

MISSIONE 4
ISTRUZIONE
RICERCA

NEST - NETWORK 4 ENERGY SUSTAINABLE TRANSITION SCENARI ENERGETICI DEL FUTURO



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e della Ricerca



Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA

Tematica: 2. Scenari energetici del futuro

Obiettivi (*Sez A dell'Annex 1*)

Objectives, activities and respect of the NRP in the research program The objectives of energy transition towards the carbon neutrality that our country aims to reach by 2050, following national and EU programs, require to follow a program of rapid reduction in the consumption of fossil fuels in the coming years with the full adoption of renewable energy sources, in civil, industrial, and transport sectors. These objectives can be achieved through a strong interaction among Universities, Research centers, and industrial system operating in the energy field through large groups as well as SMEs, start-ups and spin-offs which are all extraordinary sources of innovation. The challenges of the energy transition cannot to be faced only by the present technologies but need the development of new knowledge that stimulates the development of new technologies. The program of the project "NEST, Network for Energy Sustainable Technologies" framed in the PE program "Green Energies for the Future" aims to connect the main laboratories and university research groups and the main national research bodies, identifying interdisciplinary skills in order to develop technologies for the conversion and use of renewable sources that should be sustainable, both from an environmental and a social point of view, and resilient for the energy production and distribution, while being less subject to the risks deriving from the current supply system of fossil fuels, basically, oil, and natural gas. The ambition is to build a competent Italian leadership, strongly integrated with the territory and companies and capable of supporting the future development towards sustainable and decarbonized energy production and distribution. The project NEST is totally interconnected with the NextgenerationEu Program, Horizon Europe Cluster 5: Climate, Energy and Mobility and, in particular, with those Italian actions of the PNRR that aim to boost the uptake of renewable energy with specific measures on several levels: investing in new green energy technologies, green hydrogen and sustainable biofuels, interoperability and smart integration in the different sectors, new, environmentally friendly materials with low carbon footprint. Within this framework the network created by NEST will act as an innovative excellence ecosystem able to promote innovation through the systematic connection of the energy research with the whole productive system. The network NEST has the primary mission to build a competent Italian leadership, consistent with existing excellence of the partners and affiliates, capable of supporting the growth of new generation of energy technologies, researchers and research infrastructures for a future sustainable and resilient energy sector. The objectives of the NEST Project range from technical, economic to social ones:

- Making the energy production system greener, promoting technologies capable of expanding the production of electricity and thermal energy from renewable sources.
- Increase the resilience of the national energy sector through the development of innovative solutions and enabling tools to support "sector coupling" in multi-carrier and multi-sectorial integrated energy systems, also addressing grid flexibility and resilience issues.
- Increase the penetration of renewable sources through innovative conversion systems in hard-to-abate sectors, also thanks to the introduction of innovative technologies related to the hydrogen supply chain and energy storage systems.
- Strengthen the research of new materials and associated production technologies will help manufacturers to reduce costs, energy use, pollution, improve product quality, increase competitiveness and environmental and economic benefits.
- Introduce breakthrough digital innovation in the energy management systems, for the implementation of renewable technologies in real contexts, promoting social inclusion and fighting energy poverty.
- Strengthening the national competitiveness and international visibility boosting synergies between companies and research institutions active in the field of energy transition.
- Strengthening skills in the industrial field and national/regional policies supporting institutions identifying priorities and strategies for a parallel and osmotic development of research and industrial applications.

With the above strategic objectives, the project NEST responds to a real need of the Italian and the European society, including citizens, industrial business sectors, and policymakers, working to identify a path to sustain the transition to a green, independent, and sustainable energy economy. The partners of the NEST project have elaborated an organization structure based on four Spokes on Renewable Energy Sources and Carriers and five spokes on Cross-integration activities and Technologies, strongly interconnected as illustrated in Figure A.1. This organization allows for a strong interaction among the research groups active in the different spokes, backed up by a significant investment in human resources

and infrastructures to increase TRL (Technology Readiness Level) of the most promising ideas and make solutions scalable.

The implementation of the NEST program is based on three major pillars:

- **KNOWLEDGE AND HUMAN CAPITAL:** The NEST project has the ambition to create new knowledge and enhance the human capital in the energy sector. This will be obtained through the following actions
 - o Recruitment programs for young researchers NEST will activate the recruitment of young researchers in a long-term strategy to foster a new generation of researcher with specific competence in the field of new and emerging energy technologies.
 - o Activation of PhD courses strongly interconnected with research activities and industrial skills, capable of training the future research and entrepreneurial generation.
 - o Creation of long-life learning paths and MOOCs aimed at facilitating the dissemination of knowledge and expertise in the field of energy, to support the update and innovation, mainly in professionals and SMEs.
- **INNOVATION FLOW:** Investments will be placed on industrial research and infrastructures, through a proof-of-concept stream providing as outcomes technologies, processes and materials at a low-medium TRL 4-5. Subsequent scaling up will be possible thanks to a favourable environment created within the partners of the NEST project, involving public research and industries.
 - o Proof-of Concepts and TRL acceleration programs: NEST will activate specific calls to accelerate and scale up technical solutions developed within the Research and Innovation project. The presence of a Management Board and of a Scientific Board will guarantee the scientific and technical quality as well as marketability of the prospected solutions.
 - o Open Innovation: NEST will promote the cooperation among the partners in an open innovation approach where expertise and skillsets found in academia, industry and in the business community, create an ecosystem to support cutting-edge technologies and innovation.
- **TECHNOLOGICAL TRANSFER:** The Consortium NEST will implement actions to facilitate the collaborations of the public research groups with industrial partners, large companies SMEs and start-ups. In particular, the partners of the consortium will promote the most promising ideas and technologies with active and specific acceleration programs designed for technology scaleups with international growth ambitions.
 - o Technological Observatories will be created and promoted by the Consortium with periodic meetings, to facilitate the implementation of innovation actions.
 - o Joint Labs NEST will promote cooperation between startups and Italian companies that focus on innovation. Definition of programs to support the scouting of innovative entrepreneurial realities that can turn out to be potential business partners.

The Legal Entity undertaking to realize NEST, as provided by the Mission 4 of the RRP, will be a consortium (in Italian: “Società consortile” - S.c.a.r.l.) and will be based in Bari (Italy). The consortium, in accordance with the call, will be organized with a Hub and Spokes model. The role of the HUB will be to perform the whole program coordination and to enhance the network valorizing the specific scientific excellence; the hub will encourage the dialogue between the different spokes in order to synthesize high-impact solutions and projects. Spokes are the places where research activities take place, defining not only clear and specific objectives, but also milestones and specific actions. The objectives and activities planned in the program NEST fully meet the objectives and priorities of the NRP 2021-2027, in particular, in the area of research and innovation regarding “climate, energy and sustainable mobility”. The NEST project is fully coherent with the NRP, in terms of field of action, priorities, and goals. In particular, NEST recalls the field of “climate, energy and sustainable mobility”, and the related priorities. This is evident in the capacity to support a wide and inclusive research network, involving 11 universities distributed across the country, CNR and ENEA, research centers like EURAC, FBK, and IIT, all active in the energy field. This structure will unlock a continuous and dynamic exchange of knowledge, supporting within the country as well as internationally new synergies. Meanwhile, the local territories of different Italian regions will be supported by the geographic distributions of the universities, which will secure the continuity of research agendas with local priorities. NEST, being developed across research lines with a low TRL, will secure fundamental research goals, which will find in NEST, as evoked by the same acronym of the project, the place of incubation for future technological transferring targets. This will reflect the long-term impact of NEST. In fact, the strong support to young researchers will also provide long-term vision and impacts of NEST, which aim to secure a significant body of future researchers, capable of developing their own research lines, while being able to support the critical needs of the country in the field of Green Energy. As this theme has value for the entire population, the project will benefit everybody. Another element of coherence of NEST with the NRP is the interdisciplinary approach, which emerged from the

awareness of the multiple aspects needed to better resolve the energy crisis, ranging from basic science, evident in the mathematical, physical, and chemical aspects involved in each spoke, to engineering and socio-economic consideration, which also characterize every spoke. NEST will provide a continuous exchange between academic research and industrial partners, also thanks to the promotion of open innovation approach. This paradigm will be explored not only through open access to research results and freely availability of codes and modeling results, but also by promoting a systematic exploration of a wide range of internal and external sources for open innovation opportunities, within and outside the NEST partners. The NEST partners share the awareness that the energy crisis is much more than an economic or technological aspect, as its solution is urgently needed for both social and environmental reasons; as such, the results will be shared whenever possible. In this regard, the project aims to build a wide sense of collaboration also thanks to the continuous exchanges of researchers within the network as well as outside. For example, the international missions and visiting research periods both aboard and in other national research centers will support a new sense of community among NEST partners. In fact, the consortium NEST will facilitate the collaborations and specific acceleration programs designed to work for technology scale-ups with international growth ambitions too. The scope is the creation and the promotion of a new mindset among researchers and partner companies, with the capacity to later transfer the innovative results into stronger entrepreneurial realities for solving the energy paradigm within the country as well as globally.

Partner

N TOTALE SOGGETTI:25

Proponente: Politecnico di Bari

SOGGETTI PUBBLICI

Università

- Politecnico di Bari
- Alma Mater Studiorum – Università di Bologna
- Politecnico di Milano
- Politecnico di Torino
- Università degli Studi di Cagliari
- Università degli Studi di Genova
- Università degli Studi di Napoli Federico II'
- Università degli Studi di Padova
- Università degli Studi di Palermo
- Università degli Studi di Pisa
- Sapienza Università di Roma

Organismi di ricerca

- Consiglio Nazionale delle Ricerche
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

SOGGETTI PRIVATI:

Organismi di Ricerca

- EURAC Research

- Fondazione Bruno Kessler
- Istituto Italiano di Tecnologia

Imprese

- ARCO FC s.r.l.
- Engineering Ingegneria Informatica S.p.A
- Exprivia S.p.A
- IDEA75 S.r.l.
- Intesa Sanpaolo
- IREN Spa
- Istituto di ricerca Ingenia S.r.l.- Impresa sociale
- Nuovo Pignone Tecnologie S.r.l.
- SNAM S.p.a.

Gli Spoke

Spoke n. 1: Solar: PV, CSP, CST

Leader spoke: Università degli Studi di Palermo

Affiliati allo spoke:

- Università degli Studi di Cagliari
- Università degli Studi di Padova
- Consiglio Nazionale delle Ricerche
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
- EURAC Research
- Istituto Italiano di Tecnologia

Spoke n. 2: Energy Harvesting and Off-shore renewable

Leader spoke: Politecnico di Bari

Affiliati allo spoke:

- Politecnico di Milano
- Politecnico di Torino
- Università degli Studi di Cagliari
- Università degli Studi di Napoli Federico II
- Sapienza Università di Roma
- Università degli Studi di Cagliari

Spoke n. 3 Bio energy and new fuels for a sustainable future

Leader spoke: Università degli Studi di Pisa

Affiliati allo spoke:

- Consiglio Nazionale delle Ricerche
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
- Politecnico di Torino
- Università degli Studi di Napoli Federico II
- Sapienza Università di Roma

Spoke n. 4: Clean hydrogen and final uses

Leader spoke: Università degli Studi di Genova

Affiliati allo spoke:

- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
- Consiglio Nazionale delle Ricerche
- Sapienza Università di Roma
- Università degli Studi di Pisa
- Alma Mater Studiorum – Università di Bologna
- Politecnico di Bari
- Politecnico di Milano
- Fondazione Bruno Kessler
- Istituto Italiano di Tecnologia
- ARCO FC s.r.l.
- Istituto di ricerca Ingenia S.r.l.- Impresa sociale
- Nuovo Pignone Tecnologie S.r.l.
- SNAM S.p.a.
- IREN Spa

Spoke n. 5 Energy conversion

Leader spoke: Politecnico di Milano

Affiliati allo spoke:

- Alma Mater Studiorum – Università di Bologna
- Università degli Studi di Padova
- Sapienza Università di Roma
- Università degli Studi di Pisa
- Politecnico di Bari
- IDEA75 S.R.L.
- Nuovo Pignone Tecnologie S.r.l.

Spoke n. 6: Energy storage

Leader spoke Politecnico di Torino

Affiliati allo spoke:

- Università degli Studi di Padova
- Università degli Studi di Napoli Federico II
- Politecnico di Milano
- Alma Mater Studiorum – Università di Bologna
- Sapienza Università di Roma
- Università degli Studi di Pisa
- Università degli Studi di Palermo
- ARCO FC s.r.l.
- Intesa Sanpaolo
- IREN Spa

Spoke n. 7 Smart sector integration

Leader spoke Università degli Studi di Napoli Federico II

Affiliati allo spoke:

- Alma Mater Studiorum – Università di Bologna
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
- Politecnico di Torino
- Politecnico di Bari
- Università degli Studi di Palermo
- Università degli Studi di Genova
- EURAC Research
- Engineering Ingegneria Informatica S.p.A
- Exprivia S.p.A
- IDEA75 S.r.l.
- Istituto di ricerca Ingenia S.r.l.- Impresa sociale
- SNAM S.p.a.

Spoke n. 8: Final use optimization, sustainability & resilience in energy supply chain

Leader spoke: Sapienza università di Roma

Affiliati allo spoke:

- Università degli Studi di Cagliari
- Politecnico di Milano
- Università degli Studi di Napoli Federico II

- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
- Politecnico di Torino
- Università degli Studi di Palermo
- Università degli Studi di Genova
- Università degli Studi di Pisa
- Università degli Studi di Padova
- Engineering Ingegneria Informatica S.p.A
- Exprivia S.p.A

Spoke n. 9: Energy-sustainable advanced materials

Leader spoke: Consiglio Nazionale delle Ricerche

Affiliati allo spoke:

- Fondazione Bruno Kessler
- Sapienza Università di Roma
- Alma Mater Studiorum – Università di Bologna
- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile
- Politecnico di Milano
- Università degli Studi di Cagliari
- Università degli Studi di Genova
- Università degli Studi di Padova

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