

# ClimateWell®

*The Solar Cooling® Company*

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New Markets

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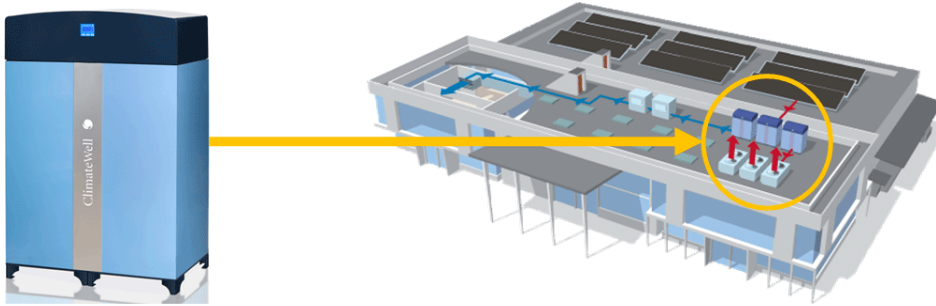
[www.ClimateWell.com](http://www.ClimateWell.com)

**Our Vision:** “One Billion Tones Less CO<sub>2</sub>”

**Our Mission** is to make a global sustainable energy supply possible by applying ClimateWell®'s unique heating and cooling technology.

## **Our Products**

Along with our partners, we install energy efficient solutions that provide cooling, heating and domestic hot water in commercial buildings, hospitals, factories, hotels, offices, multi-family homes and single family homes around the world. ClimateWell® products are highly efficient heat pump, optimized for solar thermal collectors to minimize electricity consumption. It also works together with other thermal sources such as district heating or micro co-generation. ClimateWell® products are unique, the first product ever to make efficient and integrated energy storage possible.



**Figure 1: ClimateWell® System**

## **Our Locations**



**Figure 2: ClimateWell® Corporate Headquarters in Stockholm, Sweden**



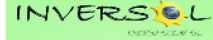
**Figure 3: ClimateWell® Demo House in Madrid, Spain**



**Figure 4: ClimateWell® Manufacturing Plant in Olvega, Spain**

## Our Partners

We recognize our worldwide partners, sales channels, established network of distributors and solution providers.



## Our Awards



First Prize at the International Solar Cooling Conference 2005 granted in Germany



Cleantech 100 - Top 100 Cleantech Companies in the world



"Technology Pioneer 2007" at the World Economic Forum in Davos, Switzerland



Per Olofsson, Group CEO "Business Leader of the Year 2007" and "European of the Year 2007" (Nominations Only)



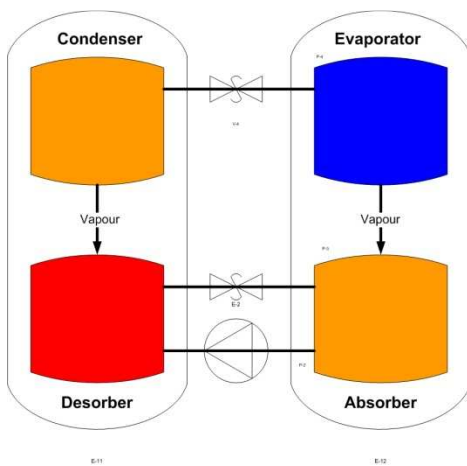
"Most Promising Mature Clean Tech Start-Up in Europe" recognition at The Transatlantic Green Platform 2009 in La Baule, France.



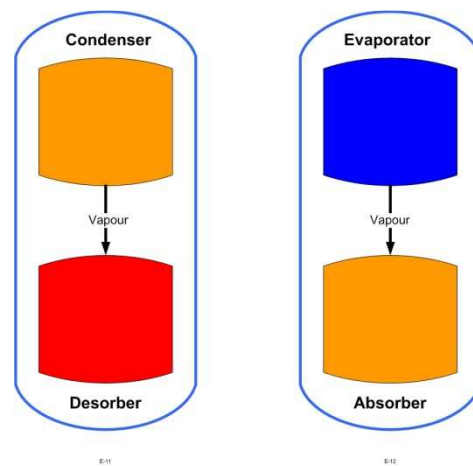
VISIONS for Sustainability, the Ruppenthaler Institute, awarded ClimateWell's Demo House: "Good practice for Solar Cooling®"

## How it Works

While the four fundamental absorption steps are similar with traditional absorption, the difference with triple state absorption is that the process is not continuous as traditional absorption, but discontinuous as shown in *Figure 5* and *Figure 6*. One advantage of decoupling the absorption process from the desorption process is that the four fundamental steps can be done in only two vessels instead of using four. Absorption and desorption in *Figure 6* are done in one vessel just as evaporation and condensation are done in another.



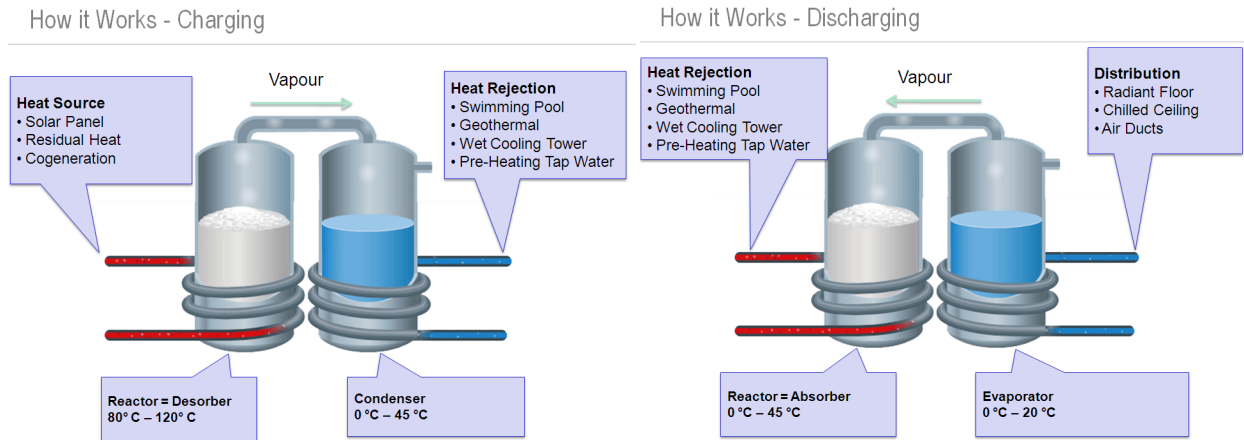
**Figure 5: Conventional Absorption**



**Figure 6: Triple State Absorption**

The only differences between the charging process and the discharging process as illustrated in *Figure 7* and *Figure 8* are the temperatures, pressures and vapour flow direction. The distinguished phases are explained below.

**Charge:** equivalent to the left hand side of *Figure 5*. The heat introduced from the solar collectors boils the diluted absorbent solution creating a vapour transport towards the condenser. The vapour is condensed, and the heat removed by the heat rejection circuit allows the vapour flow to continue. Once sufficient refrigerant has been moved to the condenser the discharge process can start. The salt, although fixed in one position, is maintained thermally active through a ClimateWell® patented technology that keeps the salt crystals separated and prevents them from clogging together.



**Figure 7: Charging Principle**

**Figure 8: Discharging Principle**

Discharge: equivalent to the right hand side of *Figure 5*. When the reactor is connected to the heat sink circuit and sufficiently heat is removed from the system the discharge process can start. The lower reactor temperature is enough to lower the operating pressure in the evaporator which in turn allows for evaporation of the refrigerant at low temperatures. The absorbent that could consist of 100% crystallized lithium chloride has a very high affinity to the refrigerant and so attracts the vapour in the evaporator.

The discharge process will continue as long as there is refrigerant left in the evaporator and the absorbent solution is sufficiently concentrated in order to sustain a lower pressure in the reactor compared to the evaporator. When either of these conditions is not fulfilled the machine is empty and will swap to charging process again.

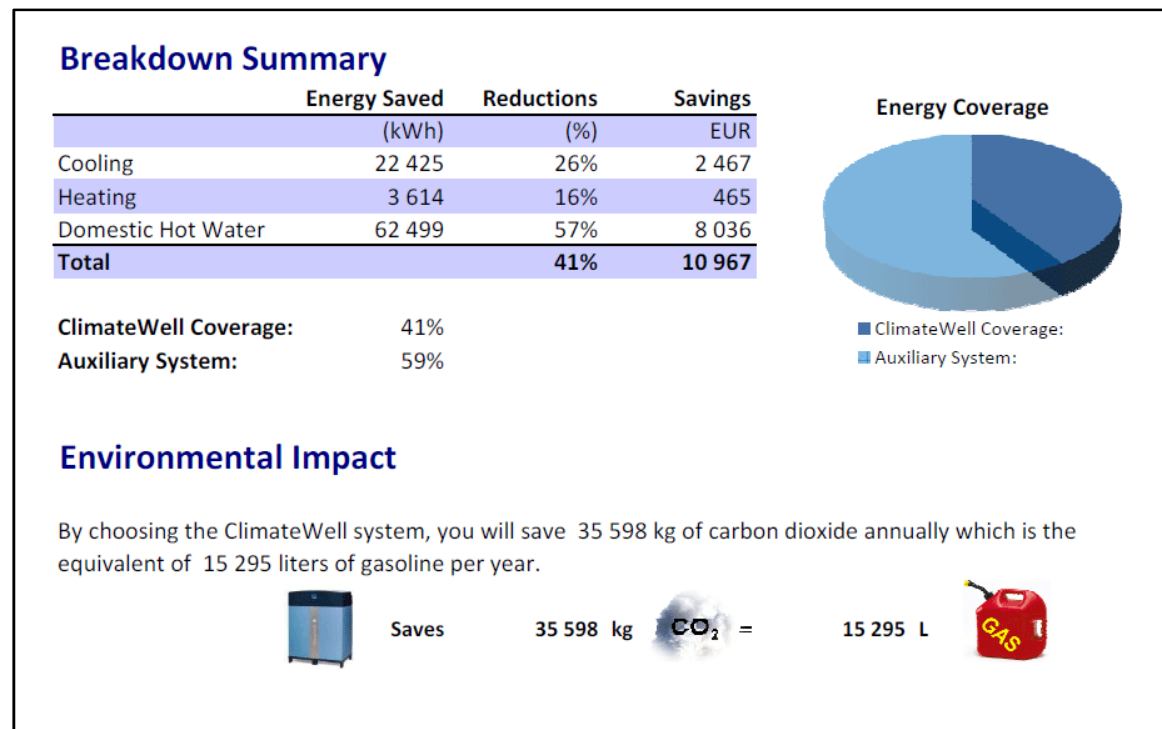
Since the absorption process is discontinuous (either charge or discharge) the system is duplicated in order to deliver cooling continuously in the same way as in an adsorption cycle. Key differences are that the available temperature lifts are higher and that the time between swaps is greatly increased.

This technology does not require any circulation of the absorbent solution which means that no circulation pump is necessary. Since there is no pump and no internal circulation there is no danger with crystallisation and if there is no risk with crystallisation, variable inlet temperatures and flow rates can be used for all circuits. The crystallisation is

actually used as a way of storing the thermal energy chemically which makes an external cool storage abundant. All in all the ClimateWell® Solar Cooling® technology allows for a robust and simple solar cooling installation that needs very little control and will continue delivering heating and cooling for many years.

## Our Simulations

ClimateWell® uses a custom made Transient Energy System Simulation Tool (TRNSYS) model developed together with the Swedish Energy Research Center (SERC) for simulating the performance of our technology with different solar cooling systems in various locations. Please contact us if you require a simulation for a project or you require more information.



**Figure 9: ClimateWell® Solar Cooling® Simulation**