

Setting

Country	Italy
Location	Priolo Gargallo - province of Siracusa (Sicily Region)
Project start date	November 2003
Project end date	2011
Technology keywords	Solar energy (heat)
Host sector	Supply of energy. The project is carried out by ENEL together with ENEA

Technical summary of the project

Objective of the project	<p>The plant generates steam from solar radiation, which is then fed into the steam cycle of a gas-fired combined cycle power station next to it. The Archimede Project represents the first application worldwide of the integration of a gas - burned combine cycle power plant and a thermodynamic solar energy system.</p> <p>The advantage offered by this new technology is associated with the high output of the system.</p>
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Project description

The aim of this project is to develop a technology that will produce energy by solar source offering an efficient alternative to oil energy and a path to reducing CO₂ emissions.

It will increase with 5 MW the power of the existing combined loop plant in Priolo Gargallo entirely from renewable sources. ENEL's power plant at Priolo Gargallo (Siracusa, Sicily) has been deemed apt to host the project deployment due both to its very high values of insolation (incoming solar radiation) and to the site morphologic features (orography).

The existing thermoelectric plant is composed by two units of 380 MWe capacity each (250 MWe gas turbine line and 130 MWe steam line).

The concentrating solar system will be totally integrated with the thermodynamic cycle and with the equipment and services already existing in the power plant. It will increase the power plant capacity by about 5 MW and will provide an additional electric power output from solar energy sufficient to meet the demand of 5,000 consumers. This will lead to saving 3,000 ton equivalents of fuel oil in a year. Another benefit will be the reduction of CO₂ emissions for a total of 5,500 tonsly.

Technically, a field of large mirrors concentrate solar radiation on pipes containing an auxiliary fluid. The heat is used to raise the temperature of the fluid and keep it high, in order to take advantage of solar power at any time of the day or during any weather condition.

The solar plant consists of a solar field covering a total operational surface area of about 40.000 square meters, a storage system and a steam generator.

In the modular solar field the solar energy is collected in 72 parabolic solar collectors. The plant's battery of the 72 parabolic mirrors will focus the sun's rays on pipes, through which runs a saline liquid that can store heat up to 550 °C and retain it for hours. This is possible thanks to the properties of this new salt-based fluid, so as to make the heat available at a high temperature throughout the day.

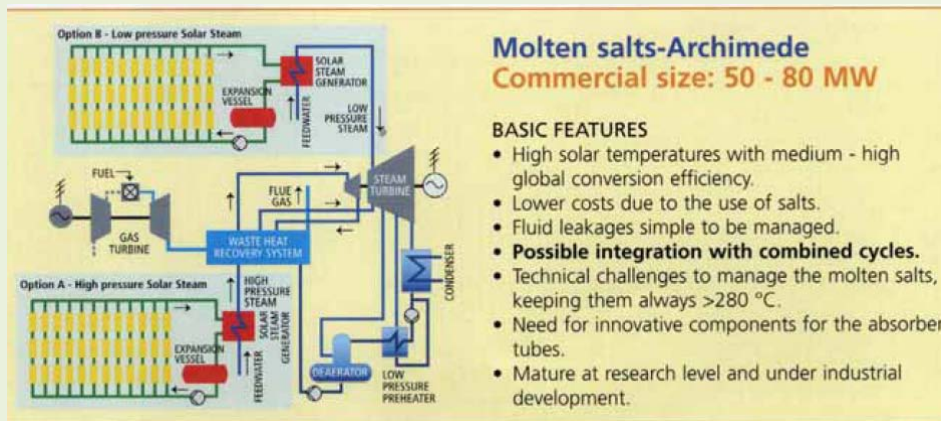
The use of large scale heat storage is an innovation of the Archimedes project. Due to two storage tanks operating at different temperatures, the plant provides heat to the steam generator at a constant rate 24 hours a day, regardless of variations in solar energy availability. The high pressure steam generator consists of 'tube and shell' heat exchangers in which heat is transferred to water to produce super-heated steam for use in a conventional thermoelectric plant.

The high pressure steam produced (110 bar) is fed through the turbines in the adjacent combined cycle gas plant and increases the amount of electricity generated, reducing the need to consume fossil fuels and improving the environmental performances.

The movable collectors are arranged in parallel rows that each form a single string. The number of strings determines the thermal energy and thus the power of the plant.

Another innovation of this project is the design of a new type of concentrator based on thinner mirrors that saves construction and installation costs which are currently the critical problem that must be resolved for solar technologies to take off and become widespread.

The possibility to obtain large quantities of clean sun-generated energy which is continuously available at comparable costs to those of fossil fuels, is in fact a real quality step forward that will significantly contribute to achieve the objectives of increasing energy independence and reducing climate-changing emissions, particularly in areas that enjoy many hours of sunshine, like the southern regions of Italy and the whole Mediterranean basin.



Concentrating solar power technology systems
Source: "The Archimede solution" brochure

High Temperature Concentrating Systems
Source: "Thermodynamic solar systems"
Archimede Project dossier

Environmental and social benefits

(Estimate of) Greenhouse Gases abated (in metric tons of CO ₂ -equivalent)	Annual: reduction of CO ₂ emissions for a total of 5,500 tons\y.
Number of reduction units (EAU, CER, ERU, AAU)	Not Known

Socio-economic aspects	A traditional oil electric generation plant is converted in a modern combined cycle plant with a great increase of the overall energy efficiency. The concentrating solar system will be totally integrated with the thermodynamic cycle and with the equipment and services already existing in the power plant. It will increase the power plant capacity by about 5 MW and will provide an additional electric power output from solar energy sufficient to meet the demand of 5,000 consumers. This will lead to saving 3,000 ton equivalents of fuel oil in a year. Another benefit will be the reduction of CO2 emissions for a total of 5,500 tons\y.
Methodology used	<p>The methodology used has been introduced by ENEA which has initiated relevant improvements to the concentrating solar energy technology:</p> <ul style="list-style-type: none"> • introduction of an adequate energy storage; • use of an alternative transfer fluid; • new solar collector design; • innovative receiving tube design. <p>The operation of the real scale test circuit starts the realization of a number of solar systems using the ENEA technology. ENEA has launched a vigorous research, development and demonstration program on concentrating solar energy in order to prepare the basis for solar energy massive utilization.</p> <p>In addition, the Sicily Region will support the experimental activities related to the "Archimede" solar thermal project with a view to assessing the feasibility of replicating the initiative at other sites.</p>

Economic data	
Capital costs	50.000.000€
Financing scheme	ENEL private investments and resources
Financing organisation	Not applicable

Project developer	
Name of the project developer	ENEL spa, Viale Regina Margherita 137, 00198 Rome, Italy
E-mail and/or web address	Progetto.ambiente@enel.it - www.enel.it/ambiente
Contact person	Relazioni con i media: Tel. +39 06 83055699 Fax. +39 06 83053771

Host organisation	
Name of Host organisation	ENEA - Ente per le Nuove tecnologie, L'Energia e l'Ambiente
E-mail and/or web address	e-mail: uffstampa@sede.enea.it - www.enea.it
Contact person	Ufficio Stampa e Rapporti con i Media Tel. +39 06 36272806 Fax + 39 06 36272286

Technology provider	
Name of Technology provider	ENEL spa, Viale Regina Margherita 137, 00198 Rome, Italy
E-mail and/or web address	Progetto.ambiente@enel.it - www.enel.it/ambiente
Contact person	Relazioni con i media: Tel. +39 06 83055699 Fax. +39 06 83053771