RSE in a nutshell

Prof. Franco Cotana
CEO

May 2024

RSE – PASSPORT

OWNERSHIP
Single owner: GSE – publicly owned company – Ministry of Economy and Finance

GOVERNANCE
Supervised by MASE, Owned by GSE

MISSION
System focussed R&D dedicated to the integrated energy system financed by public funds

DOMAIN OF ACTIVITIES
Research of public interest in the electro-energy / environmental sector

APPROACH
System approach experimental applications enhancing multidisciplinary skills

RESOURCES
About 400 people – 2/3 graduates, 80% researchers, head office Milan - mean age <47

MINISTERO DELL'AMBIENTE E DELLA SICUREZZA ENERGETICA

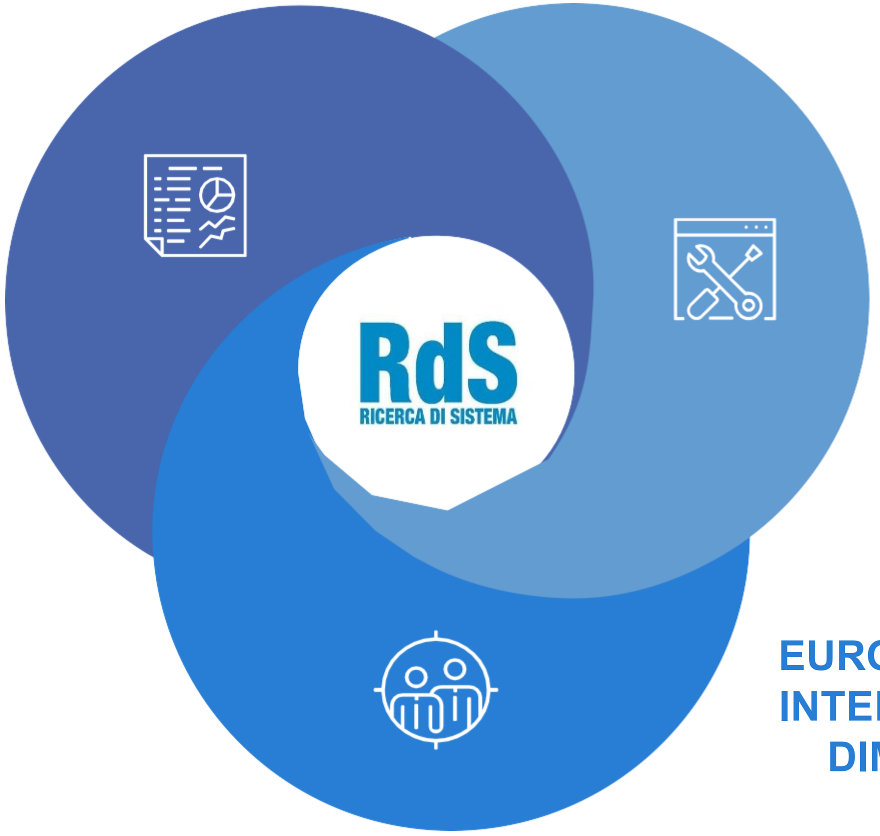
Ministero delle Imprese e del Made in Italy

Ministero degli Affari Esteri e della Cooperazione Internazionale

ARERA Autorità di Regolazione per Energia Reti e Ambiente

RSE VISION

SUPPORT TO NATIONAL
AND REGIONAL INSTITUTIONS



COLLABORATION
WITH INDUSTRY
AND OPERATORS

EUROPEAN AND
INTERNATIONAL
DIMENSION

RSE supports energy system planning

Decarbonisation Working Group - Presidency of the Council of Ministers

2016

SEN 2017

2017

National Energy Strategy

NECP **1.0**

2019

2020

Long Term Strategy

- ✓ Hydrogen National Strategy
- ✓ Interminist. Committee Ecological Transition
- ✓ Regional Burden sharing Renewable energies

2021-2022

2023

NECP **2.0** (draft)

Minister of Environment and Energy Security

NECP **2.0**

2024

Shaping Decarbonization Scenarios 2030 -2040 -2050

With or without NUCLEAR Energy (fissionSMR-fusion)

National Energy and Climate Plan

RSE COLLABORATIVE NETWORK

Brugherio (MB)
- Via Matteotti 105

Head quarter
Milano
Via Rubattino 54

Piacenza
Via Vittore
Callegari 21

Roma
Via Maresciallo
Pilsudski 124

RSE interfaces with **Public Administrations** operating at a national/central, **regional** and even **local level**, through evaluations and analyses, technical support, collaboration agreements, pilot projects, participation in working groups, etc.). There are currently around 70 collaborations of this type active.

In particular, with reference to the **Regions**, **there are 13 with which RSE collaborates**:

1. Regione Valle d'Aosta
2. Regione Piemonte
3. Regione Liguria
4. Regione Lombardia
5. Provincia autonoma di Trento
6. Regione Veneto
7. Regione Emilia Romagna
8. Regione Umbria
9. Regione Molise
10. Regione Puglia
11. Regione Sardegna
12. Regione Calabria
13. Regione Sicilia

RSE WORK STRUCTURE

BOARD OF DIRECTORS

CHIEF EXECUTIVE OFFICER

SCIENTIFIC COMMITTEE

LEGAL OFFICE

DEPARTMENTS

Energy Systems Development

Sustainable Development and Energy Sources

Transmission and Distribution Technologies

Generation Technologies and Materials

FUNCTIONS

Administration and Information Systems

Human Resources Management

Development, Communication and Exploitation

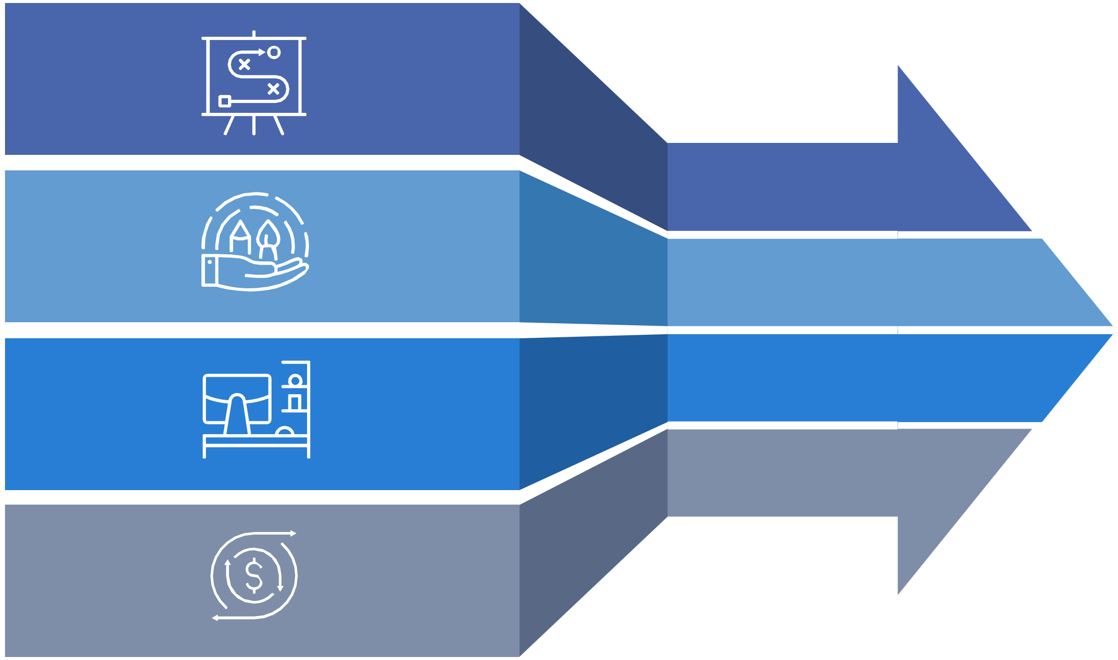
Health, Safety, Environment, Quality,
General and Technical Services

International Scientific Committe

president Prof. **Carlo Alberto Giusti**

1. ***Ing. Pietro Agostini*** (*ex* ENEA e Responsabile Direttore del Brasimone e co-autore della strategia europea sul nucleare sostenibile)
2. ***Prof. Vittorio Badalassi*** (OAK RIDGE, DOE - Dipartimento Energia USA)
3. ***Prof. Emilio Baglietto*** (MIT Boston) (alternate Jacopo Buongiono)
4. ***Ing. Marcello Capra*** (già membro del precedente Comitato Scientifico; delegato italiano per conto del MASE del SET- PLAN, Steering Group per lo Strategic Energy Tecnology Plan della Commissione Europea)
5. ***Ing. Giacomo Aiello*** (CEA - Commissariato dell'Energia Nucleare francese EUROFUSION)
6. ***Prof.ssa Eleonora Riva Sanseverino*** (Università degli Studi di Palermo; esperta del MUR per il Cluster 5 su Clima, Energia e Mobilità in Horizon Europe)
7. ***Prof. Maurizio Cellura*** (Università degli Studi di Palermo)
8. ***Prof.ssa Rosa Lombardi*** (Sapienza Università di Roma, Facoltà di Economia)
9. ***Prof. Shūji Nakamura*** (Premio *Nobel* 2014 per l'invenzione delle lampade LED, Università di Santa Barbara, California)
10. ***Prof.ssa Sara Rainieri*** (Università degli Studi di Parma, Presidente UIT - Unione Italiana Termofluidodinamica)
11. ***Prof. Massimo La Scala*** (già membro del precedente Comitato Scientifico, Politecnico di Bari)
12. ***Ing. Livio Gallo*** (già Amministratore Delegato di Enel Distribuzione e Direttore della Divisione Infrastrutture e reti di Enel Spa)
13. ***Ing. Massimo Rebolini*** (Presidente del Consiglio Tecnico CIGRE Italia, già Responsabile Sviluppo Tecnologie presso TERNA Spa)
14. ***Prof. Fabrizio Pilo*** (Università degli Studi di Cagliari)
15. ***Prof. Giovanni Betta*** (Università degli studi di Cassino e del Lazio Meridionale; membro CUN dell'area 9 - Ingegneria industriale e dell'informazione)

RSE WORK STRUCTURE



ENERGY SYSTEMS DEVELOPMENT

Scenario studies on the long-term development of the energy system, planning and secure operation of transmission networks, management of distribution networks characterized by widespread "active" resources and technologies, promotion of energy efficiency in end uses, energy market analysis and regulation.

SUSTAINABLE DEVELOPMENT AND ENERGY SOURCES

Evaluation and mitigation of the interaction between the energy system and the environment and the territory, to support management of the plants and infrastructures in view the improvement of the sustainability and resilience of the energy system.

TRANSMISSION AND DISTRIBUTION TECHNOLOGIES

Assessment, development, comparative analysis of electrical components, setting up of advanced measurements, diagnostics and life extension methods; sustainable mobility, ICT architectures and data analysis to increase observability, flexibility, security, resilience and efficiency of energy systems.

GENERATION TECHNOLOGIES AND MATERIALS

Research and experiments on current and future technologies for generation and storage of electricity, heat and renewable fuels; improvement of energy, economic and environmental performance of the generation system; characterization of structural and functional materials for the energy system. Super conductivity

RSE WORK STRUCTURE

ADMINISTRATION AND INFORMATION TECHNOLOGY

It deals with administrative, financial, tax and IT aspects in order to ensure economic sustainability and cyber security. It is the interlocutor of CEO and the Board of Directors for budget and financial and economic results. It manages the reporting aspects of expenses incurred in research projects.

HUMAN RESOURCES MANAGEMENT

It ensures the proper management of processes related to the administration and management, acquisition, development and training of Company personnel. It manages labor relations and promote initiatives for "sustainable" mobility of RSE personnel.

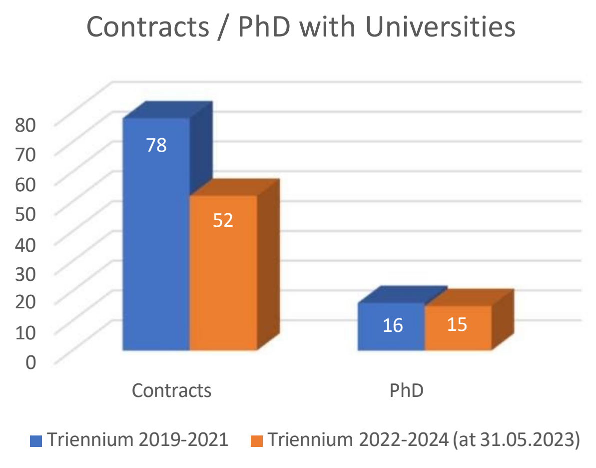
DEVELOPMENT, COMMUNICATION AND EXPLOITATION

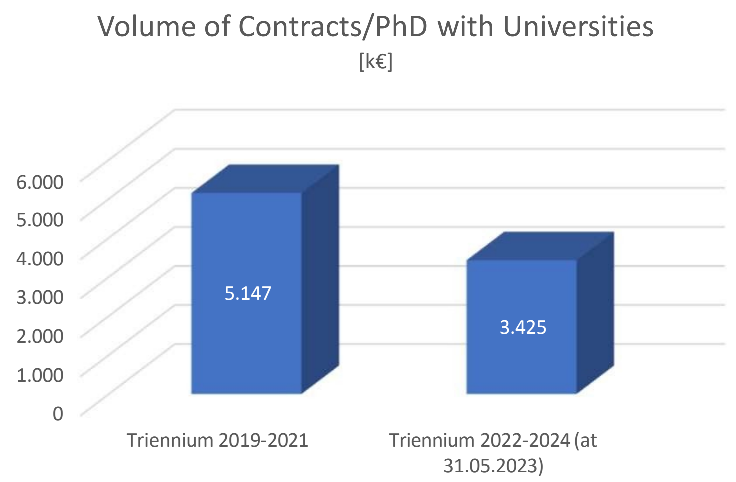
It coordinates funded research projects, ensuring their development, supporting the planning process of human and instrumental resources, monitoring and supervising reporting. It plans the communication strategy, exploiting research results and promoting the dissemination of corporate knowledge, through Knowledge Communities.

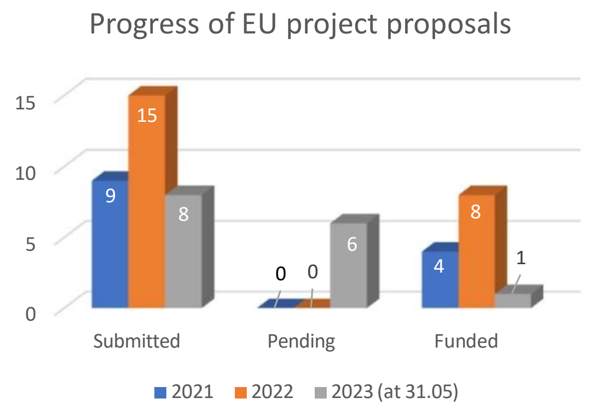
HEALTH, SAFETY, ENVIRONMENT, QUALITY, GENERAL AND TECHNICAL SERVICES

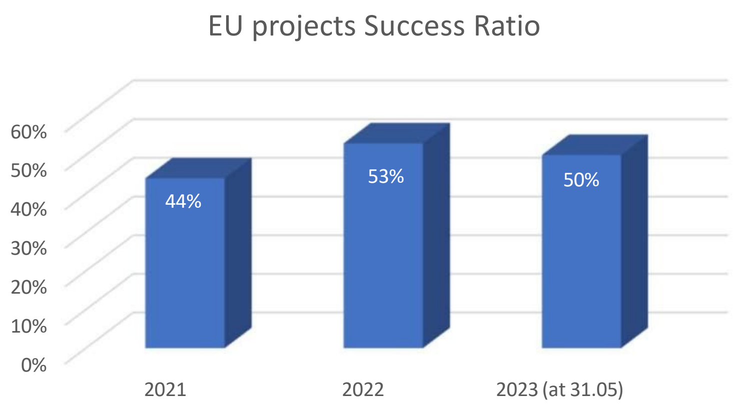
It is responsible for the improvement of the System Quality Management System and coordinates internal audits, relations with certification and accreditation bodies. In the area of health and safety, it develops preventive and protective measures and helps plan and implement training and information programs.

UNIVERSITY CONTRACTS - EU PROJECTS





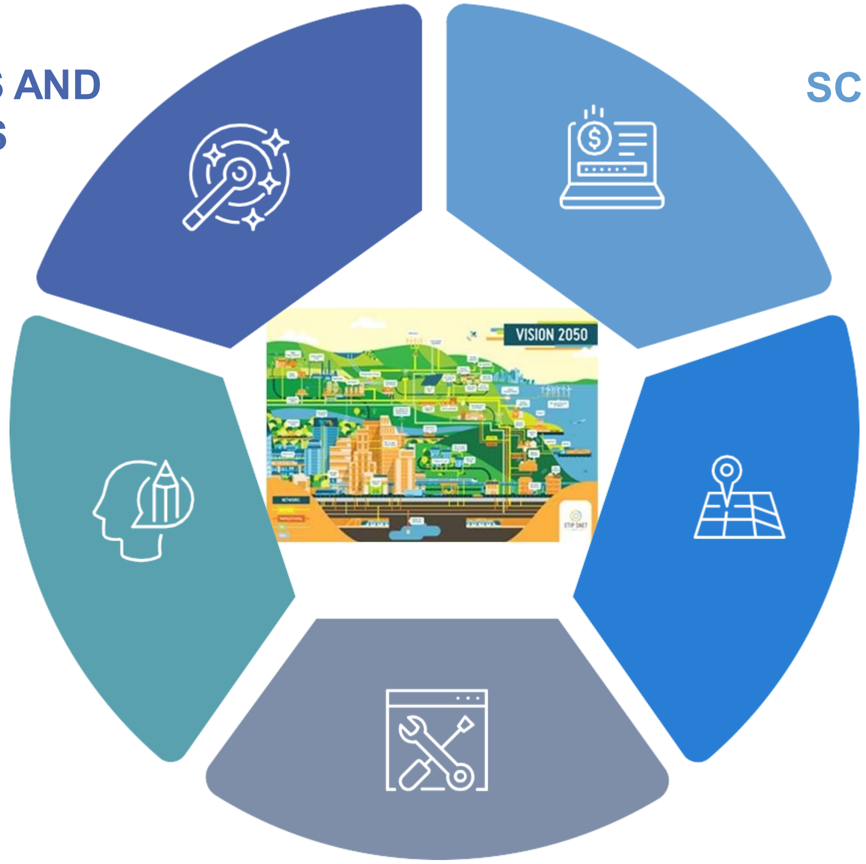




RSE WORK FLOWS

TECHNOLOGIES AND SOLUTIONS

SCENARIO – MARKET – REGULATION



SYSTEM RESILIENCE AND SECURITY

SYSTEM PLANNING

SYSTEM OPERATION – ASSET MANAGEMENT

SCENARIO – MARKET – REGULATION

SCENARIO AND SYSTEM ANALYSIS

- Development of **scenarios of the national energy system** with a view to environmental, socio-economic sustainability and technological competitiveness
- **Support to the Government** for energy planning within the framework of European and national decarbonisation policies

LIFE CYCLE ASSESSMENT

- Evaluation of the **life cycle** of products, services and **scenarios**;
- **Life Cycle Costing and Cost Benefit Analysis**;
- Assessment of **environmental externalities** (incl. Ecosystem services);
- **Economic and social impact analysis** of the energy system;
- **Multi-criteria analysis**;
- **Circularity analysis** and environmental legislation.

ENERGY MARKETS AND REGULATION

- Study and simulation of the **evolution of the electricity system and market** over medium and long- term time horizons
- Study and impact analysis of **regulatory measures and reforms** of electricity markets at national and European level
- Study of **incentive and promotion mechanisms** for efficient end-use technologies
- Specific focus on **collective self- consumption and energy communities**

SYSTEM PLANNING

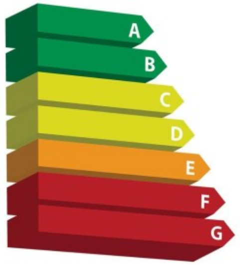
ENERGY RESOURCES AND PLANNING

- Integrated **territorial energy planning;**
- **Renewables** in the territory;
- Integrated management of **water resources**;
- Applied geology **(geothermal**, storage);
- **Storage systems** (large size, pumped hydro);
- Satellite data analysis, **GIS development**, websites and sources portals.

NETWORK PLANNING

- Development of **methodologies and tools for planning** and assessing the operational risk of transmission networks.

ENERGY EFFICIENCY



- Study and validation of systems and components for the **energy efficiency of end uses**
- Study of **solutions for sustainable mobility**

AIR QUALITY

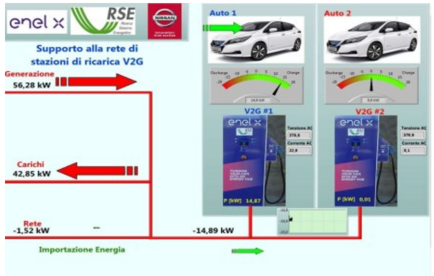
- Numerical modeling: **impact on air quality** of the electricity and energy system (and mobility);
- Development and application of methods and tools for the **control of polluting emissions** into the atmosphere.

SYSTEM OPERATION – ASSET MANAGEMENT

NETWORKS AND DEMAND MANAGEMENT

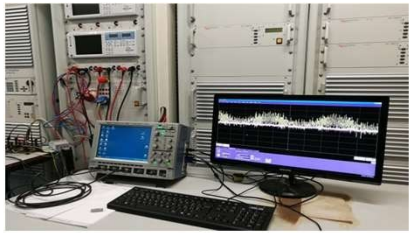
- Methods and algorithms for the planning and **management of distribution networks**, demand, distributed generation and storage systems.

ACTIVE NETWORKS AUTOMATION AND CONTROL



- **Operating modes of active networks** (virtual power plant, island operation);
- Performance and useful life of **electrochemical storage systems**;
- **Optimized control and management of Vehicle to Grid** applications, aggregates of end users, energy communities;
- Simulation, control and management **of “multi-energy” systems**, with integrated operation of the electricity, heat, fuel and mobility sectors.

TECHNOLOGIES FOR ACTIVE NETWORKS



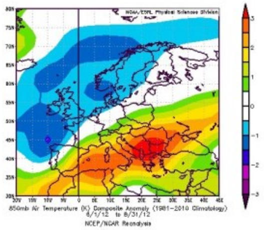
- **Control systems for power electronics equipment** for the integration of renewable sources and storage systems in T&D networks;
- **New architectures** for active distribution networks, including LV-MV DC;
- Analysis and classification of **PQ phenomena** in MV and LV distribution networks.

MONITORING AND DIAGNOSTICS

- Development **of innovative methodologies, equipment and solutions** for voltage, current, power, energy and supply quality measurements;
- **Diagnostic methods for the components** of the Electric System with particular reference to T&D networks (cables, insulators, transformers).

SYSTEM RESILIENCE AND SECURITY

THREATS: CLIMATE CHANGE



- **Weather modeling**: potential for renewable energy; short-term forecasting, nowcasting, demand forecasting;
- Experimentation and **modeling on extreme phenomena** (threats), mitigation and resilience;
- Study of **Climate Change** and its impact on the electro-energy system;
- **Greenhouse gas monitoring** at Plateau Rosa Station (PRS).

NETWORK RESILIENCE

- Development of methodologies and tools for **assessing and increasing resilience in the planning**, programming and operation phases of the electricity system.

MITIGATION MEASURES

- **Hydrophobic, ice-phobic and coatings** dirt-repellent on electrical conductors and insulators;
- **On-site monitoring** of wet snow phenomena and testing of mitigation measures and techniques.

STRUCTURES SAFETY

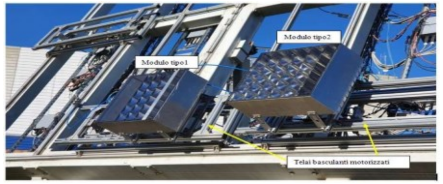
- Evaluation of the impact of mining activities - offshore-onshore (seismic, subsidence);
- **Safety (and engineering) of infrastructures** (dams);
- Energy system **seismic vulnerability;**
- Fluid dynamics mathematical models of natural phenomena, **anthropic or accidental actions - hydrogeological instability** and impacts.

TECHNOLOGIES AND SOLUTIONS I/II

MATERIALS

- **Metallic, ceramic and composite materials** for use in high temperature and in hostile environments;
- **Functional materials** for the generation of electricity and hydrogen from solar sources;
- **Ceramic membranes**, sorbents, catalytic materials for gas separation and fumes treatment;
- New materials and geometries for the **electrochemical storage**.
  Sodium Ion batteries

CONCENTRATION PV



- Innovative **multi-junction cells** for low and high concentration photovoltaics and thermal photovoltaics;
- **Concentrating system components** (optics, receiver, tracker, inverter), modules and systems;
- Characterization of concentration cells and modules;
- **Laboratory and field tests** of concentrating prototype systems;
- New **manufacturing processes of cells**, including the application of nanotechnologies.

TECHNOLOGIES ASSESSMENT

- Development and implementation of **electrical, thermal and mechanical laboratory test methodologies** for performance, and lifespan purposes on T&D network equipment and components both in support of research and development and for third party customers;
- Innovative methods **of control, management and diagnostics** of electrochemical storage systems.

INNOVATIVE TECHNOLOGIES

- Development and testing of **innovative components for the energy system** (e.g. high temperature **superconducting** devices and sensors;
- Development of **electro-optical equipmen**t for the management and analysis of the degradation of network components according to operating and environmental conditions.

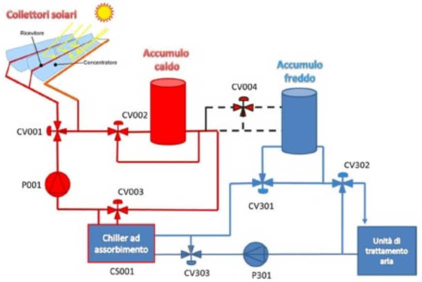
RSE Ricerca Sistema Energetico | we move rsearch

TECHNOLOGIES AND SOLUTIONS II/II

ICT AND CYBERSECURITY

- Development of **innovative ICT solutions** for the management, control and **IT security** of T&D networks, mobility and Smart Cities;
- **ICT application** to make the electricity system "smart" and "efficient" to achieve the objectives of the NPEC;
- Support to institutions for the development of **sustainable mobility.**

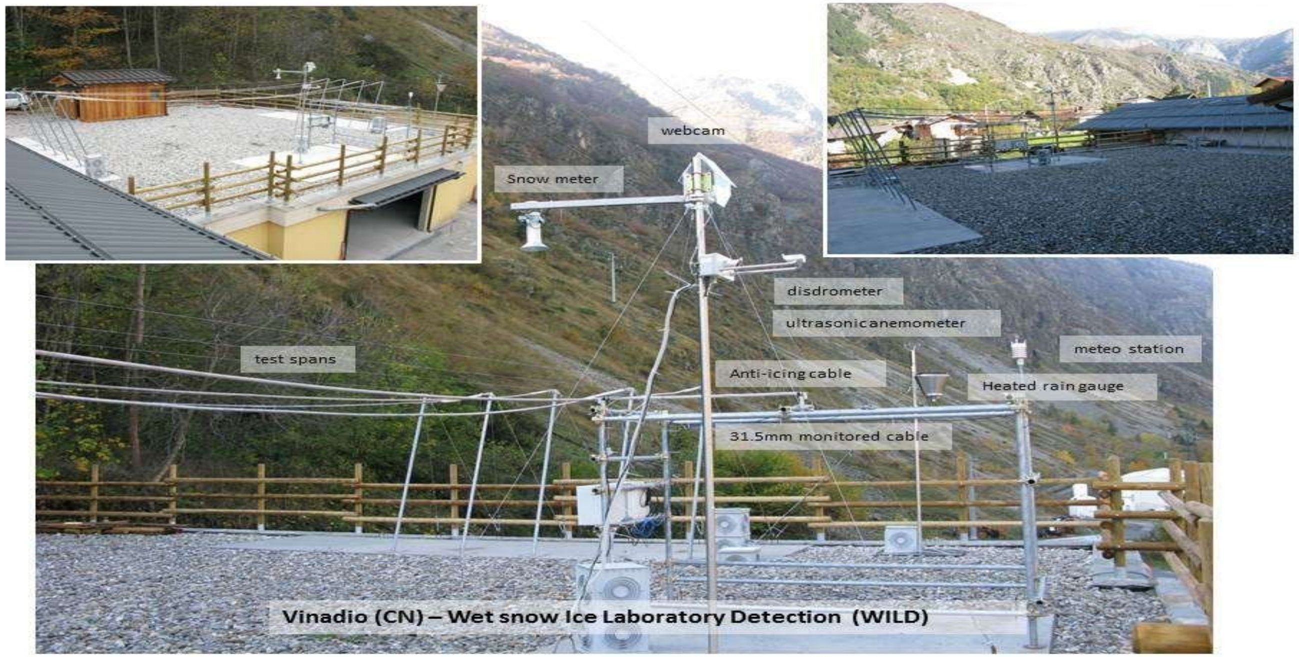
PLANTS AND PROCESSES



- **Renewable sources plants** (biomass, solar photovoltaic, solar cooling);
- Upgrading of **biogas to biomethane;**
- **District heating** / cooling / industrial heat recovery;
- **Thermal storage**, even seasonal;
- Hydrogen technologies;
- **Power 2 gas** / biological methanation;
- Design and construction of prototypes, experimental and **demonstration plants**.

LABORATORIES – ENVIRONMENTAL STUDIES

VINADIO STATION FOR WET SNOW EXPERIMENTS UNDER NATURAL CONDITIONS



SOLAR RADIATION MONITORING NETWORK

GHG MONITORING STATION IN PLATEAU ROSA

LABORATORIES – T&D TECHNOLOGIES I/II

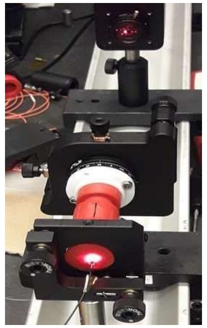
POLLUTION TESTS

DIELECTRICS

SUPERCONDUCTIVITY

AGEING TESTS ON POWER CABLES

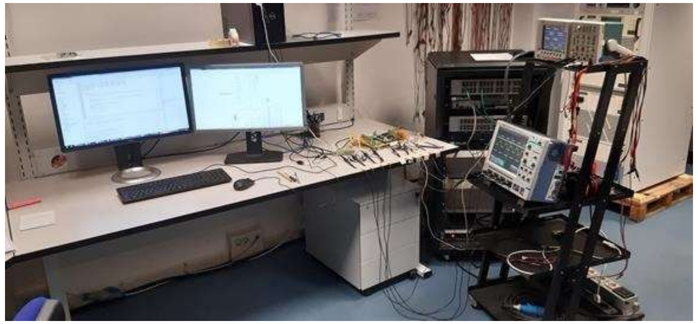
MECHANICAL TESTS ON CONDUCTORS



OPTICS

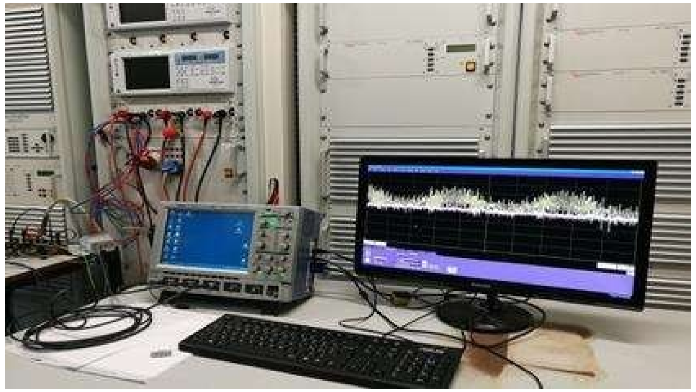
FARADAY CAGE

LABORATORIES – T&D TECHNOLOGIES II/II



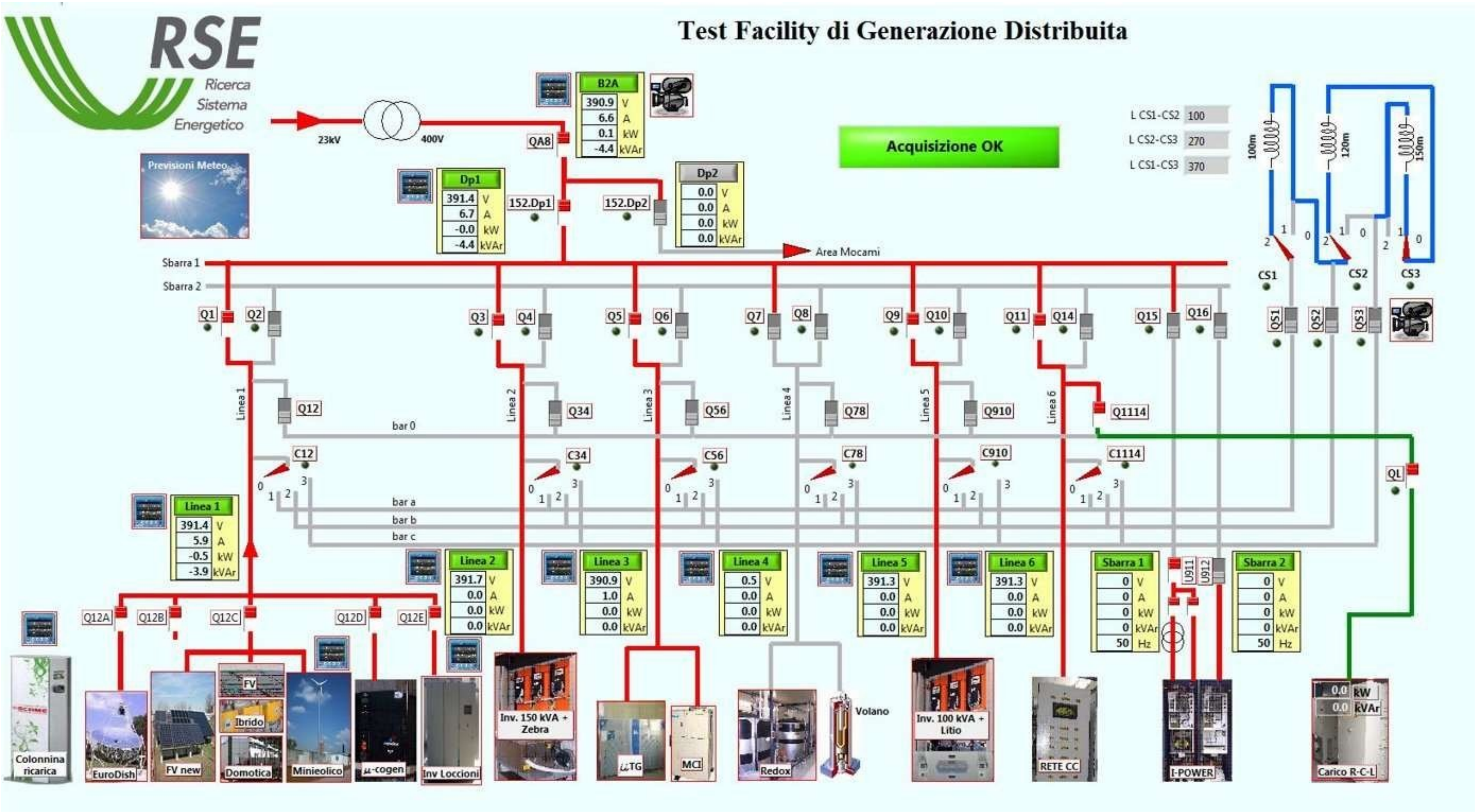
ELECTRONIC SYSTEMS LAB

CYBERSECURITY LAB



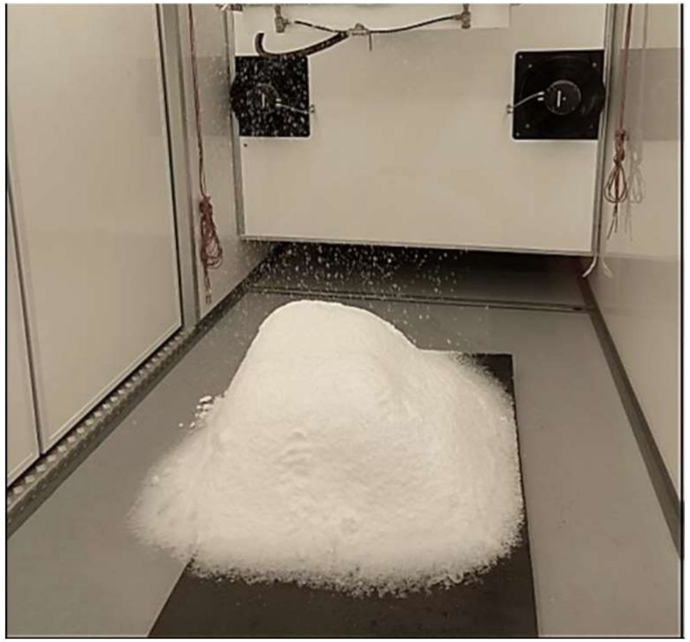
POWER ELCTRONICS LAB

IoT LABORATORY



Test Facility di Generazione Distribuita
RSE Ricerca Sistema Energetico
Acquisizione OK
Previsioni Meteo
23kV
400V
B2A
390.9 V
6.6 A
0.1 kW
-4.4 kVAr
QA8
Dp1
391.4 V
6.7 A
-0.0 kW
-4.4 kVAr
152.Dp1
152.Dp2
Dp2
0.0 V
0.0 A
0.0 kW
0.0 kVAr
Area Mocami
L CS1-CS2 100
L CS2-CS3 270
L CS1-CS3 370
100m
120m
150m
CS1
CS2
CS3
Sbarra 1
Sbarra 2
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11 Q14 Q15 Q16
QS1 QS2 QS3
Linea 1 Linea 2 Linea 3 Linea 4 Linea 5 Linea 6
Q12 Q34 Q56 Q78 Q910 Q1114
bar 0
C12 C34 C56 C78 C910 C1114
QL
bar a
bar b
bar c
Linea 1
391.4 V
5.9 A
-0.5 kW
-3.9 kVAr
Linea 2
391.7 V
0.0 A
0.0 kW
0.0 kVAr
Linea 3
390.9 V
1.0 A
0.0 kW
0.0 kVAr
Linea 4
0.5 V
0.0 A
0.0 kW
0.0 kVAr
Linea 5
391.3 V
0.0 A
0.0 kW
0.0 kVAr
Linea 6
391.3 V
0.0 A
0.0 kW
0.0 kVAr
Sbarra 1
0 V
0 A
0 kW
0 kVAr
50 Hz
U911
U912
Sbarra 2
0 V
0 A
0 kW
0 kVAr
50 Hz
Q12A Q12B Q12C Q12D Q12E
Colonnina ricarica
EuroDish
FV new
FV
Ibrido
Domotica
Minieolico
µ-cogen
Inv Loccioni
Inv. 150 kVA + Zebra
µTG
MCI
Redox
Volano
Inv. 100 kVA + Litio
RETE CC
I-POWER
0.0 kW
0.0 kVAr
Carico R-C-L

LABORATORIES – POWER GENERATION TECHNOLOGIES II/II



ARTIFICIAL SNOW LAB

DISTRICT HEATING FACILITY

BIOMETHANATION

LABORATORIES – ENERGY EFFICIENCY

LABORATORIO EFFICIENZA ENERGETICA - PIACENZA

SMART ENERGY MANAGER

HERITAGE & SUSTAINABILITY

Based on its expertise in energy efficiency, RSE conducts research activities aimed at the **energy** and **environmental** rehabilitation of buildings, with a particular focus on **heritage constructions**.

The goal is to define a **replicable methodology** that can be applied to buildings with similar characteristics, starting from "pilot" **case studies**.

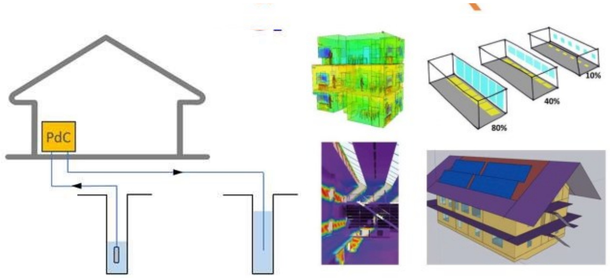
This innovative and **holistic approach** is based on assessing the current situation of the heritage construction from both an architectural and energy perspective, by using **modeling tools** and **experimental campaigns** to determine the best retrofit **strategies** and quantify the achieved benefits.

HERITAGE & SUSTAINABILITY

ENERGY RETROFIT OF HISTORICAL BUILDINGS

- Development of new methodologies for enhancing the **energy efficiency** and environmental **sustainability** of buildings with high **historical** and **cultural value** using a **conservative** and non-invasive **approach.**
- Analysis of the **role** of **occupants** in determining the final thermal-energy performance of building

INNOVATIVE SOLUTIONS & BUILDING MATERIALS



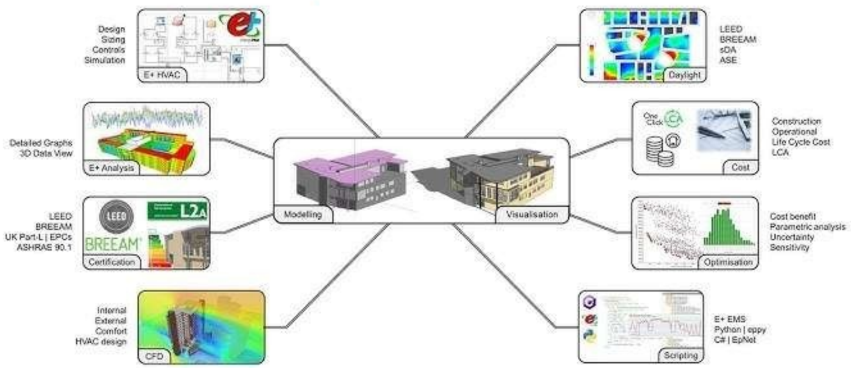
- Study of combined **active and passive strategies** suitable for application in heritage constructions
- Use of **dynamic simulation** and **microclimate modeling** to assess the impacts on energy performance, comfort conditions, and environmental benefits at **single-building** and **inter-building** scale.
- In-lab and in-field **experimental campaigns** for the characterization and optimization of the thermal-energy properties of **innovative building materials**

ENERGY CERTIFICATION PROTOCOLS

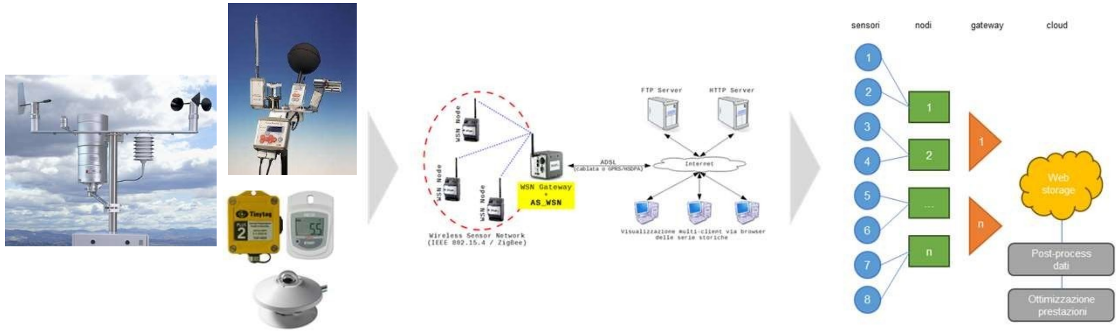
- Evaluation of national and international **energy certification protocols** (rating systems) to quantify the **benefits** generated by applying retrofit measures by using standard **criteria**, with specific attention to assets characterized by significant heritage value

HERITAGE & SUSTAINABILITY

CALIBRATED THERMAL-ENERGY SIMULATION



ENVIRONMENTAL MONITORING & EXPERIMENTAL TESTING



LCA APPROACH

ENERGY CERTIFICATION PROTOCOLS

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Contact

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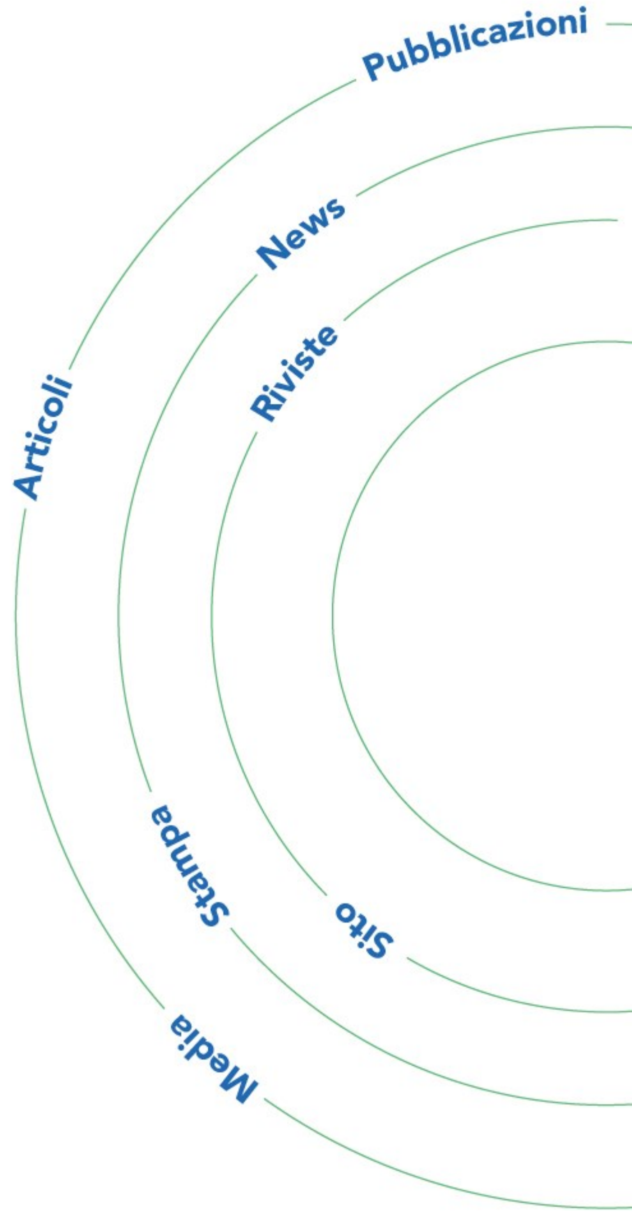

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