EU SOLARIS info day /workshop
Concentrated Solar Thermal and Solar Chemistry Technologies

CST in Italy

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The main strategic challenges at National level are

- **Competitive** and **reliable** CSP in form of linear focusing technology coupled with standard thermoelectric plants, based on molten salts
- Small-medium scale **CSP systems for both electricity and heat production** for industrial process and residential use
- **Hybridisation** with other renewable energy sources, and innovative cycles
- Hybrid solar plant for **solar to fuel applications**

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The key enabling technologies will be supported through research on

- Innovative coating materials/treatments for solar receivers
- Reflective materials
- Cost-effective collectors
- Thermal energy storage systems
- Small scale power blocks
- Control systems
- Solar fuels
- System integration with other sources

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Resources

- CSP has a good tradition in Italy, both at research and at industrial level
- **The key reference research centre is ENEA**, and several R&D groups are acquiring a growing relevance in this field (CNR, FBK, Cagliari, Florence, Rome, Naples, Palermo, Torino, etc..)
- ***ENEA is managing the national funds trough the "Ricerca Sistema Elettrico" (Electric System Research)***
- The research projects are implemented under Programme Agreements between the Italian Ministry for Economic Development and ENEA

About ENEA

Italian National Agency for New Technologies, Energy and Sustainable Economic Development

under the Ministry of the Economic Development

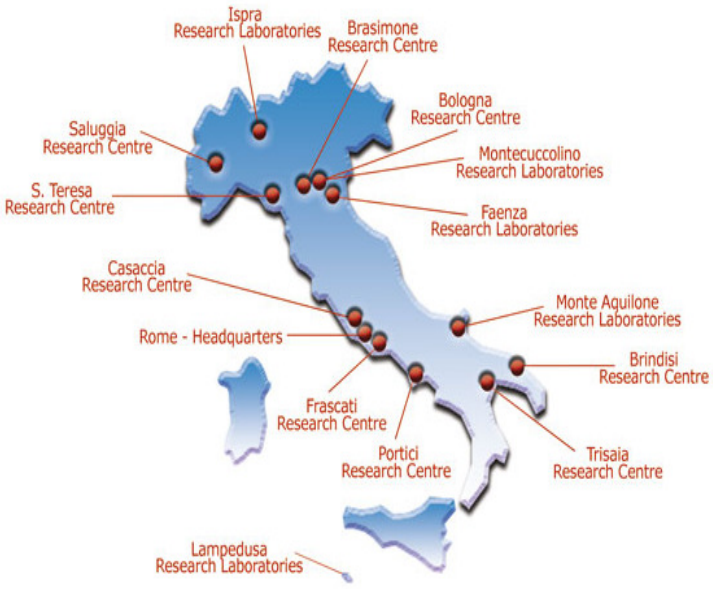
- Is a **public RTO** (***Research and Technology Organization)*** operating in the fields of ***energy***, ***environment*** and ***new technologies*** to support Country's competitiveness and sustainable development
- In 2008 ENEA has been appointed as the **Italian National Agency for Energy Efficiency,** pursuant to Legislative Decree no. 115 of 30th May, 2008, with the mission of contributing to the national energy policy by implementing measures and setting up actions for energy efficiency
- Its mission is to search for new technological solutions to ***meet the societal challenges***, fostering transition to the Low Carbon Economy
- The institutional mandate of the Agency is to disseminate and transfer ***knowledge, innovation and technology*** to industry, institutions and civil society at large

ENEA Activities

ENEA mainly operates to promote and carry out basic and applied research and innovation activities

- **Research:** mission-oriented, applied and industrial research, also through development of prototypes and product
- **Technology Transfer:** dissemination and transfer of research results to industry and exploitation for production purposes
- **Advanced services:** studies, measurements, tests and assessments to both public and private bodies and enterprises
- **Training and information:** activities aimed at broadening sector expertise and public knowledge and awareness

Where we are



- ENEA has over 2700 staff employees distributed in
  - ***headquarters*** in Rome
  - Brussels ***liaison office***
  - 9 ***research centres*** and 5 ***laboratories***
  - a network of ***territorial offices*** providing information and consultancy services for local public administrations and enterprises
- ENEA has an annual budget of about 300 Meuros

Research and Development

Fusion & Nuclear safety

- Fusion
- Fission (new gen)
- Radiation protection
- Nuclear safety & security
- Ionizing/non ionizing radiation applications

Energy technologies

- **CSP and solar thermal energy, including thermal energy storage**
- Photovoltaics and smart grids
- Energy efficiency technologies, including efficient conversion and use of energy, electric energy storage
- Bioenergy, biorefinery and greenchemostry
- Smart energy & smart cities
- Sustainable mobility
- Fuel cells and hydrogen
- Sustainable use of fossil fuels
- ICT

Sustainability of territorial systems

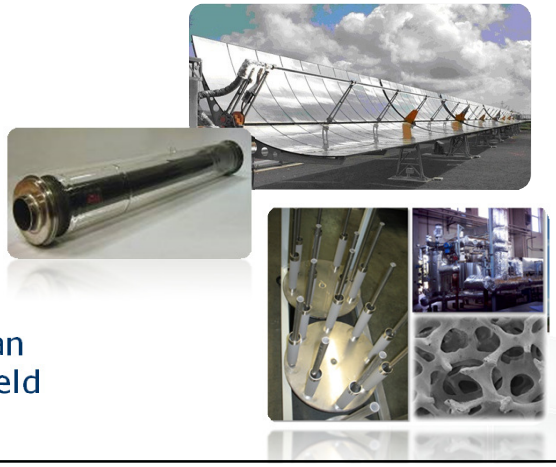
- Resource efficiency
- Environmental technologies
- Climate change: modeling, adaptation and mitigation
- Prevention and Recovery
- Seismic and natural hazards assessment and prevention
- Bio and nanotechs
- Agrifood

CSP in ENEA

- Since the early 2000's ENEA developed the first prototype and commercial scale (12.5 MWth) CSP plants based on solar troughs coupled with **molten salts as heat transfer fluid** (HTF) **and storage** (up to 550 °C)

- At the same time ENEA has been investigating **Solar Fuel** production processes

- ENEA promoted, in collaboration with industry, an Italian supply chain in this field



From Labs to Industrial Demonstration

Industrial Demonstration plant

Test facility PCS

Lab R&D

2001 Project Start-up

2002

2003 Prototype Design

2004 Prototype Operation start-up

2005

2006

2007 Components test and qualification

2008

2009 Demo design and construction

2010

Industrial role

Government role

CSP Activities in ENEA

- **R&D activities**
  - R&D of new solution for thermal fluid (new molten salt mixtures), critical components (receiver tube, steam generator, storage system) and plant configuration
  - Small-medium scale CSP systems for both electricity and industrial process heat production, also with hybridisation with other renewable energy sources
  - Production of solar fuels
- **Services**
  - Support to industry for components development, testing and qualification in ENEA facilities
  - Support to engineering firms and utilities for design and construction of power plant of different size and for various applications (power generation, hybrid plants, desalinisation, process heat...)

ENEA CSP experimental facilities

ENEA Low-Medium Solar Thermal Energy

- Quality and Reliability Test Laboratory for low temperature collectors
  - **accredited (EN 12975-2, ISO 9806 / EN 12976-2, ISO 94592)**
- Energy characterisation of collectors for uses at medium temperature (i.e. up to 300°C)
- Development of thermo-fluid-dynamic models for the optimisation of solar collectors, evaluation and optimisation of components for solar cooling systems

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Stakeholders

For the industrial scene, in Italy several enterprises are active in the CSP world both in a form of association or individually

- ANEST (Associazione Nazionale per l'Energia Solare Termodinamica) is the main association of the sector
  - In ANEST 25 companies are enrolled, whose major representatives are
    - Archimede Solar Energy, CSP-F, Enel, KT - Kinetics Technology, Innova Energy Solutions, Meccanotecnica Umbra, MF Energy, Reflex, Soltigua, Turboden, ARCA
- Major firms not included in ANEST, but active in CSP sector are
  - Astroflex, Almeco, Polokrio, Ronda and Maccaferri Group

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International cooperation

In the CSP field both research centres and industries have collaborations with international bodies

- Strong cooperation within EU funded projects involves
  - European countries
  - Middle East and North African countries
- Bilateral collaboration are ongoing with
  - India
  - China
  - South Africa

ENEA EU funded running projects

Scientific and Technological Alliance for Guaranteeing the European Excellence in Concentrating Solar Thermal Energy

EU SOLARIS

The European Research Infrastructure for Concentrated Solar Power

Solar facilities for the european research area

ENEA EU funded running projects

SOLAR CV

- Sector Skills Alliances in vocational education and training to cover skill needs through delivery and recognition of EU joint CV in Concentrated Solar Power

NESTER

- Networking for Excellence in Solar Thermal Energy Research

ENEA EU funded running projects

Multipurpose Applications by Thermodynamic Solar

MATS

Optimised Microturbine Solar Power system

OMSOP

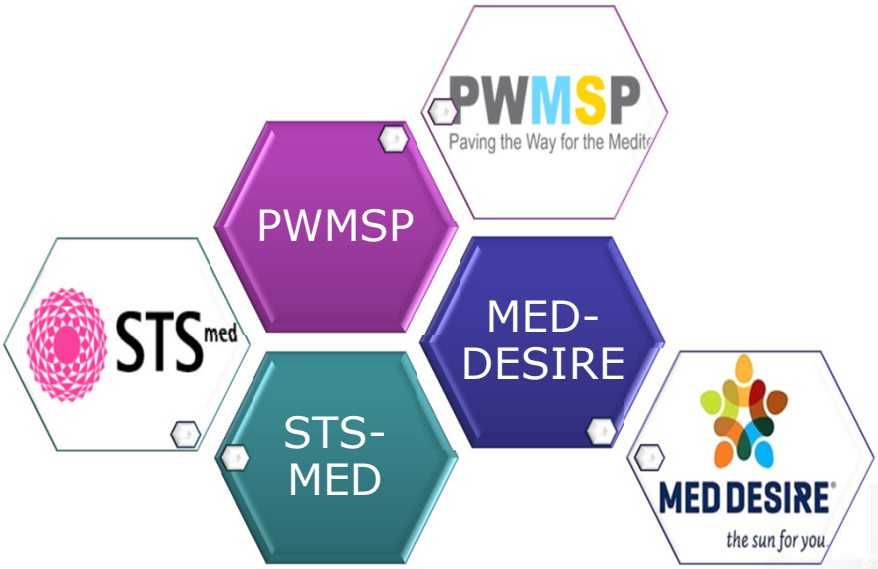
Organic Rankine Cycle – prototype Link to Unit Storage

ORC-PLUS
DISPATCHABLE SMALL-SCALE SOLAR THERMAL ELECTRICITY

REslag
Turning waste into value

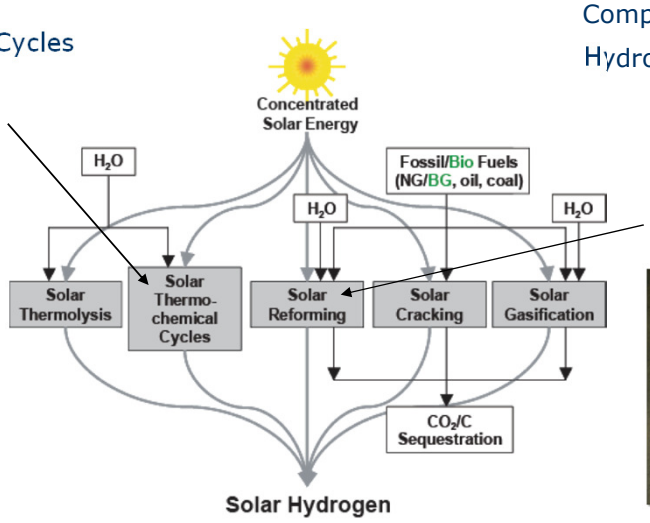
Turning waste from steel industry into a valuable low cost feedstock for energy intensive industry

ENEA EU funded running projects

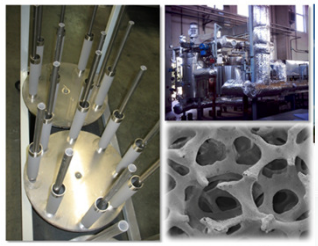


ENEA EU funded running projects

Solar To Hydrogen Hybrid Cycles



Compact Multifuel-Energy to Hydrogen Converter



Adapted from: A. Steinfeld, *Solar Energy* 78 (2005) 603–615

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Needs assessment

- Additional funding for R&D Programmes for CSP technologies are needed both at National and Regional levels to guarantee the continuity of the activities in the long term
- Implementation of a National strategy to support the Italian CSP supply chain in better deploying the technology into the market

Thank you for your attention

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