather a first step towards something much more ambitious. The house was built under the guidance of professor of product development Mick Eekhout (Faculty of Architecture) and is meant to demonstrate that not only villas can be built to be energy neutral - examples of these abound - but apartments too. The apartment has been designed in such a way that it will still be energy neutral when combined with other apartments in stacks of up to four stories high. Since it opened its doors in October last year, the home has been functioning as a laboratory for the Faculty of Industrial Design Engineering (IDE) to study users' behaviour and test new inventions. During our stay in the apartment we intend to test its claim to energy neutrality to the limit. First things first: we fill the fridge with beer and turn the lights in the living room up full blast. We turn the thermostat up a notch as well. On the counter in the kitchen we find one of the gadgets developed at IDE. It's a tablet with an app that displays how much energy the house receives from its solar panels and how much energy is consumed. Various residents of the Heijplaat neighbourhood have stayed in the apartment before us and experimented with the app.



Cooking, ironing, watching TV; the team tests the house's claim to energy neutrality to the limit.

This app, called Ampul, clearly shows that our beers, the heating and the lighting have not made any kind of dent in the energy balance: we are still supplying plenty of power to the grid. The solar panels can generate between 1800 to 3200 watts. Our efforts so far are only consuming a few hundred of these. And this is hardly surprising, considering the apartment has LED lighting, triple glazing, highly insulated walls and huge windows that let in plenty of light. The fridge is the main consumer; the energy consumption doubles temporarily after the fridge is filled. But the heat pump barely has to kick in at all. When we arrived, the house was still a comfortable 18.5 degrees Celsius.

## Doing the ironing

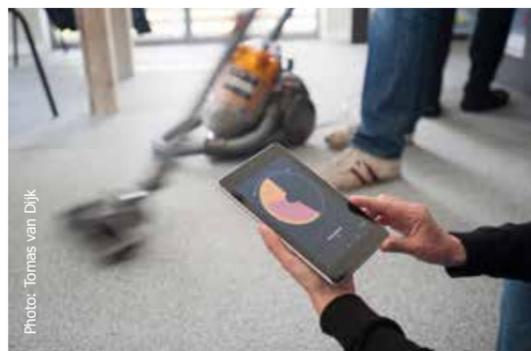
Time for tougher measures. We use the kettle to make tea, vacuum the entire house and iron a few shirts. We turn on the TV and one of us takes a nice hot fifteen-minute-long shower. The solar panels, which cover about half the roof, are no longer generating sufficient energy. By the end of the afternoon, when it becomes cloudier and we start cooking dinner, we note that we are regularly drawing up to two kilowatts off the grid. The energy peak resulting from our potato gratin, fillet of pork and banana cake is clearly visible in the graph. After dinner we experiment with the Niko Home Control app. This app enables you to operate all the lights and sun blinds in the house individually and adjust their settings. We discover other novelties too, such as a urine and faeces separator in the WC and motion sensors in the bathroom. Sadly, the sensors don't quite reach all the way to the shower cabin, so

## 'The toilets can be connected to a biogas plant'

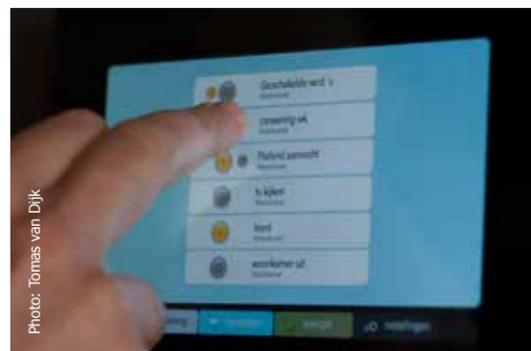
that you end up showering in the pitch dark after a few minutes. At night we leave the thermostat on at twenty degrees, which is a bit on the warm side. The next morning we make a copious breakfast and then turn on the dishwasher and the washing machine, even though they are only half full, and we all take another long shower. In other words, we were able to resist the temptation to save energy, even though this house stimulates you to do so in every possible way.

## Free heat

We consumed some 20 kilowatt hours during our stay of just under 24 hours, while the solar panels produced over 17 kilowatt hours. However, the month of May was not a particularly representative one. During the whole of 2012 the solar panels produced 2500 kilowatt hours. Divide that by 365 and you have 6.8 kilowatt hours, which means we more than exceeded our budget. "There were four of you though," IDE man and designer of the Ampul app Jaap Rutten points out as an extenuating factor. "That's quite a lot for a three-room apartment, and you made a lot of use of the oven. On any other day, with less people in >>



The Ampul app displays our exact energy consumption, in this case of the vacuum cleaner.



The home control system enables us to operate all the lights and sun blinds.

the house, and if you stick to preparing simple pasta dishes on the stove, you will probably break even.” David Keyson, professor of smart products & environments at IDE, laughs loudly when he hears about our experiment. He is the Project Manager of SusLab, an energy efficiency project. “You needn’t have spent the night in a hot bedroom,” he smiles. “The underfloor heating is extremely efficient. We have used a heat loop in the house, meaning that warm water is pumped up from 130 metres deep and channeled past a heat exchanger incorporated into the heat pump, to help warm the house. That warmth is practically free.” The professor tells us our hot showers had little effect either. The water for the shower is also heated using the heat loop. Moreover, there is another heat exchanger under the drain in the shower that ensures that part of the energy that would otherwise have drained away can be reused. But Keyson has underestimated us here; the apps showed us that the heat pump used no less than 5.6 kilowatt hours of energy.

**Building the apartments**

Admittedly, we did get a little bit carried away. We too have become convinced that this home can be

energy neutral. But will it still be energy neutral when it’s part of a four-storey apartment building? “The proof of the pudding will be the construction of the Urban Villa, a four-storey building consisting of sixteen of these apartments,” says professor Mick Eekhout. “I would like to make a start on the construction of that apartment complex before I retire in eighteen months’ time. I’m really pushing this project, while the market should really be taking much more of the initiative. Sadly, these are hard times for the construction industry.” IDE alumnus Jaap van Kemenade is confident that such an apartment complex will indeed be energy neutral. After his graduation he spent four years working on the Concept House under Eekhout’s guidance. He was responsible for managing the construction of the apartment on site. (See box on Prefab development baby) “Due to the tight budget we were only able to cover half the roof with solar panels,” explains Van Kemenade. “If the apartment complex does eventually get built then of course the entire roof surface will be used.” Up on the roof, Van Kemenade points to another “energy source”; solar collectors. They are in place but have yet to be hooked up. Not only do these solar collectors generate heat, they also cool the solar

**Prefab development baby**

The original purpose of the Concept House project was threefold. First, they wanted to build an energy-neutral house that could be stacked with others to create a four-storey apartment building. Secondly, the house had to be made of sustainable materials, particularly wood. And finally, the Architecture-faculty researchers wanted to demonstrate that the house building industry can be industrialized to a much greater degree than is the case now. All the large components- the walls, floor, roof and wet room - are prefabricated. Almost all the various parts of the building were completed before they were transported to the building site in December 2011. Walls

came ready equipped with sockets, windows and plasterboard. The house was put together like a Lego set on the building site, with the space of two weeks. The prototype cost some €400,000, most of which was paid in kind in the form of building materials supplied by dozens of participating construction companies. Eekhout is keen to continue the project and build a cheaper version, but the economic situation is against him. Eekhout: “Where two years ago we were able to find companies to participate in the project, today they are no longer willing.” Moreover, the Faculty of Architecture has terminated the project. “My development baby has been taken from me

for reasons of bureaucracy and frugality,” he says. “Happily, IDE retained a budget for the building’s maintenance, so that it can still be used as laboratory.” Architecture dean Karin Laglas told us in an e-mail that she thinks the Concept House is “an excellent project”. “Unfortunately,” she says, “the project grew beyond the faculty’s financial capacity, which is why I had to pull in the reins.”

[www.suslab.eu](http://www.suslab.eu)  
[concepthouse.bk.tudelft.nl](http://concepthouse.bk.tudelft.nl)

panels, improving their efficiency. And in the winter you can use them to melt the snow on the roof. There are more surprises inside too. “The toilets can be connected to a biogas plant,” explains Van Kemenade. “There is also a connection for a hot fill, allowing the white goods to use the heat pump rather than their built-in heating elements, which are much less efficient.”

**Virtual aquarium**

Of course there is also room to experiment with new technologies. Professor Keyson has a whole list of projects in the pipeline; computer-controlled washing machines and dishwashers that automatically switch on when the sun is at its brightest, and smart grid technologies, for charging electric cars at home for example. The E-quarium app, a virtual aquarium with a goldfish swimming around in it, is intended to make people more energy conscious. If you use energy sparingly, the little fish will look contented and its tank will be filled with clear water and lots of beautiful water plants. The app will be tested shortly in the Concept House. Together with the OTB Research Institute and research partners in England, Germany and Sweden -

who have also built energy neutral houses - he wants to study people’s energy consumption behaviour and link this to data to weather conditions. To this end they have installed a weather station next to the entrance of the Concept House. Keyson: “My main aim is to gain a better understanding of how people use a home. The current models cannot explain the considerable variation in energy consumption. I suppose many people think they can be less careful with energy when they are staying in an energy-neutral house,” he laughs. <<

*“The energy peak resulting from our potato gratin, fillet of pork and banana cake is clearly visible in the graph”*

