Archimede Solar Energy
Company Presentation
ANGELANTONI INDUSTRIE GROUP

Headquarters:
• More than 16,000 m² (160,000 sq. ft.)
• Manufacturing and Testing Departments

Special capabilities:
• Large anechoic chamber (600m³) for EMC testing
• Research & Development Center:
  • biomedical equipment
  • test chambers
  • sputtering systems

Employees:
250 in Massa Martana
700 in the Group

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
ARCHIMEDE SOLAR ENERGY S.p.A.

PRODUCTION

Thermodynamic Solar Power Plant
SOLAR RECEIVER TUBES

Photovoltaic Power Plants
CONCENTRATED PHOTOVOLTAIC MODULES

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
CPV MODULE

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
CONCENTRATED TRICOIC PHOTOVOLTAIC MODULES WITH AUTOMATIC TRACKING SYSTEM

HIGHER PERFORMANCE: ➔ LOWER COST ➔ 50% LESS SURFACE

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
## TECHNICAL DATA

<table>
<thead>
<tr>
<th>TECHNICAL DATA</th>
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<tbody>
<tr>
<td>EXTERNAL DIMENSIONS (LxDxH)</td>
<td>mm</td>
<td>1400x700x248</td>
</tr>
<tr>
<td>P. POWER</td>
<td>W</td>
<td>220</td>
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<tr>
<td>WEIGHT</td>
<td>Kg</td>
<td>30</td>
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<tr>
<td>CONCENTRATORS</td>
<td>N°</td>
<td>18</td>
</tr>
<tr>
<td>PHOTOVOLTAIC SOLAR CELLS</td>
<td>N°</td>
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<tr>
<td>Specific Band Frequency</td>
<td>nm</td>
<td>350 ÷ 650</td>
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<tr>
<td></td>
<td>nm</td>
<td>650 ÷ 900</td>
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<tr>
<td></td>
<td>nm</td>
<td>900 ÷ 1200</td>
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<tr>
<td>CONCENTRATIONS METHOD: FRESNEL LENS AND PARABOLIC MIRROR</td>
<td></td>
<td></td>
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<tr>
<td>ON BOARD LIGHT SENSITY</td>
<td></td>
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<tr>
<td>SELF SUPPORTING STRUCTURE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASSEMBLING SURFACE: ORIZZONTAL OR VERTICAL</td>
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</tbody>
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**ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS**
DEVELOPMENT LINES OF CONCENTRATED PHOTOVOLTAIC

2008 ➔ TRACKING SYSTEM DEVELOPMENT AND STARTING TESTS ON TRICROIC MODULES

2009 ➔ PRODUCTION OF A SMALL LOT OF PANELS AND CARRYING OUT OF ONE OR MORE PILOT INSTALLATION

2010 ➔ STARTING UP OF IN SERIES PRODUCTION WITH 20 MW/YEAR CAPACITY

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
PARABOLIC LINEAR MIRRORS AND TUBES

Fluid temperature 550 °C

Sun energy are amplified 80 times on the receiver tube

Receiver tube

Mirror

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
SOLAR RECEIVER TUBE

New coating

New bellow

Higher performance
- Stable up to 600°C
- Solar absorbance $\geq 94\%$
- Thermal emittance $\sim 10\%$ at 400°C
  $< 14\%$ at 550°C
The surface coating deposited on the tube is constituted of a thin film multilayer structure including an inferior layer of metal reflecting in the infrared and a superior layer of anti-reflex ceramic material. Other layers of ceramic-metallic material (CERMET) having different volumetric fraction of metal are interposed between the two films.
THE ENEA EQUIPMENT FOR COATING
THE STAINLESS STEEL TUBE

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
“Archimede” project
Integration between:

**Combined cycle**

**Solar system**

Diagram illustrating the integration between a combined cycle and a solar system, showing components such as Turbogas, Vapour, and Bravolutorielare.

Key temperatures and system components are indicated, including:
- 540°C for Turbogas
- 550°C and 290°C for solar system components
- Various other components like Pompa and Condensatore.
Demonstration plant: “Archimede” project

The plant will be located in Sicily at Priolo Gargallo near Siracusa and will be integrated in an ENEL Plant.
ENEA-ENEL Archimede solar power plant

A traditional oil electric generation plant was here recently converted in a modern combined cycle plant

Nominal electric power 760 MWe
ENEA – ENEL  Archimede solar plant

Nominal power: 5 MWe
Electric energy produced: 10,8 GWhe
Energy saving: 2,365 TEP/year
Emission avoid CO2: 7250 t/year
Number of collector: 72
“Archimede” project: photographic reconstruction
Archimede project: solar field

Budget of the plant is 21 M€
Nominal power: 5 MWe
Electric energy produced: 10,8 GWhe
Energy saving: 2.365 TEP/year
Emission avoid CO₂: 7250 t/year
Number of collector: 72

Funds for the plant are 40% public and 60% private
DEVELOPMENT LINES OF THERMODYNAMIC SOLAR POWER

2008 ➔ PRODUCTION STARTING UP FOR ENEL AND OTHER CUSTOMERS (ABOUT 10000 TUBES) USING SPUTTERING TECHNOLOGY AND PRODUCTION TECHNOLOGY DEVELOPMENT WITH REACTIVE SPUTTERING (DUAL MAGNETRON)

2009 ➔ PRODUCTION STARTING UP WITH REACTIVE SPUTTERING HAVING A PRODUCTION CAPACITY OF 50,000 TUBES/YEAR

2010 ➔ INCREASING OF PRODUCTION CAPACITY UP TO 100,000 TUBES/YEAR

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
THERMODYNAMIC SOLAR POWER FOR PVS

SOLAR STATIONS “STAND ALONE” FOR ELECTRIC ENERGY FROM THE SUN

CONSTRUCTION OF BIG COASTAL PLANTS TO PRODUCE ELECTRIC ENERGY AND DESALTED WATER TO BE USED AS DRINKABLE WATER AND FOR IRRIGATION

PRODUCTION OF MICRO PLANTS TO PRODUCE ELECTRIC ENERGY AND SOFT WATER, CONDITIONING

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS
DESERTEC: Clean Power from Deserts
the clean concept for energy, water and climate security

ARCHIMEDE PROJECT, SOLAR RECEIVER TUBES AND CONCENTRATED PANELS