

Case study summary

Willis Renewable Energy Systems, Belfast, Northern Ireland, UK

2010 Ashden Award

Willis Renewable Energy Systems' 2010 Ashden Award recognises the technical innovation of their Solasyphon, which minimises the cost and disruption of installing solar water heating systems and encourages greater uptake of the technology.

In the UK there are approximately 26 million existing homes, most of which do not yet have solar water heating. The cost and disruption of installing this technology sometimes presents a barrier to take-up. The Solasyphon, invented by Willis Renewable Energy Systems, tackles this by allowing solar water heating to be installed using the existing hot water tank, avoiding the need to fit a new one.

- The Solasyphon is a small heat exchanger installed outside the existing water tank. This simplifies and speeds up retro-fitting of solar water heating.
- The Solasyphon delivers small amounts of hot water quickly. In standard European tests where hot water is drawn from the tank during the 'solar day', it produces a higher average water temperature compared to conventional technology.
- Higher delivery temperature inevitably leads to a small reduction in efficiency.
- Using a Solasyphon saves between £600 and £1,200 on installation costs (15% to 28% of cost of retrofitted solar system).
- 2,500 Solasyphons installed so far, in the UK as well as in Ireland, Finland, Germany, New Zealand, USA, South Korea and Indonesia.
- Systems sold to date save 600 to 1,300 tonnes/year CO₂.
- Additional savings in embodied energy and carbon, since existing cylinder is not being replaced.
- Solasyphon complies with the Microgeneration Certification Scheme, allowing access to grants and the upcoming Renewable Heat Incentive.
- New jobs created in business development and manufacturing in Northern Ireland.

Willis Renewable Energy Systems was established in 2007 as a subsidiary of Willis Heating and Plumbing Ltd, a family business that has been in operation since 1887. The business as a whole has a turnover of £1.6m, and employs 20 people, three of whom work in the renewable energy subsidiary.

UK statistics 2006

(IMF 2009, UNFCCC 2006)

GDP: £20,500/year per person

CO₂ emission: 9.2 tonnes/year per person

Location



"We've had the Solasyphon in place for three years now, and it's been absolutely fantastic. We have piping hot water all day long. It starts working as soon as the sun hits the solar panel. It's brilliant in the winter as it activates with the winter sun as so we're not dependent on a really hot sunny day."

Liz McElkerney, owner of a Solasyphon.



The Solasyphon is compact and easy to install.

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Case study

Willis Renewable Energy Systems, Belfast, Northern Ireland

Background

Solar water heating is an effective way of incorporating renewable energy technology at a household level in the UK. When installed during construction of a house, it is straightforward to include a suitably designed hot water tank. However, most hot water tanks in the UK's 26 million existing homes are not suitable for direct connection to a solar water heating system and it is usually necessary to install a new water tank during a retro-fit.

Willis Renewable Energy Systems has invented the Solasyphon, which allows existing water tanks to be left in place and used with solar water heating. The Solasyphon is just the latest in a series of inventions from Willis, which has been an innovator in plumbing and heating for over 100 years.

The organisation

Willis Renewable Energy Systems is a subsidiary of Willis Heating and Plumbing Ltd, a family business that has been in operation since 1887, has an annual turnover of £1.6m, and employs 20 people. The subsidiary was set up in 2007 specifically to develop and market the Solasyphon. The parent business also installs underfloor heating and ground source heat pumps.

Willis is based in Belfast, but sells the Solasyphon to solar water heating installers across the UK. It has also been marketing the product across the world and installations have been carried out in Ireland, Finland, Germany, New Zealand, USA, Indonesia and South Korea.

The technology

How does it work?

Solar water heating is normally installed with a specifically designed hot water tank, which includes a heat exchanger near the bottom. The hot fluid from the solar collector panel passes through the heat exchanger, giving up its heat to the water in the tank and then returning to the solar panel. This is the most efficient way of capturing the heat, but the water temperature increases slowly because the whole tank is being heated. Retrofitting solar water heating to an existing house normally requires a new hot water tank, which adds to the cost and disruption to the household during fitting, as well as taking up valuable storage space.

The Solasyphon is a heat exchanger installed outside the hot water tank, which allows the existing tank to be retained. It works on the basis that hot water is less dense than cold water, and so rises or 'thermosiphons'. As the hot water rises out of the Solasyphon it enters the top of the water tank, and cold water is drawn in from the bottom of the tank. As a result, small amounts of hot water are delivered quickly. In standard European tests where hot water is drawn from the tank during the 'solar day', the Solasyphon produces a higher average water temperature than conventional technology. Delivering hotter water inevitably leads to a small reduction in the overall efficiency of the solar water heater system.

How much does it cost and how do users pay?

US\$1 = £0.81 (Great Britain Pounds) [May 2010]

The cost of a Solasyphon depends on the number of units bought, but it is usually under £300. By using a Solasyphon, the customer avoids the cost of purchasing and installing a new water tank. The net saving is typically £600 for a vented system (equivalent to 15% of the total cost of the retrofitted solar water heating system) and £1,200 for a pressurised system (28% of the total cost).

The technology in more detail

Conventional solar water heating uses a panel to capture heat from the sun and a pump to circulate a heated fluid, transferring heat into the hot water tank. The panel may be a flat metal plate behind glazing, or a series of glass vacuum tubes with metal pipes inside. The heat transfer fluid is usually water mixed with anti-freeze to cope with low temperatures during winter. An electronic controller monitors the temperature of the fluid in the panel, and when it is sufficiently higher than the temperature at the bottom of the water tank, a pump is switched on to circulate fluid from the panel through the heat exchanger in the water tank. When the temperature of the fluid in the panel drops down to the level of the water tank, the pump switches off again; this is required to prevent heat being lost from the tank at night or during cloudy weather.

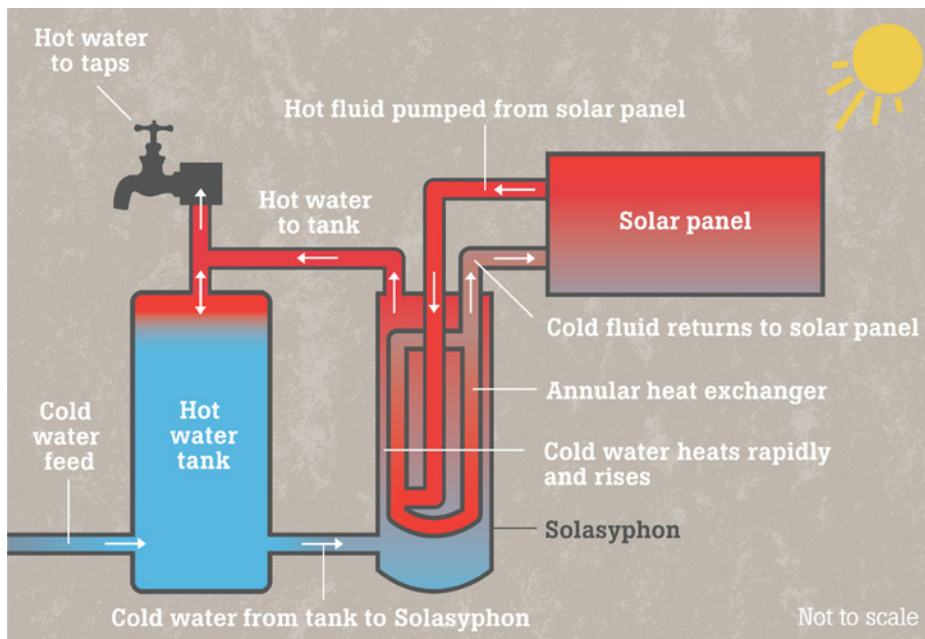
Using a Solasyphon requires slightly different plumbing, with connections from the solar panel going to the Solasyphon instead of the water tank (see diagram in main text). The Solasyphon has two further connections, one to the cold water feed at the base of the hot water tank, and the other to the hot water outlet at the top of the tank. This extra circuit does not require a pump, because the water leaving the top of the Solasyphon is much hotter than the water entering the base of it, so is less dense and therefore rises and flows into the top of the tank, continuously drawing in more cold water from the base.

As the volume of the Solasyphon is small, it provides a small flow of water at a high temperature, which can avoid the need for 'top-up' heating to produce water which is not hot enough for domestic use. However, supplying water at a higher temperature inevitably reduces the overall efficiency of the system. Detailed measurements by the University of Ulster suggest an efficiency loss of between 5 and 10%.

How is it manufactured, promoted and maintained?

The metalwork of the Solasyphon is manufactured by a local coppersmith business, which also makes water tanks, pipes and other parts for plumbing. The completed assembly is then tested to 10 bar (double the normal mains water pressure) and sent to Willis, where it undergoes a quality check and has an insulation jacket added before the product is packaged up ready for sale. No maintenance is required: the Solasyphon is supplied with a 25 year warranty and is approved by the Water Regulations Advisory Service.

The Solasyphon is patented and the name is a registered trademark. Willis markets it through their website, and installers who use it recommend it to their customers.



Benefits

Since production began in 2007, Willis has sold over 2,500 Solasyphons, and is currently selling about 1,000 per year. 300 of these have been installed by Willis itself, with the remainder sold to other installers.

Environmental benefits

The amount of CO₂ saved by a solar water heating system depends on a number of factors, including the amount of water used, the size of the solar panel and the energy source it replaces. Typical savings per installation range between 0.26 and 0.58 tonnes/year CO₂. Using a Solasyphon allows installations to go ahead where the cost and disruption of replacing the hot water tank would have been a barrier. If all 2,500 Solasyphons sold to date represent installations that would not have happened otherwise, they equate to savings of between 600 and 1,300 tonnes/year CO₂ (taking into account the small efficiency penalty of the Solasyphon).

An additional benefit of using a Solasyphon is the saving in the use of copper or stainless steel by avoiding the need for a new hot water tank, and the embedded energy associated with the tank.



Willis uses local skilled coppersmiths to build the Solasyphon.

“The benefits for me as an installer are there’s much less work. It’s very simple to fit. You just attach [the Solasyphon] to the original heating system and don’t lose any storage space. After 10 or 15 minutes they’re already producing hot water.”

Willis installer



The installed Solasyphon takes up very little space.

Social benefits

By reducing the cost and disruption associated with installing solar water heating, the Solasyphon allows more households to take advantage of renewable energy, saving money on their fuel bills at the same time as reducing CO₂ emissions. The cost saving on installation also reduces the payback period of this technology.

The Solasyphon heats a small quantity of water quickly, bringing considerable benefit to users who frequently need small amounts of hot water throughout the day, potentially reducing the need for an additional heating system to be brought into use.

Willis has worked with local colleges to help them learn first-hand about the latest solar water heating technology and how it is installed, providing them with free Solasyphons for apprentice training. It has also worked with the University of Ulster on research and independent testing of the Solasyphon.

Economic and employment benefits

The Solasyphon has resulted in the creation of business development jobs at Willis, and jobs at their manufacturer. It has also helped solar water heating installers by allowing them to offer a lower cost service and complete the installations more quickly.

Potential for growth and replication

The potential for the Solasyphon in the UK and further afield is significant, as there are millions of homes that could be retro-fitted with solar water heating: reducing the cost and disruption of installation is likely to increase take-up of the technology.

Despite the recession in 2009, Willis has continued to sell the Solasyphon, albeit in reduced numbers, and sales have now started to increase again. It has been working to develop opportunities for the Solasyphon outside the UK and Ireland, and now has distributors in USA and New Zealand and is close to reaching agreement with distributors in other countries.

A key change for the business in 2009 was the acceptance of the Solasyphon into the Microgeneration Certification Scheme, which enables customers to access grants for installation. The Renewable Heat Incentive, due to start in 2011, will pay customers for the heat generated by their solar thermal systems, further encouraging take-up of the technology.

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John Willis with a Solasyphon.

"It's a completely home grown product, right through from invention to manufacture. Every part is manufactured here and as production increases the opportunities for creating new jobs will increase.

...It's because we have the belief in it, it's not just another idea. It's not just a job. We do passionately believe in it."

John Willis



Evacuated tube solar water system installed on a house. A solar water heating system typically provides a third of a household's annual hot water.

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