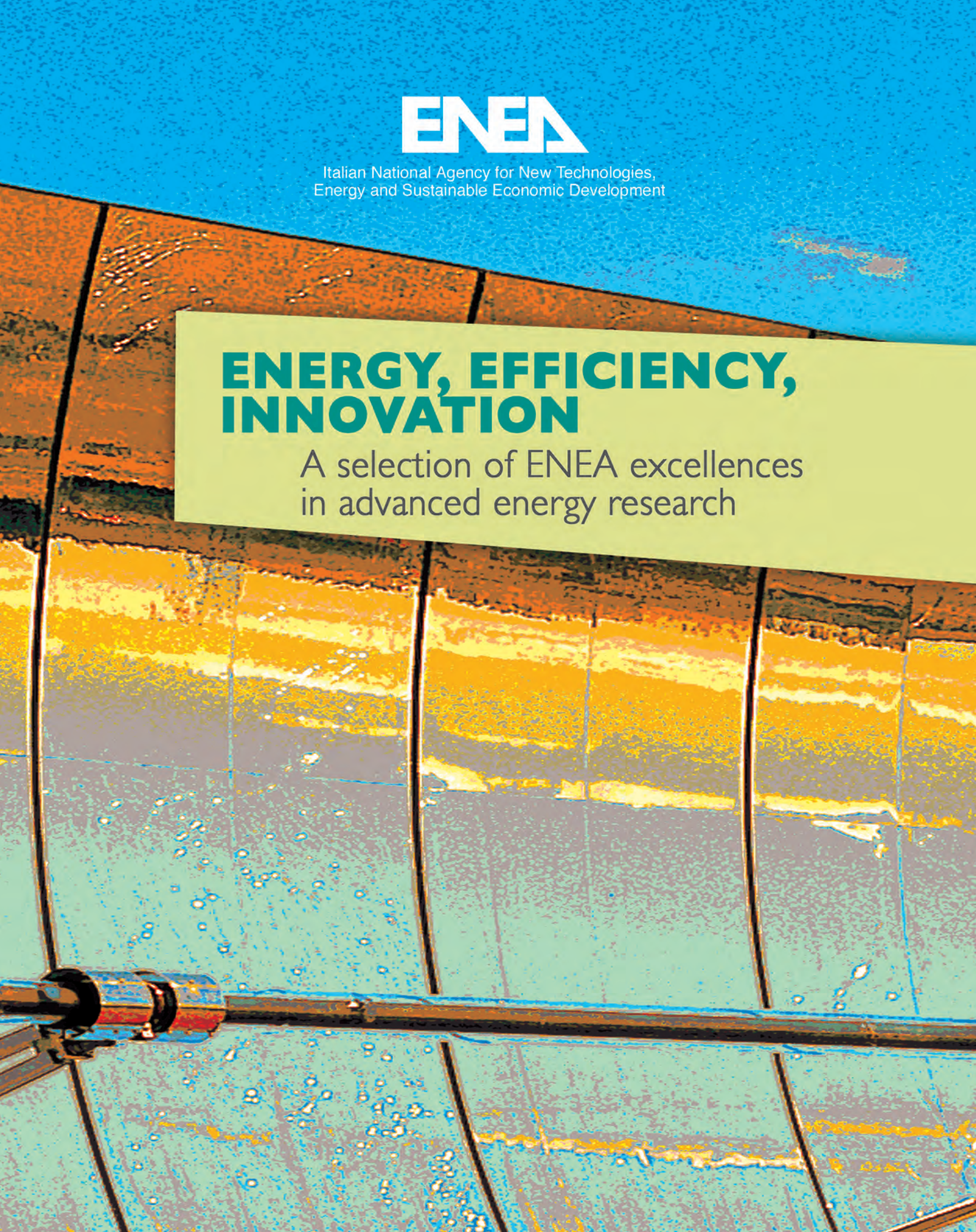
ENEA

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



ENERGY, EFFICIENCY, INNOVATION

A selection of ENEA excellences in advanced energy research

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

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CONCENTRATING SOLAR POWER - CSP

THE ENEA CSP TECHNOLOGY

Over the past decade ENEA has developed, within the parabolic trough technology, a new concept of high-temperature solar power plant. The main innovation consists in using molten salts (temperature up to 550 °C) as both heat transfer fluid and thermal storage medium. In the current CSP plants, a synthetic oil (temperature up to 390 °C) is used as heat transfer fluid and the molten salts only as thermal storage medium with the need of an intermediate heat exchanger between the two fluids. Unlike oil, molten salts are environmentally friendly, non-flammable, chemically stable, without any degradation of the receiving tube (hydrogen migration).
Using high-temperature molten salts improves the power plant efficiency and increases the performance of the thermal energy storage system, with a considerable cost reduction. An efficient low-cost thermal storage increases the capacity factor of the plant and the annual electricity generation, reducing the specific cost of electricity (€/kWh).
Thermal energy storage improves the dispatchability and flexibility of solar power plants. Furthermore, the thermal energy stored can be used to supply high-temperature heat for industrial or residential applications.

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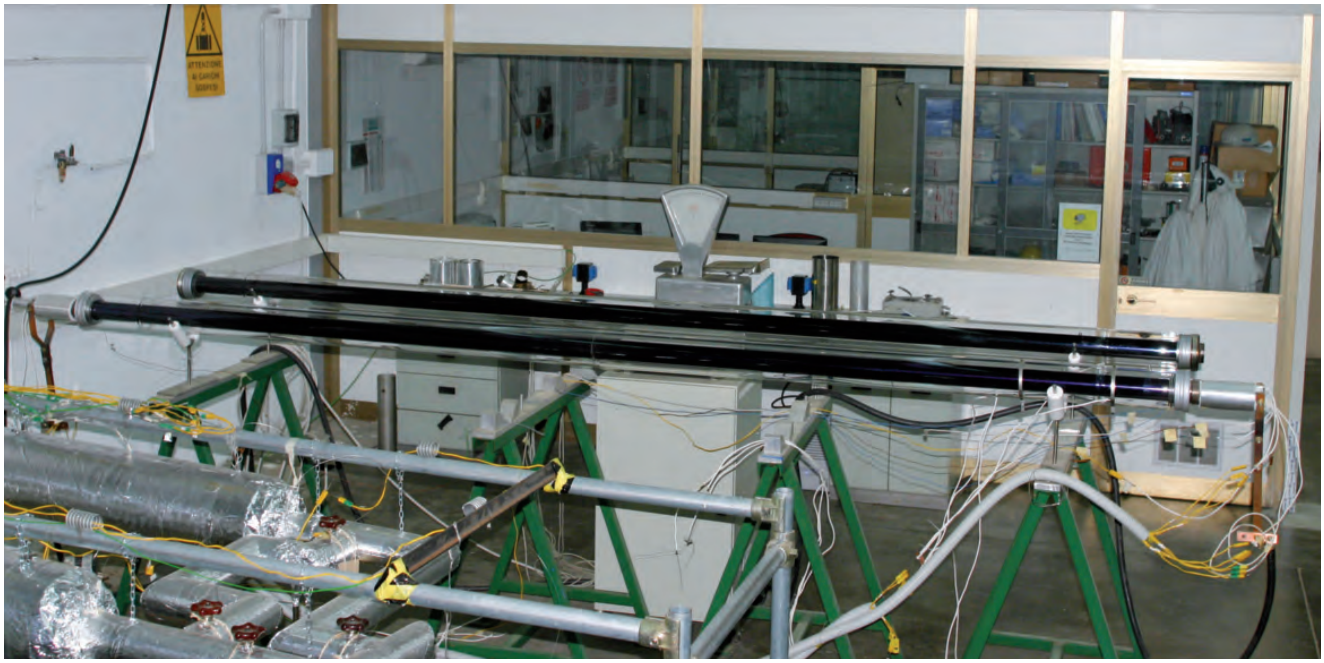
PCS test facility

CSP components design & test laboratory



DEVELOPMENT OF CSP COMPONENTS AND SYSTEMS

Using high-temperature molten salts requires new technologies and components for heat capture and storage. In particular, ENEA has successfully developed, tested and patented new and efficient receiver tubes that can be used with high-temperature molten salts.
A close cooperation with manufacturing companies (e.g., Archimede Solar Energy) and utilities (ENEL) resulted in technology transfer to industry and led to the construction of a 5 MWe demonstration plant (Archimede power plant) in Sicily, which has been in operation since July 2010 for more than 4 years. Since then, ENEA has continued the R&D programme on CSP technology, working on components optimization, exploring alternative CSP concepts (e.g., solar dish) and energy storage systems. ENEA is also involved in a number of feasibility studies and design of CSP plants to be built either in Italy and abroad.

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PCS test facility

ENEA CSP INFRASTRUCTURE AND LABORATORIES

To support the CSP R&D programme, experimental plants and test facilities have been installed and operated at the ENEA Casaccia and Portici Research Centres.

PCS Test Facility - Extensive, integrated full-scale testing of basic concept, systems and components of CSP plants in real operating conditions have been carried out at the ENEA Casaccia PCS Test facility since April 2004, with over 60,000 h operation.

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MOSE (Molten Salt Experiments) Loop - The ENEA-Casaccia MOSE experimental plant has been built to test CSP materials and components under high-temperature, molten-salt flow. The plant is also used to carry out solar-heat-based reforming experiments for solar fuels production.

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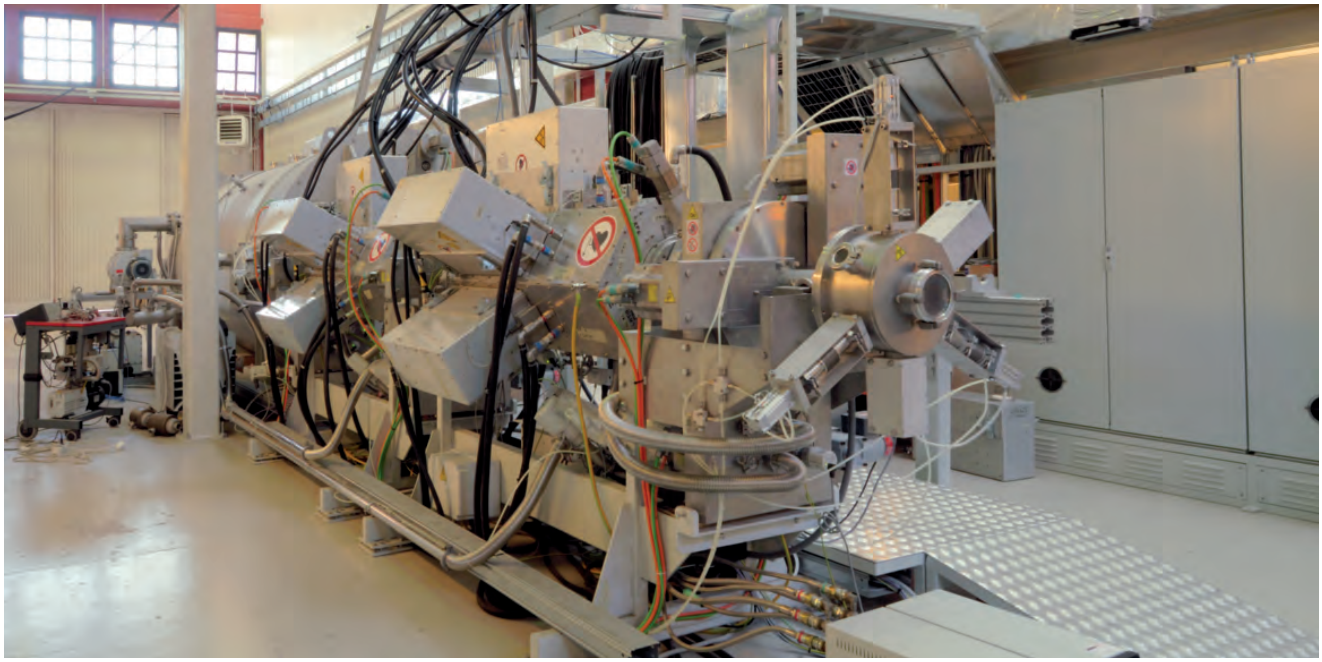
MOSE experimental plant



Selective coating laboratory

CSP Components Design & Test Lab. - The Casaccia-based Design and Testing Lab carries out design and tests of key CSP components such as receivers, flexible joints and heaters. The Lab. is also involved in the design and testing of advanced CSP solar dish concepts with gas turbines to produce electricity.

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Solar Irradiance Lab. - The Solar Irradiance Lab. performs measurements, modeling and mapping of Direct Normal solar Irradiance (DNI) for CSP applications all over the word, using the Meteonorm system.

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Solar Collectors Optics Lab. - The optical lab. deals with measurements of the optical performance (e.g., efficiency) of reflecting panels and receiver tubes as well as procedures and techniques for the alignment of solar collectors (mirrors, receivers) during the assembly.

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Selective Coating Lab. - The Portici-based (Napoli) Selective Coating Lab. is the ENEA laboratory where key CSP technologies have been developed and patented, e.g. the selective coatings for CSP heat tube-receivers as well as deposition and innovative sputtering facilities for CSP selective solar coatings.

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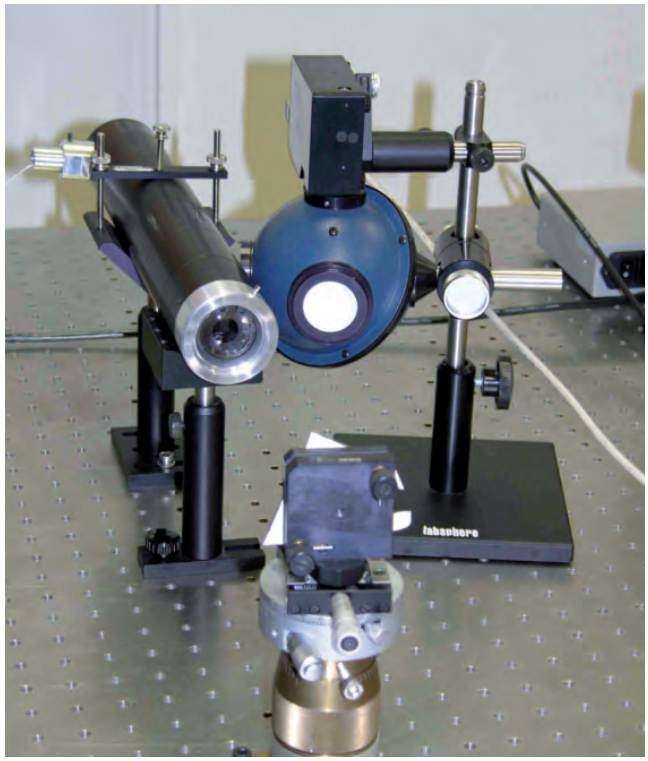


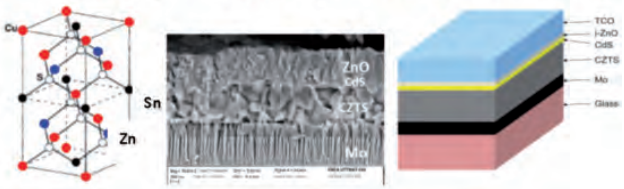
Solar collector optics laboratory

PHOTOVOLTAICS

THIN-FILM SOLAR CELLS FROM EARTH ABUNDANT MATERIALS

Thin-film solar cells have recently surpassed the 20% efficiency limit using the ternary $CuInSe_2$ and the binary CdTe semiconductors. Nonetheless, much effort is devoted to the search of compounds based on naturally

CZTS Cu_2ZnSnS_4 CTS Cu_2SnS_2 materials and cells



abundant and non-toxic elements able to give similar performances. ENEA is working on two such compounds: Cu_2SnS_3 (abbreviated as "CTS") and Cu_2ZnSnS_4 (abbreviated as "CZTS"). CTS is quite similar to $CuInSe_2$, yet its development by the world scientific community has just begun. The optimization of the CZTS quaternary compound has a longer history but, due to its complex nature, it has proved to be quite difficult and the maximum efficiency obtained so far is around 9%.

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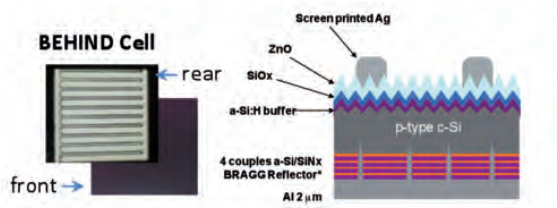
a-Si:H/c-Si HETEROJUNCTION SOLAR CELLS

Currently the amorphous/crystalline silicon heterojunction solar cells are the most interesting, merging the well addressed silicon

Amorphous/Silicon heterojunction cell



technologies with amorphous thin-film properties to obtain high-efficiency solar cells. ENEA labs are working to promote an innovative cell architecture, such as BEHIND cell concept, in which both emitter and base contacts are placed on the cell rear side, so as to avoid the shadowing effect caused by the front metal grid electrode. Innovative high-transparency SiOx thin emitter films and low-cost, ZnO-based transparent conductive oxide (TCO) layers are under investigation to further enhance solar cell performances. A fine-line-screen printing technique, using low silver content and an innovative plating system to produce metal electrodes, is under development in close collaboration with industries.

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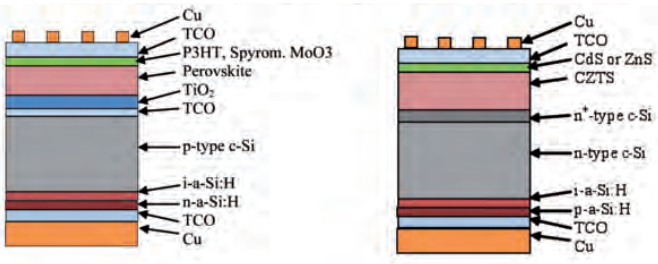
HIGH-EFFICIENCY TANDEM SOLAR CELL

ENEA photovoltaic Labs are now starting new activities on the high-efficiency cell concept, merging the silicon technology with large energy gap CZTS or Perovskite thin-film

Tandem device to achieve higher efficiency solar cell



materials. Theoretical calculations demonstrate that the stacked-material tandem device is suitable to obtain a 30% efficient solar cell.

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ORGANIC PHOTOVOLTAICS

Organic photovoltaics offers the possibility of realizing low-cost, large-area, light-weight, foldable modules for solar energy conversion. These properties will even more allow a wider exploitation of solar radiation wherever clean energy is needed. ENEA investigates new blends of organic materials and solar cell structure to achieve higher efficiency and reliability, as well as several techniques for mass production of polymer solar cells.

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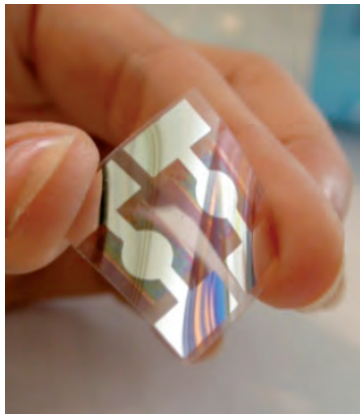
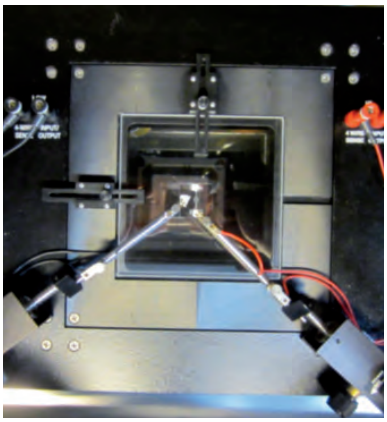
Flexible polymer solar cell



Solar cell under test



SMART PV

The next step for the enhancement of PV systems and their optimum integration in the electrical grid (for both existing and new plants) lays in the development of new and advanced system functions for added value services dedicated to producers/users and distributors. ENEA is developing devices, software, modeling, smart-grid concepts and strategies synthetically known as "Smart PV". Valuable results have been achieved in the design and development of innovative Distributed Maximum Power Point Trackers (DMMPT), smart-grid design and modeling, autonomous micro-grid modeling, integration and sizing of non-dispatchable sources and storage, power flow algorithms, data communication for optimum energy trading. In this context, ENEA is working on systems representative of residential and commercial applications to investigate models and management of energy flows and storage systems.

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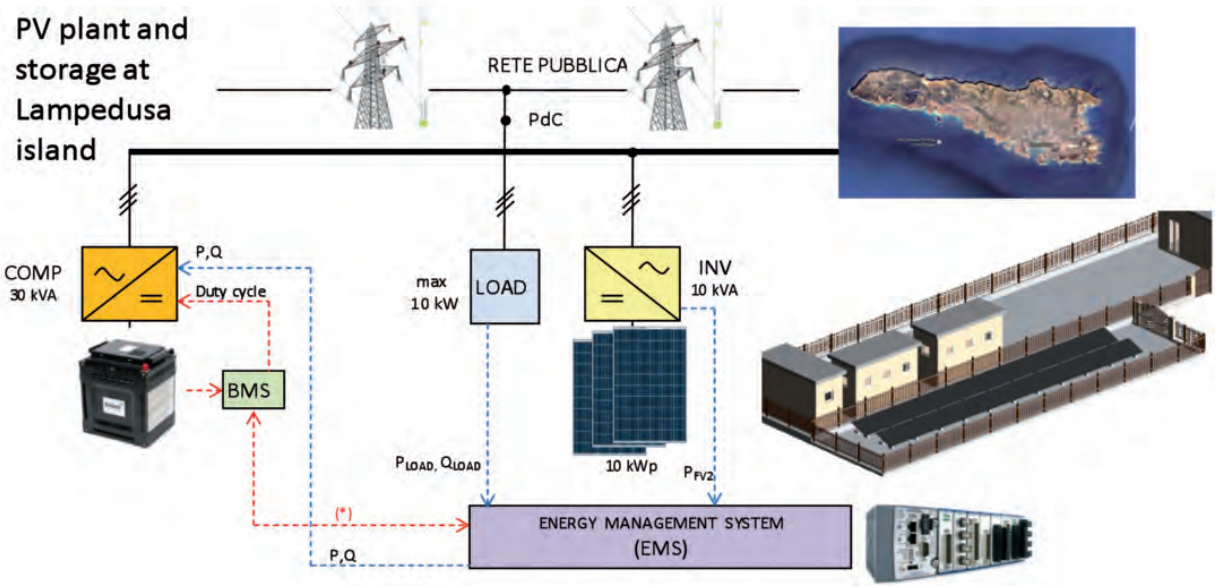

BIOMASS FOR ENERGY AND GREEN CHEMISTRY

THERMOCHEMICAL PROCESSES

A technology park dedicated to biomass gasification is present at the ENEA Trisaia Research Centre. R&D activities are focused on the development of innovative gasification technologies for efficient power production on a small to medium scale. This is in order to allow the exploitation of low-value feedstocks – such as biomass residues from forest management, agro-industrial sectors and wood industries – and, thus, facilitate the diffusion of decentralized energy production. R&D activities carried out at the Trisaia Centre are mainly focused on addressing the critical issues related to the design of reactors and gas cleaning. Hopefully new advancements in these two technological areas will bring important breakthroughs to achieve the final goals of efficient power production and optimized integration between gasification and end-use of the produced gas. Moreover, innovative processes for the production of secondary energy carriers (i.e. H_2, SNG, MeOH) are also included in the R&D programme. The pilot-scale experimental biomass gasification plants available at the Trisaia Centre are based on gasification reactors of different design, fixed or fluidized bed, and equipped with sections for gas cleaning and conditioning. As mentioned above, all pilot scale facilities will certainly help to evaluate the whole process chain 'Biomass-to-end' application (i.e. BTP, BTG, BTL) to scale up, transfer of know-how, technology industrialization, etc..

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BIOLOGICAL PROCESSES

The production of biogas through anaerobic digestion (AD) of animal manure and slurries, as well as of a wide range of digestible organic wastes, converts these substrates into renewable energy and offers a natural fertilizer for agriculture. AD is a microbiological process of decomposition of organic matter in the absence of oxygen, common to many natural environments and largely applied today to produce biogas in airproof reactor tanks, typically named digesters. The biogas may be used either in distributed plants (from some tens of kW up to 1 MW) to locally supply heat and power or, after an appropriate treatment to remove pollutants and to separate CO_2, it may be added as bio-methane to the national grid, or used as fuel for cars. At ENEA, studies and experiments are being carried out in this field to

Different types of biomass gasification plants at the ENEA Trisaia Research Centre

Mobile anaerobic digestor

optimize the fermentation and anaerobic digestion of various biomass mixtures and to increase the hydrogen and bio-methane production yield. To this end, appropriate microbial catalysis is used and the structure and composition of suitable microbial communities are studied through molecular techniques. Moreover, new materials as well as chemical-physical and biological processes for reducing pollutants in biogas production and for CO_2 removal, up-grading biogas to bio-methane, are developed and tested. Pilot plants of different sizes and using various organic wastes have been designed, built and operated at the ENEA laboratories and in cooperation with industries and other research organizations.

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BIOREFINERIES AND GREEN CHEMISTRY

Biorefineries represent an opportunity to convert biomass into a spectrum of marketable products (food, feed, materials, green chemicals) and energy (fuel, power and heat). Lignocellulosic materials have a complex structure and require the use of effective technologies and processes to convert its macromolecules, namely cellulose, hemicellulose, and lignin, into value-added products. In the 90's ENEA built an integrated pretreatment and fractionation station able to deliver 300 kg/h of homogeneous product with high release of sugars. The technology uses saturated water-steam for a few-minute treatment. The ENEA pilot-scale biorefinery is also equipped with extraction units with size compatible for a continuous fractionation process. The combination of effective pretreatment technologies with the high selectivity of the biotechnological processes or the chemical-catalyzed process makes it possible to produce several products. Fermentative products include alcohols, diols and polyhols, microbial lipids, several organic acids and esters. Research efforts are dedicated to the investigation of novel enzymatic functions assisting biomass destructuration, the development of processes to convert hemicellulose and lignin and produce new bio-products through the fermentation of the biomass carbohydrates or process by-products (e.g., glycerol).

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Steam explosion pretreatment and hall for bio-technological process

TECHNOLOGIES AND INSTRUMENTS FOR EFFICIENCY

SOLAR COOLING AND HEATING

Solar energy can provide all-year-round climatisation of buildings when coupled with absorption heat pumps. These pumps need a heat source for generating cold water/air or hot water. ENEA investigates the coupling of solar panels and absorption heat pumps to develop new technologies and technical solutions, and works on the development of water/ammonia absorption heat pumps. HVAC can therefore be achieved without the harmful effects of greenhouse gas emissions created by fossil fuels, also greatly reducing energy consumptions. The PCM (Phase Change Material) accumulation tank can be coupled with solar cooling and heating systems for cold and heat accumulation, to cope with the non-programmability of renewable sources.

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TEST FACILITY FOR CONCENTRATING SOLAR COLLECTORS FOR MEDIUM-TEMPERATURE APPLICATIONS

Small-sized concentrating collectors, capable of generating process heat at temperatures between 100 °C and 300 °C, are suited to both medium-temperature decentralized applications and combined heat and power generation in industrial processes. ENEA's R&D activities are aimed at supporting manufacturing companies in the development and technological improvement of such systems. The ENEA Trisaia Research Centre hosts an accredited test laboratory where energy characterization of different concentrating systems (Linear-Fresnel, mini- and micro-CSP, CPC, dish/sterling systems) is performed by analyzing their optical and thermal behaviors. The Test Lab. also conducts studies and provides models to predict short-and

Solar cooling and heating in the Casaccia test building

ENEA Trisaia test facility for the characterization of concentrating collectors at medium temperature

long-term thermal performances in different operating conditions. Furthermore, ENEA develops dynamic models to estimate efficiency curves by using in-site measurements obtained in transient conditions. Finally, the ENEA Test Lab. is the Italian national representative in the CEN and ISO standardization committees.

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CO_2 AS NATURAL REFRIGERANT FOR INNOVATIVE, LOW-ENVIRONMENTAL-IMPACT HEAT PUMPS AND FOR REFRIGERANT CYCLES AT HIGH, MEDIUM AND LOW TEMPERATURE

CO_2 is a versatile natural refrigerant for multiple applications, allowing to eliminate the GWP effect associated with refrigerants. ENEA is working at developing multipurpose heat pumps using CO_2 to produce hot water (for domestic use) and chilled water or air (for air conditioning) simultaneously, allowing energy savings in the range of 75% compared to the conventional electric boiler and air conditioning systems. Carbon dioxide is also employed in ENEA as a natural refrigerant for both domestic refrigerators (medium temperature) and the industrial low-temperature refrigeration, i.e., ice cream machines, supermarket benches for frozen food.

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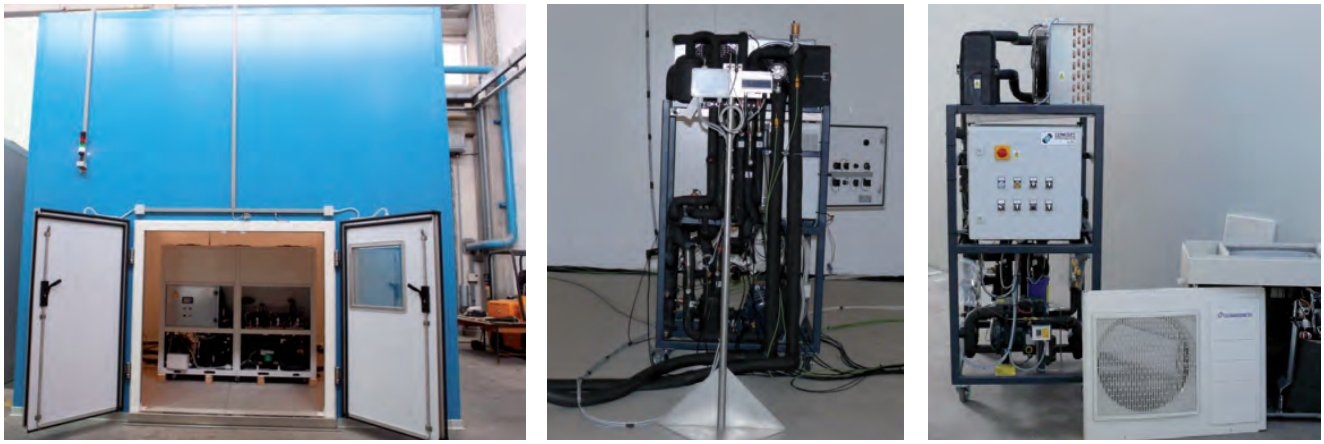
Calorimeter for the characterization of commercial and prototypical heat pumps, in collaboration with the Italian industry



HIGH-TEMPERATURE FUEL CELLS

Fuel cells in general are the most suited technology for small-scale, clean and high-efficiency power generation: making optimized use of electrochemical processes, electricity is generated directly, without resorting to combustion and associated harmful emissions devices. High-temperature fuel cells (HTFC, namely molten carbonate fuel cells – MCFC – and solid oxide fuel cells – SOFC) in particular can use different types of fuel with high efficiency and produce high quality heat as a by-product in addition to the electrical power. Furthermore, HTFC can be reversed in operation, making it possible to convert electricity (for example from excess wind or solar PV power) to fuel, guaranteeing efficient and durable energy storage. Research activity in this field at ENEA consists of carrying out advanced testing, characterization and evaluation of HTFC components and systems, making use of cutting-edge experimental approaches and measurement techniques, for the benefit of industries interested to apply HTFC technology and for the advancement of scientific knowledge in the field. ENEA's Lab., with its far-reaching national and international collaborations, is a point of reference in Italy and Europe as regards the realization and enabling of fuel cell deployment, through mediation between developers and customers, providing platforms for entrepreneurs and policymakers in the field, building awareness, exploring market opportunities and pointing out gaps in knowledge and regulation.

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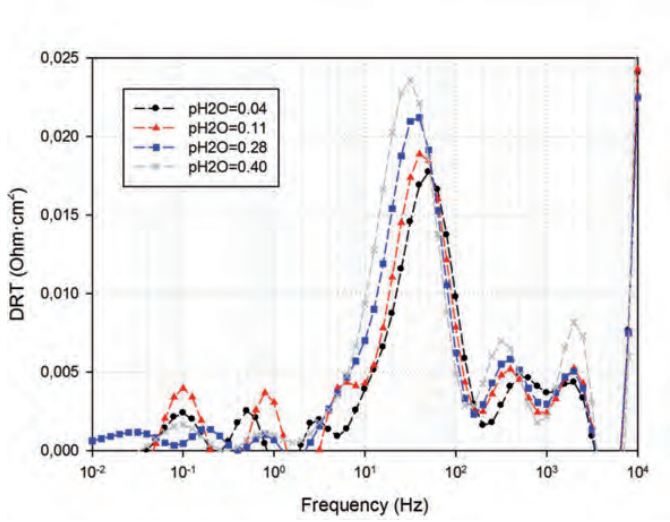

ELECTRIC ENERGY STORAGE SYSTEMS FOR AUTOMOTIVE AND ELECTRICITY GRID APPLICATIONS

ENEA research is focused on innovative applications of energy storage systems for advanced, electrically-powered vehicles and smart energy grids, with technical and economic assessments and evaluations, simulations, prototype design and fabrication, and bench

and field testing under selected operating conditions. Research, development and experimental activities cover the full life of electrochemical storage systems, from basic research on materials to applied research and demonstration in real service and subsequent recycling. Electrochemical storage systems (batteries based on lithium and redox flow, supercapacitors) are the key storage technologies being investigated with the principal aim of improving the technical and economical storage characteristics for clean vehicles and electricity grids, through the increasing integration of renewable energy sources. Lithium-based batteries have as major focus the current projects for their technical features and economic prospects with original contributions on: materials and processes, experimental cells, control technologies and interface with the grid, hybrid storage systems, and “second life” investigation.

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Dry room, battery cycler, climatic chamber and IR thermocamera at ENEA laboratories

LOW-ENVIRONMENTAL-IMPACT VEHICLES (ELECTRIC, HYBRID, INNOVATIVE ENGINES)

ENEA research focuses on the improvement of energy efficiency in the transport sector and the realization of low-environmental-impact vehicles. Particular attention is dedicated to Electric and Hybrid Vehicles and related charging and storage systems. As a matter of fact, the use of lithium batteries for electric traction is one of the most promising approaches for the electrification of road transport. However, investing in research and development is still necessary to reduce costs, enhance performance and facilitate the deployment of such systems. Hence, ENEA is also committed on the full-cycle characterization of battery modules and BMS (Battery Management System), cooling system and mechanical structure of the modules, fast charge V2G (Vehicle-to-Grid).
In the field of alternative fuel, ENEA has carried on several experimental test campaigns, aimed at identifying the prospective of the use of blends of natural gas (HCNG) and hydrogen in existing ICE vehicles.

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Equipment for the complete testing of batteries and testing "on the road" (in Ravenna) of a bus fuelled with a hydrogen-methane mixture

INNOVATIVE TOOLS FOR SUSTAINABLE MOBILITY

ENEA provides innovative tools for planning, management and operation of transport systems. Recent ENEA research outcomes include new solutions in the fields of: real-time traffic monitoring and forecasting, georeferenced energy and environmental impact estimation based on effective driving cycles, mobility analysis based on floating sensors, optimization of urban freight distribution and long-distance multimodal freight transport. Current research and main development projects are focused on improving the evaluation of sustainable transport policies both at the national and local levels, home-work mobility management and urban transport system's resilience.

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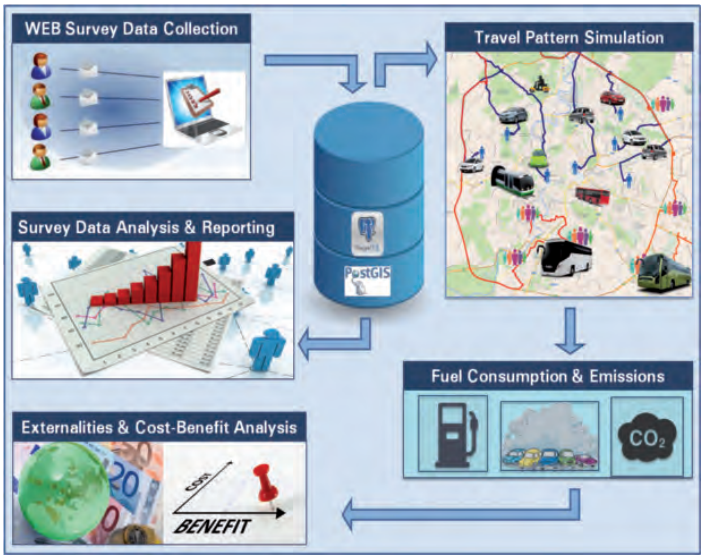
Home-Work Mobility evaluation: methodological scheme



SMART CITIES (URBAN NETWORKS, SUSTAINABLE ENERGY, MOBILITY AND SOCIAL DEVELOPMENT)

ENEA is active in the development of a smart city model and the related smart technologies and infrastructures for the optimized management of energy through the implementation of smart buildings, smart villages, smart rings. The ENEA smart city model is based on the integration of public smart lighting (monitoring consumption and adaptive control) with: smart mobility and environmental monitoring (public e-mobility with position, speed, and passenger sensors, fixed and mobile air quality monitoring); smart buildings (remote electric and thermal diagnostic of public buildings); smart node (network interface between citizens and public administration, information on local cultural heritage, territorial social network dedicated to the public).

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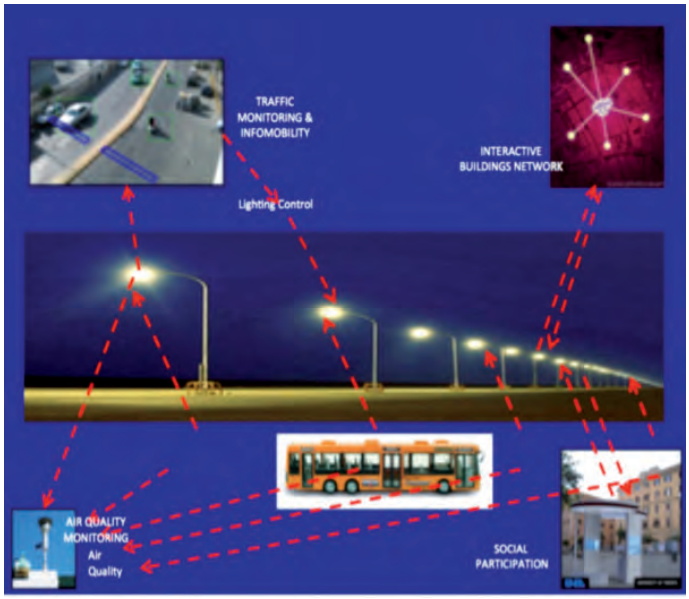

PUBLIC LIGHTING - LUMIÉRE PROJECT

Public lighting in Italy is around 12% of the electric energy for lighting and is one of the greater expenses in municipalities' budget. Through the Lumiére Project ENEA is supporting municipalities to evaluate the energy status of their lighting plants, helping them in the whole process of public light plants renovation, achieving a high-efficiency solution with at least 30% energy saving (and CO_2 emissions). The Lumiére Project, through the modernization and efficiency of public lighting, is the basis of the ENEA smart city model, implementing smart technologies for e-mobility, light control, energy monitoring and diagnostics of buildings, smart node, ... The Lumiére Project also involves ESCo, Associations, Universities.

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Typical municipality interested in benefitting from the Lumiére project

INTELLIGENT SENSING TECHNOLOGIES

ENEA realizes tranducers and develops architectures and algorithms for intelligent cooperating multi-sensory smart devices, targeret at energy efficiency in buildings, environmental quality detection and other vertical applications. This smart devices family comprises:

@lisee: multisensory devices measuring energy consumption and environmental variables for the evaluation of the indexes of energy efficiency in buildings

ICARO: electronic nose for surface contaminants detection

MONICA: a small portable box of sensors array for air quality monitoring.

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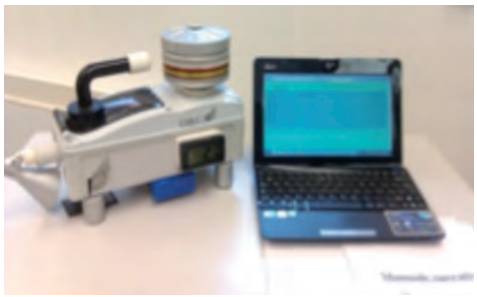

@lisee sensor box for building applications and ICARO e-nose for surface contamination assessment

MONICA prototype mounted on a bicycle and its App screenshot for Android smartphones

ORGANIC LIGHT-EMITTING DIODE

Pervasive use of artificial light in modern towns and buildings, both for lighting and decoration, needs a huge amount of electricity and brings a significant environmental impact. The best answer to these problems are the "Organic light-emitting diodes", a new kind of light sources with the potential of high energy efficiency, simple, high-throughput, large-area, and green production processes (e.g., printing techniques coupled with roll-to-roll configuration process systems), and using non-toxic and easily recoverable and recyclable materials.

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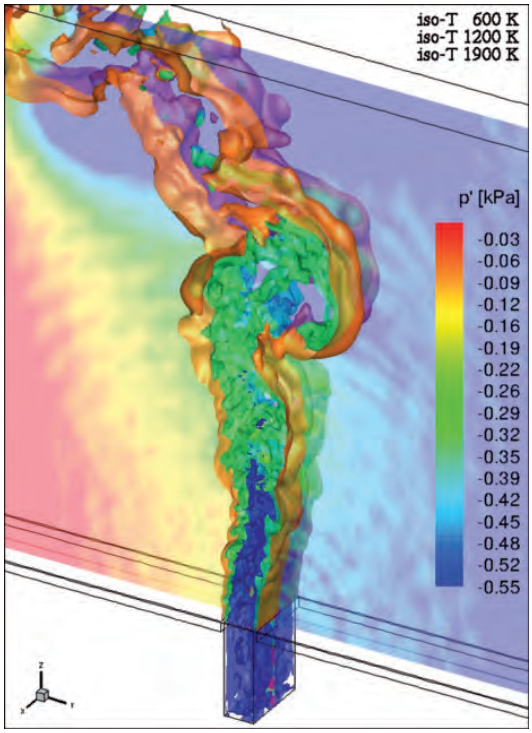
Lighted OLED in the shape of the ENEA logo

Integrated OLED process system

SUSTAINABLE USE OF FOSSIL FUELS AND CCS TECHNOLOGIES

TECHNOLOGIES FOR THE OPTIMIZATION OF COMBUSTION PROCESSES

ENEA activities in the field are mainly high-performance numerical simulation, advanced diagnostics, and design of innovative and higher-performance devices, characterized by high "load & fuel flexibility" and reduced emissions.



LES simulation of a pre-mixed CH_4/H_2/Air flame

ENEA has developed the HeaRT® (Heat Release and Turbulence) code, an advanced computing tool based on the LES/DNS (Large Eddy Simulation and Direct Numerical Simulation) model, capable of simulating compressible, turbulent, mono- and multi-phase, reactive and non-reactive, subsonic and supersonic 3D flows.

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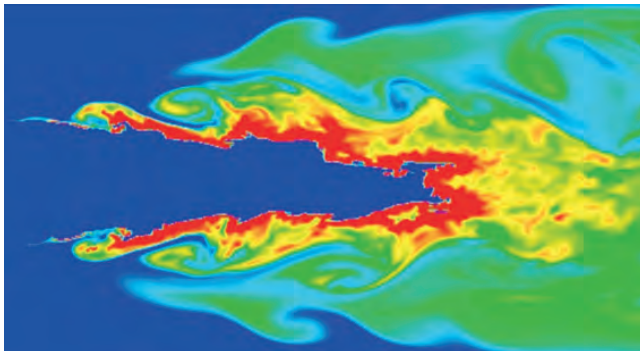

LES simulation of a pre-mixed syngas flame

ENEA also develops advanced, non-invasive diagnostic systems (e.g., ODC, Optical Diagnostics for Combustion, based on the analysis of emissions in the visible and UV regions of a flame – three patents), for fluid-dynamic, thermal and chemical measurements aimed at the combustion process monitoring and the prediction of unstable events, which can seriously damage equipment and cause lack of efficiency and significant polluting emissions.

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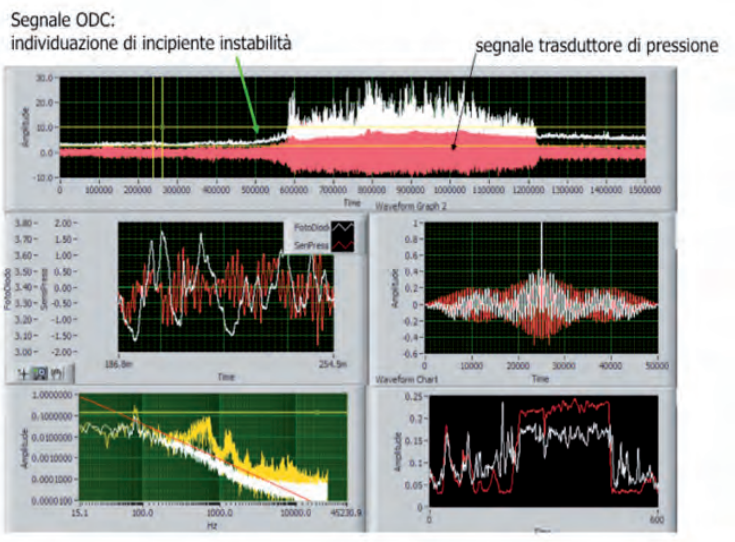
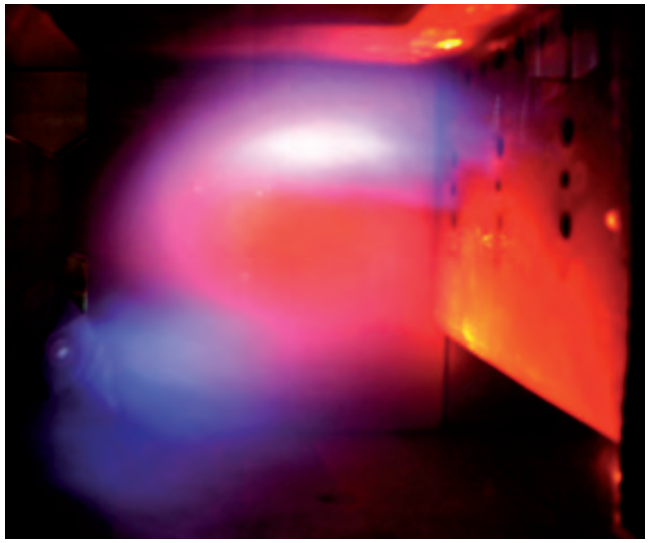
ENEA-ODC Diagnostics of the combustion process instability





ENEA Trapped Vortex experimental burner for gas turbines

The combined numerical/experimental approach allowed to develop innovative, pre-mixed/MILD (patented) burners for gas turbines, characterized by high operative flexibility, in compliance with the latest operation requirements.

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CCS TECHNOLOGIES

ENEA is working at a large-scale multi-cyclical, zero-emission, CO_2 capture process, based on solid or gas fossil fuel decarbonization, with capture of CO_2, production and combustion of hydrogen in a gas turbine to generate electric power by running the multipurpose ZECOMIX (Zero Emission of Carbon with Mixed technologies) platform, included in the database of MERIL as a Research Infrastructure of great importance in Europe in the field.
In parallel, calcium-oxide synthetic sorbents are developed in laboratory, which are capable of integrating chemical and CO_2 separation processes in one single step, withstanding repeated capture and regeneration cycles. One of the strengths of this technology is that it can find application in non-energy (steel and cement) industries, too.

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ADVANCED GAS TURBINE CYCLES ASSESSMENT AND TEST

Advanced gas-turbine power cycles that use a CO_2-rich working fluid could provide a partial mid-term and a more effective long-term solution for the sustainable use of fossil fuels. "Exhaust Gas Recirculation" (EGR) gas turbines can successfully contribute to a better implementation of CCS technologies on both OCGT (open-cycle gas turbines) and CCGT (combined-cycle gas turbines) cycles, as a mid-term solution. Supercritical-CO_2 (S-CO_2) gas turbines may be a long-term solution that simultaneously meets the requirements for: load-flexibility, fuel-flexibility, CCS, thermodynamic efficiency, P2G (Power-to-Gas), enhanced gas recovery and cost-effectiveness. S-CO_2 cycle configurations can be closed (using external heat sources) and semi-closed (using internal oxy-combustion). CO_2ReTurn (Supercritical-CO_2 Recompression Turbine Cycle) is the ENEA proposal using the oxy-combustion of natural gas and implementing a highly-integrated, efficient and cost-effective CO_2 capture process. S-CO_2 cycles in closed configuration coupled with OCGT could represent a new concept of CCGT with potential increase in load-flexibility compared to the conventional coupling with the steam section. The peculiarities of closed S-CO_2 cycles make

ZECOMIX experimental platform

AGATUR experimental platform

further interesting applications viable in fields other than power generation, e.g. naval transport, where layout compactness along with thermodynamic efficiency can simultaneously increase the payload and decrease both operating costs and emissions.
AGATUR (Advanced GAs TUrbine Rising) can be a test-bench for advanced Brayton-Joule cycles, emulating gas turbine cycles with working fluids other than air, with the basic idea of making an experimental Brayton-Joule cycle with oxy-combustion capabilities, aimed at the evaluation of EGR gas turbine cycles with a variable content of CO_2 in the working fluid and with or without oxygen enrichment.

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USING CO_2 TO PRODUCE FUELS

Using CO_2 to produce fuels and chemicals (CCU, Carbon Capture and Utilization technologies) can be a cost-effective alternative to its geological capture. The most important application is certainly the synthesis of fuels directly usable, such as the case of methane produced by reducing CO_2 with H_2 (obtained from water through electrolysis with a renewable energy source or with surplus energy from the electric grid). Other important fuels are methanol and dimethyl ether (DME). ENEA is developing this technology (selection of the catalyst, detection of the maximum conversion performance conditions, etc...) also by running a little demonstration facility (FENICE).

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FENICE experimental facility

ENEA is the name for Italian National Agency for New Technologies, Energy and Sustainable Economic Development and is the second major Italian research organization with around 2700 staff employees, distributed in its 11 research centers all over the national territory. The Agency's activities are mainly focused on Energy Efficiency, Renewable Energy Sources, Nuclear Energy, Climate and the Environment, Safety and Health, New Technologies, Electric System Research.

The Agency's multidisciplinary competences and great expertise in managing complex research projects are put at the disposal of the Country system. Specifically, its activities are devoted to: basic, mission-oriented, and industrial research exploiting wide-ranging expertise as well as experimental facilities, specialized laboratories, advanced equipment. The Agency also: develops new technologies and advanced applications; provides public and private bodies with high-tech services, studies, measurements, tests and assessments; delivers training and information activities aimed at providing greater public knowledge and awareness on the Agency's fields of competence, and a higher level of dissemination and transfer of research results, thus promoting their exploitation for production purposes.

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