

## High Energy in a Low Country

*Within the next 20 years the supply of fossil fuels, mainly oil and gas, will not be sufficient to provide for the world's economies. Anticipating this shortage, the Dutch government policy focuses on a completely sustainable energy supply system by 2050. Renewable heat and heat storage will be key issues to achieve this goal.*

With a high energy demand and a spirited mind, both Dutch scientists and businesses are working on new and innovative energy initiatives. The Energy Agreement for Sustainable Growth, drawn up in 2013, is guiding this change and the Netherlands Enterprise Agency (RVO.nl) is implementing the policies. In this Agreement, a 16% share of renewable energy is foreseen in 2023 compared to the current 4.5% share. In this article, the work of Dutch experts in the field is highlighted to show practical examples of new solar energy and energy in buildings (research) results. All these activities are contributing to the goals set for renewable heat in the Netherlands.

### Joined Forces for Reaching Goals

Holland Solar, the Dutch association for solar thermal and PV, supports and promotes the application of solar energy by organizing campaigns and events, ensuring the quality of solar applications and serving the interests of its 130 members. Erik Lysen, Chairman of the Board of Holland Solar (and the Dutch representative in the IEA SHC Executive Committee from 1992 to 1995) remarks that, "The Dutch solar energy sector is really active and the members of our solar thermal section frequently meet to discuss new developments in the field and how we can achieve the agreed upon goal to grow from the present 1 PJ contribution by solar thermal to an ambitious 6 PJ in 2023."

### And Action!

A broad range of measures are proposed to reach this Energy Agreement goal, some of which are implemented already: product innovations, incentives to reach the rental housing sector, exploiting benefits of the EU Ecodesign and new tax incentives as well as more aggressive market strategies targeting wellness centers, sport clubs, schools, farms and new industrial applications, for example.

### The Challenge

The largest heating demand is in the building stock, both for space and for water heating. The challenge here is to increase the contribution of solar thermal. For example, by introducing combi-systems, promoting and implementing seasonal storage and by allowing solar thermal

*continued on page 16*



▲ **Solar Island in Almere with 7,000 m<sup>2</sup> of solar collectors was the first solar district heating system in The Netherlands.**



▲ **Installing a typical Dutch roof integrated solar collector.**

systems to feed into district heating systems. A good example is the 'Solar Island' in Almere, where a large 5 MW solar heating system (7,000 m<sup>2</sup>) feeds into a district heating system for 2,700 homes. "Besides these types of developments, we also expect an increase in the application of solar thermal because of the tighter European directives on net zero energy housing in 2020," says Erik Lysen.

### Sustainable and Beautiful 'New' Houses

Net zero refurbishment is the core business of Transition Zero, an initiative of Platform31 commissioned by the Dutch Ministry of Home Affairs. "We brokered a deal between housing associations and builders to refurbish 111,000 houses to Net Zero Energy (E=0) levels in the Netherlands," says Harmke Bekkema, Programme Secretary at Energiesprong-Platform31.

#### A Unique Construction

E=0 means that a house consumes less energy for heating, hot water, lights and appliances than it produces in a year. The refurbishments are financed from these energy cost savings. In other words, participants hand in their energy bill for a period of 25-40 years. In exchange, they get a loan for the Net Zero refurbishment. This "barter" means that the residents can live in an improved, more sustainable and more attractive home. A refurbishment is completed within just 10 days and comes with a 30-year energy performance warranty from the builder. "A fairly unique construction!" notes Harmke Bekkema.

#### In Constant Development

Large innovation shifts are made in process, technique and financing. Important preconditions are registered in legislation, which enables housing associations to rent the residences, including the energy costs.

#### Exporting E=0

A consortium of Transition Zero, 10 partners and 17 social housing organizations across France, the UK and the Netherlands are preparing a cross-country program to make E=0 refurbishments a market reality in each of these countries. Harmke Bekkema remarks, "What a fantastic and feasible challenge!"

### Compact Storage: Research is Key

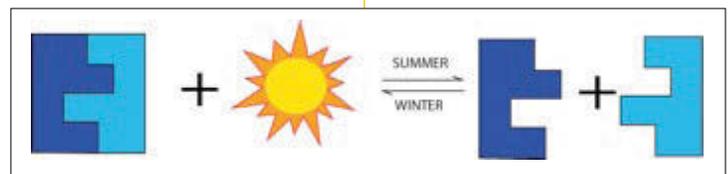
"Until now, there has been no real cost-effective compact storage technology based on the reversible water vapor sorption process of salt hydrates. At least not for commercial use" says Camilo Rindt, Associate Professor at Eindhoven University of Technology and working group leader in IEA SHC Task 42: Compact Energy Storage. "For high solar fraction systems, hot water storage is generally not applicable because of space requirements. Therefore, we need to find a way to reduce the volume by searching for phase change materials (PCM) and thermochemical materials (TCM) with a higher specific energy storage density and low material costs. Besides that, more compact storage requires new reactor designs."

#### Numerical Modeling

To reach high solar fractions, it is necessary to store heat (or cold) efficiently for longer periods of time. "Seasonal heat storage is one of the most promising methods to do this," explains Camilo Rindt. During winter the sorption material is hydrated releasing heat and in summer the material is dehydrated by solar heat. Basically, this cycle can be repeated over and over again. The goal of this research is to gain more physical insight into the limiting transport properties of vapor and heat.



▲ A Net Zero refurbishment: before (left) and after (right).



▲ Principle of thermochemical materials (TCM).

continued on page 17

The results are being used to set up design guidelines/numerical models for new solid sorption materials and more compact heat storage systems. Eindhoven University of Technology aims to launch a pilot project on seasonal heat storage in the built environment within the next five years.

#### Team Work

"Around the world, it seems researchers are working on either thermal energy storage materials or applications. We are bringing these two fields of expertise together in SHC Task 42, which is crucial for finding the best solution for compact storage of thermal energy," according to Camilo Rindt.

#### Solar Thermal and PV – Best of Both Worlds

"Energy consumption in Dutch households consists of one third electricity and two thirds heat," explains Corry de Keizer, project manager at Solar Energy Application Centre (SEAC) "so there's a need for a lot of (sustainable) heat!" PV systems, which only generate electricity, are far more popular in the Netherlands, but a standard PV system only converts approximately 15% of the solar irradiation into electricity and 75% into unused waste heat. Therefore, the combination of PV and solar thermal applications is very logical, but in practice there are still some challenges to overcome.

#### Make Your Wish (Roof) Come True

SEAC helps companies develop their solar ideas. One such project is WenSDak (roughly translated means Wish Roof, the roof you wish for). Several project partners will develop five different product concepts for Building Integrated PV Thermal (BIPVT) roofs in different market sectors. A field test roof is set up to measure the thermal and electrical energy yield of the BIPVT roofs for different user profiles and system configurations. The collected data will then be used in computer simulations to figure out what produces the most beneficial output.

#### Ready, Steady... GO!

Project WenSDak will be considered successful when the measurements can be used by the companies involved to predict which applications are likely to be the most beneficial. "There is still so much to be learned from both solar power and solar heat performances. Right now we are installing the systems and by the third quarter of this year the first results are expected. SEAC is also investing in an outdoor field test environment to facilitate research on solar thermal systems in the Netherlands. Did I mention we strive to develop aesthetic BIPVs in all our projects as well?" concludes Corry de Keizer.

#### The Best Is Yet To Come?

Renewable heat plays a major role in the renewable energy policy of the Netherlands and will continue to do so as demonstrated by the government's April 2015 Heat Vision for the country. As highlighted in this article, many parties are trying their best to reach the goals set in the Energy Agreement by being bold and innovative. "All these efforts should make it possible to increase the market share of solar energy and renewable heat in the Netherlands – a necessity for a sustainable future," concludes Lex Bosselaar.

*This article was contributed by Lex Bosselaar, the Dutch IEA SHC Executive Committee member. For more information on the Dutch activities contact Mr. Bosselaar at [lex.bosselaar@rvo.nl](mailto:lex.bosselaar@rvo.nl).*



▲ BIPV project SolarBeat. Left PVT panels, middle PV panels and right 3 PVT panels and 3 solar thermal collectors.