EPG
ENERGY POLICY GROUP

The Gemasolar Thermosolar Plant:

One Step Closer to Energy Storage of the Future

Eduard Cristian Vasile

March 2015

Energy has always fueled progress. Electricity has become as essential as sunshine, air or water. There have been endlessly innovative ways to generate it, but when it comes to storing the energy, innovation seems to have stalled.

The problem with renewable energy is the lack of continuous supply: solar power works only when it's sunny, wind power only when it's windy and wave power only when the sea is not too rough.

Photovoltaic is a unique concept, if looked at how fast this technology has been growing. In the next decade, global demand could be significantly fueled by solar power. Today, just 0.5% of the electricity comes from photovoltaics worldwide. It may seem like a small number, but in 1998 this was 0.003% and if the trend continues, in 2028 it will grow to 50%. Therefore, by then half of the energy demand could come from solar-powered plants.

However, there is a big problem that needs to be solved: the problem of demand between day and night peaks. To close that gap, conventional power was always kept by the grid operators in such an amount that exactly matched the difference. But then, a lot of solar energy can and is going to waste, absent a solution for storage.

The first solar power-tower station that can produce electricity 24 hours a day has been built in the south of Spain. Its scale, however, is enormous, spreading over 185 ha (Photo).

Photo: Gemasolar thermosolar plant
Source: www.torresolenergy.com

Photovoltaic is one of the fastest growing energy sources in the world at the moment, but the facility in the photo is not photovoltaic. It is glass mirrors that concentrate the solar radiation 1,000 times and reflect the resultant on to the central receiver. The reflected sunlight from the 2650 heliostats combined can produce 110 GWh per year. If calibrated to point at exactly the same spot, the facility can provide power to 25,000 homes, with very significant CO2 emissions' reduction. Torresol states that the project was financed with a EUR 171 million (USD 247 million) loan by several private banks, led by the Popular Bank.

The tower is placed in the middle of a circle of heliostats, so that every heliostat takes a different angle to reflect the light on the top of the tower and then focuses all the energy in a single spot. It's a very sensitive process. To move the heliostats in the right position is a job of high precision, otherwise the light will not be concentrated enough to produce the needed power.

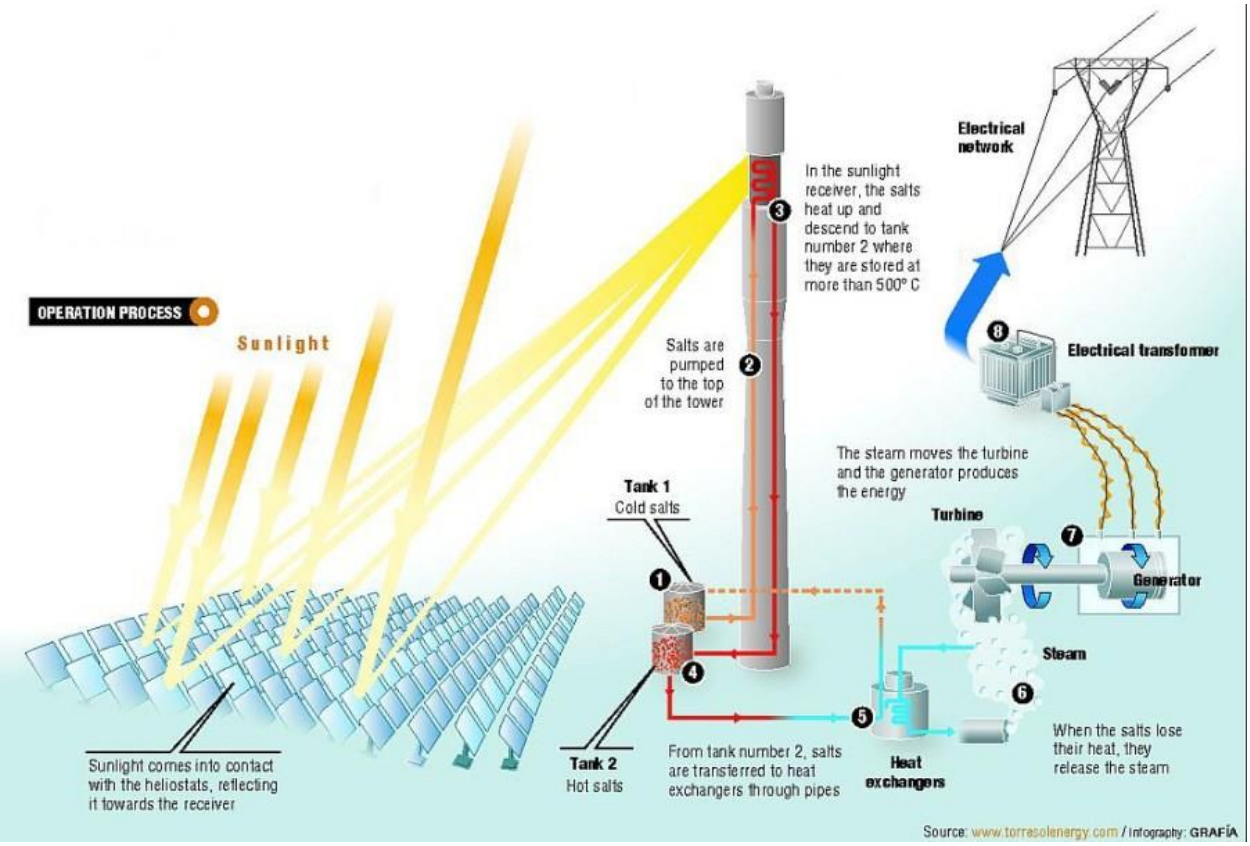

Figure: Operating scheme of the solar tower

Operating principle

Sunlight is reflected from each heliostat onto a central receiver at the top of the tower. Sodium and potassium nitrate salts are pumped from the cold salts tank up to the receiver, where they absorb the focused solar thermal energy reaching temperatures of up to 565 degrees Celsius. The heated salts are then pumped down into the hot salts tank where they are stored in a molten state or used to generate electricity via the heat engine.

The tank that contains the molten salts resembles a large battery. However, it is a thermal battery, not an electrical one. In fact, the energy accumulated in the tank suffices to continue operating the turbine for 15 hours at full speed. This is what distinguishes it from other solar towers around the world. It is actual storage. Being able to store energy this way means that solar power can be provided 24 hours a day, not just when the sun is shining.

In heat exchangers the water is turned into steam at 500 degrees Celsius and 100 bar pressure. Basically, despite the futuristic sound of it, the actual process of creating

actual electricity is very much the same as any other coal-fired or even nuclear plant. It is a steam-driven power plant.

In basic form, this technology has been around for hundreds of years. The real innovation is the outside part of the building, namely the heliostats and the tower. With power generated from the molten salt, the discussion returns to good old-fashioned steam turbines.

Hence, slowly but surely the future of green, clean energy that can be used 24 hours a day is on its way, with innovations and ideas being presented and tested every day.

Eduard Cristian Vasile is EPG Junior Analyst

Str. Buzeşti 75-77, 011013

Bucureşti, Romania

www.enpg.ro

office@enpg.ro