

Curriculum vitae di *Luigi Crema*

PERSONAL DETAILS

Family name, First name: Crema Luigi

Birthdate: 29.07.1972

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• Education and key qualifications

- 2002 **Degree in Innovative Physical Technologies**, University of Ferrara – Sensors and Semiconductors curriculum. Thesis: “*Chemoresistive Sensors for Environmental Monitoring.*” **Final grade: 102/110.**
- 1999/2000 **INFN Research Grant**, Italian National Institute for the Physics of Matter. *Development of Thick-Film Sensors for Environmental Pollution Monitoring (CH₄, H₂S, NH₃, CO, NO_x, O₃)*, University of Ferrara. **Ranked 1st nationally.**
- 1996/1997 **University Diploma in Physical Methodologies**, University of Ferrara – Environmental Monitoring and Diagnostics. Thesis: “*Development of an Innovative System for the Measurement of Tropospheric Ozone.*” **Final grade: 66/70.**

• Current position(s)

- 2021 – present **Director** of the Centre for Sustainable Energy
Fondazione Bruno Kessler, Italy
- 2018 – present **Vice President**, President of the Scientific Committee
Italian Hydrogen Association – H2IT, Italy
- 2023 – present **President**
Hydrogen Europe Research – HER, Belgium
- 2021 – present **Member of the Academic Board, PhD Programme in Industrial Innovation**, University of Trento, Italy.
- 2022 – present **Founding Member**
ITATEC – Italian Academy of Engineering and Technology (Accademia Italiana di Ingegneria e Tecnologia).

• Previous position(s)

- 2014/2020 **Fondazione Bruno Kessler (FBK)**, Trento, Italy - Head of the ARES Research Unit – Applied Research on Energy Systems, leading and coordinating FBK’s research activities in the energy field.
- 2014/2020 **N.ENERGHY / Hydrogen Europe Research** – *Member of the Coordination Board and Vice – Chair of the Energy Pillar for Hydrogen production, handling, storage and distribution*
- 2007/2013 **Fondazione Bruno Kessler** (Trento) – Full time employee and Senior Researcher, scientific responsible for energy related activities within REET (Renewable Energies and Environmental Technologies) unit. Involved in activities in the sector of solar energy, biomasses, thermal and electrical energy storages, fuel cells, smart buildings and cities.
- 2006/2007 **SESA S.p.A., Este (Padua), Italy** — Permanent position
Technical Manager of a municipal organic waste treatment and recycling plant, including composting, aerobic and anaerobic digestion, biogas production and cogeneration. Plant

capacity: 250,000 tonnes/year of organic waste; **6 MW_e** installed electrical capacity and **5 MW_{th}** installed thermal capacity, including a district heating network. SESA operates one of Europe's largest plants for the treatment and recycling of the organic fraction of municipal solid waste.

- 2002/2006 **LGS Technology, Ferrara, Italy** — Permanent position
Project & R&D Manager — Responsible for the Sensor Department, covering R&D, manufacturing, testing and after-sales technical support.
- 2000/2001 **Unitec S.r.l., Ferrara, Italy** — Permanent position
R&D Manager — Responsible for the development of instrumentation based on thick-film sensors for environmental monitoring, as well as production and technical assistance activities.
- 1998/1999 **Orion S.r.l. & Department of Physics, University of Ferrara, Italy** — Research Collaboration
Research activity on “*Development of Thick-Film Sensors for Environmental Pollution Monitoring.*”
- 1997/1998 **INFM – National Institute for the Physics of Matter, Department of Physics, University of Ferrara, Italy** — Research Collaboration.
Research activity on “*Development of a Thick-Film Sensor for Tropospheric Ozone Monitoring*”, Sensors and Semiconductors Laboratory.

RESEARCH ACHIEVEMENTS AND PEER RECOGNITION

Bibliometric indicators: 60 publications indexed in Scopus, 1,630 citations (from 1,509 citing documents), h-index: 21 (Scopus, August 2026; Author ID: 57188688232).

Research achievements

The candidate's research activity spans hydrogen technologies and systems, renewable-energy integration, energy-system modelling and optimisation, hydrogen storage and advanced materials, with a strong emphasis on translating research results into European and national energy strategies and industrial applications.

1. Renewable hydrogen production and competitiveness

E. Crespi et al., L. Crema, “Renewable hydrogen production through electrolysis: An analysis of the cost gap for its economic competitiveness in Italy,” *International Journal of Hydrogen Energy*, 68 (2024), 1163–1177.

The study quantifies the economic gap between renewable hydrogen produced by electrolysis and competing conventional alternatives under Italian energy-market conditions, identifying cost gaps and the conditions required for renewable hydrogen deployment. It provides a recent contribution to the debate on the economic sustainability of large-scale renewable hydrogen production.

Candidate's role: senior co-author, contributing expertise in hydrogen technologies, energy-system integration and techno-economic assessment.

2. Italian hydrogen mobility scenario and national policy implementation

D. Viesi, L. Crema, M. Testi, “The Italian hydrogen mobility scenario implementing the European Directive on Alternative Fuels Infrastructure (DAFI 2014/94/EU),” *International Journal of Hydrogen Energy*, 42 (2017), 27354–27373.

The work developed a comprehensive methodology to quantify FCEV deployment, hydrogen demand, production, refuelling infrastructure, renewable-energy integration, emissions reduction and financial support requirements for Italy. Its results were reproduced in **Annex III of Italian Legislative Decree No. 257/2016**, becoming an official national reference for hydrogen mobility.

Candidate's role: co-author and scientific leader in the development of the national hydrogen-mobility scenario and its translation from research evidence into policy.

3. Impact of renewable hydrogen on future energy and fuel markets

G. Maggio, A. Nicita, G. Squadrito, L. Crema, M. Testi, “How the hydrogen production from RES could change energy and fuel markets: A review of recent literature,” *International Journal of Hydrogen Energy*, 44 (2019).

This widely cited review analysed hydrogen production from renewable electricity as a key element of sector coupling and explored its potential impact on future electricity, transport and fuel markets. It anticipated several issues that later became central to European hydrogen strategies. The publication has accumulated several hundred citations across scholarly databases.

Candidate’s role: co-author, contributing the hydrogen-system, market-integration and European energy-transition perspective.

4. Multi-objective optimisation for refinery decarbonisation

J. de Maigret, D. Viesi, M.S. Mahbub, M. Testi, et al., L. Crema, “A multi-objective optimization approach in defining the decarbonization strategy of a refinery,” *Smart Energy*, 6 (2022), 100076.

The paper develops an optimisation methodology for identifying cost-effective decarbonisation pathways for a complex industrial energy system, considering multiple technologies and competing economic and environmental objectives. It demonstrates how integrated modelling can guide investment decisions in hard-to-abate sectors.

Candidate’s role: senior co-author contributing to conceptualisation, energy-system methodology and industrial decarbonisation strategy.

5. Deep decarbonisation of integrated territorial energy systems

D. Viesi et al., L. Crema, “A cost-optimized approach in the deep decarbonisation of a local energy system,” *Energy*, 2020.

The study develops an integrated, cost-optimised approach to deep decarbonisation, combining energy demand, renewable production, storage and sector-coupling technologies rather than optimising individual technologies independently. The work represents an important contribution to the candidate's research on system-level energy transition modelling.

Candidate’s role: conceptualisation, methodology, validation and scientific supervision of the integrated energy-system approach.

6. Green hydrogen as industrial feedstock

Research on photovoltaic-powered electrolysis for renewable hydrogen as industrial feedstock, 2020.

The work assesses the financial and technical conditions under which renewable hydrogen can replace fossil-derived hydrogen in industrial applications, linking photovoltaic generation, electrolysis sizing and investment economics. It addresses one of the earliest high-value applications for renewable hydrogen.

Candidate’s role: contribution to the hydrogen-system architecture and techno-economic assessment.

7. Advanced methodology for hydrogen-sorption measurements

M. Testi, R. Bartali, L. Crema, “Design and optimization of Isochoric Differential Apparatus (IDA) to reduce uncertainty in H₂ sorption process measurements,” *International Journal of Hydrogen Energy*, 2020.

The work introduced an innovative differential Sieverts-type apparatus to improve the accuracy of hydrogen absorption/desorption measurements. The configuration compensates temperature transients and nonlinear effects and was validated using reference hydrogen-storage materials.

Candidate’s role: co-author and senior scientific contributor to the conception, development and validation of the experimental hydrogen-storage measurement methodology.

8. Carbon nanostructure–magnesium materials for hydrogen storage

Research on carbon nanostructures/Mg hybrid materials for solid-state hydrogen storage, *Diamond and Related Materials*, 2018.

The work investigates carbon–magnesium hybrid materials aimed at overcoming kinetic limitations of Mg-based hydrogen storage, linking nanoscale materials engineering with practical solid-state hydrogen-storage applications.

Candidate's role: co-author and scientific contributor within FBK's hydrogen-storage research programme, connecting materials development with energy applications.

9. Graphene technologies for energy applications

Collaborative Graphene Flagship research on graphene and related materials for energy applications.

The research explored graphene-based solutions across hydrogen storage, batteries, fuel cells and other energy technologies, contributing to the assessment of opportunities and technological barriers of graphene in energy conversion and storage.

Candidate's role: FBK scientific contributor with particular responsibility for hydrogen-storage applications within the European Graphene Flagship activities.

10. Production and processing of graphene and related materials

C. Backes et al., including L. Crema, "Production and processing of graphene and related materials," *2D Materials*, 7 (2020), 022001.

A major international reference work providing reproducible methodologies for production, processing, functionalisation and characterisation of graphene and related materials. The article is highly cited and has become an important methodological reference in the field.

Candidate's role: contributor through the Graphene Flagship collaboration, particularly in relation to graphene-based materials for energy and hydrogen applications.

11. Flow-battery electrochemistry and energy storage

Research on bromine/bromide electrolytes and electrochemical behaviour for redox-flow battery systems, *Journal of The Electrochemical Society*, 2020.

The work contributes to the understanding and optimisation of electrolyte chemistry for redox-flow batteries, supporting the development of scalable stationary energy-storage technologies.

Candidate's role: senior scientific contribution within FBK's electrochemical energy-storage research activities and integration of component research into system-level storage development.

12. Advanced solar receiver technologies

Research on additively manufactured volumetric/open solar receivers for concentrated solar energy, *Solar Energy*, 2018.

The study investigates advanced receiver architectures manufactured using additive technologies to enhance volumetric absorption and heat transfer in concentrated solar-power applications.

Candidate's role: scientific leadership and contribution to CSP receiver development, linking thermal-fluid modelling, advanced manufacturing and experimental solar-energy research.

13. Small-scale concentrated solar cogeneration – DiGeSPo

Development of a distributed small-scale Concentrated Solar Power system integrating solar concentration and Stirling-based cogeneration.

The DiGeSPo research programme developed a modular solar micro-CHP concept intended for distributed electricity and heat generation, combining concentrating optics, receiver technology, thermal management and power conversion.

Candidate's role: project coordinator and scientific/technical leader, responsible for system integration and coordination of the European research consortium.

14. Solar thermal receiver and heat-transfer optimisation

L. Crema and co-authors, research on direct-flow/coaxial concentrating solar collectors and receiver heat-transfer optimisation, *Journal of Solar Energy Engineering* and related publications.

This work developed thermal-fluid methodologies for compact concentrating solar collectors, addressing receiver design and heat-transfer limitations relevant to distributed CSP systems.

Candidate's role: lead/senior author and scientific coordinator of the associated solar-energy research activities.

15. Integration of solar energy and hydrogen production

Research on hydrogen-production systems combining concentrated solar energy, high-temperature processes and gasification, 2024.

The work connects two long-standing research areas—solar thermal technologies and hydrogen—through integrated system modelling for renewable hydrogen production. It demonstrates the potential of high-temperature solar energy to support alternative thermochemical hydrogen pathways.
Candidate's role: senior scientific contribution in system integration, solar-energy technologies and hydrogen-production pathways.

16. EDEN – high-energy-density solid-state hydrogen storage

EDEN – development of an integrated Mg-based metal-hydride hydrogen-storage system, FP7/Fuel Cells and Hydrogen Joint Undertaking.

EDEN advanced the integration of Mg-based solid-state hydrogen storage, heat management and fuel-cell systems, addressing one of the main limitations of metal hydrides: the coupling between hydrogen sorption kinetics and thermal management.
Candidate's role: European project coordinator, responsible for the scientific integration of materials, storage-system design, thermal management and system validation.

17. CH2P – high-efficiency co-generation of hydrogen and power

CH2P – Cogeneration of Hydrogen and Power, European Fuel Cells and Hydrogen Joint Undertaking project.

The project investigated innovative high-efficiency concepts for the combined production of hydrogen and electricity, integrating fuel-processing and electrochemical technologies and targeting higher overall efficiency than conventional separate production pathways.
Candidate's role: project coordinator, responsible for the overall research strategy, multidisciplinary system integration and coordination of the European consortium.

18. SWITCH – flexible hydrogen production and power generation

SWITCH – European research project on integrated and flexible hydrogen/electricity conversion systems.

The research developed innovative system concepts enabling greater flexibility between hydrogen production and electricity generation, targeting highly renewable future energy systems where conversion technologies must respond dynamically to variable electricity supply and demand.
Candidate's role: project coordinator, responsible for scientific direction, system integration, demonstration strategy and exploitation of project results.

19. Translation of hydrogen R&I into European research priorities

Contribution to the definition of European Strategic Research and Innovation priorities for clean hydrogen.

Through leadership roles in Hydrogen Europe Research and participation in the governance of the Clean Hydrogen Partnership, the candidate has contributed to translating scientific and technological evidence into European research priorities covering hydrogen production, storage and distribution, end uses and system integration. This represents a research-strategy output influencing the direction of European collaborative R&I rather than a conventional publication.
Candidate's role: initially Technical Committee leader and Governing Board member and subsequently President of Hydrogen Europe Research, contributing to the formulation and prioritisation of European hydrogen R&I needs.

Selected Peer Recognition, Scientific Leadership and Invited Lectures

- 2009 – Coordinator of DiGeSPo, selected as a leading CSP project under the FP7-Energy-2009-1 call.
- 2010 – Recipient of the FBK Luigi Stringa Award – “Research for Innovation”. Il premio è confermato anche dalla biografia istituzionale FBK.
- 2010 – Invited Lecturer, Master Course on *Nano- and Micro-Technologies for Renewable Energy*, FBK and University of Trento.

- 2011 – Coordinator of EDen, selected for funding under the FP7 Fuel Cells and Hydrogen Joint Undertaking call FCH-JU-2011-1.
- Since 2011 – Member of the Editorial Board, *Energy, Sustainability and Society* (Springer).
- 2012 – Invited Expert, European Commission SET Plan Education & Training Initiative, horizontal priority *System Integration*.
- 2013 – FBK Coordinator within the Graphene Flagship, leading activities on hydrogen storage in decorated graphene nanostructures.
- 2014 – Vice-Chair, Energy Pillar, N.ERGHY, the European research grouping of the Fuel Cells and Hydrogen Joint Undertaking.
- 2014 – Member of the Italian Extended Energy Board for Horizon 2020.
- 2015 – Invited National Expert, Italy–Korea bilateral Fuel Cells and Hydrogen Symposium, Seoul, Republic of Korea.
- 2015–2016 – Scientific Coordinator for the preparation of the Italian National Strategic Plan for Hydrogen Mobility, developed in the framework of the EU Alternative Fuels Infrastructure Directive (DAFI) and subsequently incorporated into Italian legislation through Legislative Decree No. 257/2016.
- 2018 – Invited National Expert, Italy–India Summit, New Delhi, attended by Italian Prime Minister Giuseppe Conte and Indian Prime Minister Narendra Modi.
- 2018 – Member of the Scientific Board, Green Energy Storage.
- 2018 onwards – Contributor to the strategic definition of the European Fuel Cells and Hydrogen R&I programme, including the transition from Horizon 2020 towards Horizon Europe/Clean Hydrogen.
- 2019 – Invited Expert, PAT Forum on strategic research priorities for Trentino.
- 2019 – Invited Expert, SNAM Hydrogen Challenge, with the participation of the Italian Prime Minister and national ministries.
- 2020 – Elected Vice-President, H2IT – Italian Hydrogen Association.
- 2020 – Elected Member of the Governing Board of Hydrogen Europe Research, as Leader of Technical Committee 1 – Hydrogen Production.
- 2023 – Elected President of Hydrogen Europe Research, becoming its first Italian President, representing the European hydrogen research community; Member of the Governing Board of the Clean Hydrogen Joint Undertaking alongside the European Commission and Hydrogen Europe.
- 2023 – Signatory, on behalf of Hydrogen Europe Research, of the Joint Declaration on Hydrogen Valleys, “*Moving the Hydrogen Economy from Niche to Scale*”, with European Commissioner Mariya Gabriel and European hydrogen stakeholders, Brussels, 1 March 2023.
- 2023 – Signatory, on behalf of Hydrogen Europe Research, of the MoU between Hydrogen Europe Research, Hydrogen Europe and EURAMET, establishing cooperation between the European hydrogen and metrology communities. Questo è un elemento che aggiungerai: la firma avvenne il 17 marzo 2023.
- 2023 – Plenary Lecture, *109th National Congress of the Italian Physical Society (SIF)*, University of Salerno — “*Materials, Methods and Priorities for the Development of the Hydrogen Value Chain.*”
- 2023 – Invited Speaker, Plenary Session, *European Fuel Cells & Hydrogen – Piero Lunghi Conference (EFCH₂ 2023)*, Capri.
- 2023–2025 – Institutional Opening Speaker, *European Hydrogen Research & Innovation Days / EU Hydrogen Research Days*, representing the European hydrogen research community.
- 2024 – Re-elected President of Hydrogen Europe Research for a second mandate, at the HER General Assembly in Budapest.
- 2025 – Invited Speaker, *10th Mission Innovation Ministerial (MI-10)*, Busan, Republic of Korea; signatory, on behalf of Hydrogen Europe Research, of the MoU with the Clean Hydrogen Mission.
- 2025 – Guest Editor, *International Journal of Hydrogen Energy*, Special Issue “*Global Perspectives*

on Hydrogen Technologies: Innovations, Challenges, and Pathways to a Hydrogen Economy", Elsevier.

- 2025 – Keynote Speaker, *9th International Hydrogen Technologies Congress (IHTEC 2025)* — “Overview on the European Research and Innovation in the Hydrogen Sector: Best Practices and Priorities.”
- 2025 – Invited Speaker, *International Conference on Electrolysis (ICE 2025)*. La qualifica “Invited Speaker” è confermata dal programma ufficiale.
- 2025 – Invited Speaker, *European Fuel Cells & Hydrogen – Piero Lunghi Conference (EFCH₂ 2025)*, Capri — “Strategic Research Priorities for Hydrogen: A Roadmap Beyond 2030.”
- 2026 – Re-elected President of Hydrogen Europe Research for a further two-year mandate, HER General Assembly, Dublin. Questo lo aggiungerei assolutamente: la General Assembly del 17 giugno 2026 ti ha nuovamente eletto Presidente.
- 2026 – Plenary Speaker, *2nd International Congress on Sustainable Energy and Related Technologies (ICSET 2026)*, Palermo. La tua biografia ufficiale ICSET evidenzia anche il coordinamento di quattro progetti europei e il contributo alla definizione del programma europeo Clean Hydrogen.
- 2026 – Keynote Speaker, *European Hydrogen Skills Conference*, Brussels.
- 2026 – Invited Speaker, Plenary Session, *European Fuel Cells & Hydrogen – Piero Lunghi Conference (EFCH₂ 2026)*, Capri.

ADDITIONAL INFORMATION

Other contributions to the research community, research management and third mission

1. Leadership of the FBK Sustainable Energy Center (since 2021).

Director of the Sustainable Energy Center at Fondazione Bruno Kessler (FBK), leading a multidisciplinary organisation of more than 80 researchers and technical staff. Responsible for scientific strategy, organisational development, research portfolio, recruitment and career development, research infrastructures, industrial partnerships and competitive funding, with a major focus on hydrogen, batteries and integrated energy systems. FBK confirms Crema as Director and identifies hydrogen, batteries/storage and grids among the Center's core research areas.

2. Development of a major research and innovation infrastructure for hydrogen and batteries.

Scientific and strategic leadership in the development of the **Hydrogen and Batteries Hub in Rovereto**, conceived as a large-scale platform connecting research, technology validation, scale-up and industrial deployment. The initiative involves more than €50 million in investment and supports, among others, the implementation of the IPCEI Hy2Tech programme, strengthening Trentino's role as a European innovation ecosystem for energy technologies.

3. Development of TESSLabs as an open research infrastructure.

Contribution to the establishment of **TESSLabs – Territorial Ecosystem for Sustainable Technologies Laboratories**, jointly developed by FBK and the University of Trento in Rovereto. The initiative provides advanced experimental capabilities for research and industrial collaboration and contributes to building an integrated regional ecosystem for sustainable-energy technologies.

4. Leadership of the European hydrogen research community

President of Hydrogen Europe Research since 2023, representing the European hydrogen research community and promoting cooperation among universities, research organisations, industry and European institutions. First Italian elected to the Presidency; subsequently re-elected in 2024 and again in 2026, demonstrating continued confidence from the European research community.

5. Governance of the European Clean Hydrogen Partnership.

As President of Hydrogen Europe Research, **Member of the Governing Board of the Clean Hydrogen Joint Undertaking**, contributing to the strategic governance of the European public-private partnership together with the European Commission and Hydrogen Europe. The role includes contributing to the identification of European R&I priorities and strengthening the link between scientific research, industrial needs and European policy.

6. Contribution to European hydrogen research strategies and programmes.

Long-standing contribution to the definition of European hydrogen R&I priorities, initially through N.ERGHY/Hydrogen Europe Research Technical Committees and subsequently through its Board and Presidency. Activities include contributions to strategic research agendas, research priorities and European programmes supporting the development of the hydrogen value chain. His earlier election to lead the Hydrogen Production Technical Committee explicitly included responsibility for supporting development of the European hydrogen programme.

7. Leadership within the Italian hydrogen community.

Vice-President of H2IT – Italian Hydrogen Association since 2020, reconfirmed for the 2026–2028 term and additionally appointed **Chair of its Scientific Committee**. The role supports dialogue between research, industry and policymakers and the development of scientific and technological priorities for the Italian hydrogen ecosystem.

8. Contribution to Italian hydrogen policy and regulatory development.

Provision of scientific and technical expertise to Italian institutions in the development of hydrogen strategies and regulatory frameworks. Contributions have included the National Hydrogen Strategy, regulatory measures and implementation of RED III, building on earlier work on Italy's hydrogen mobility strategy and implementation of the Alternative Fuels Infrastructure Directive.

9. Building bridges between research and industrial deployment.

Development of a research-to-industry model in which FBK infrastructures and expertise support companies in developing, testing, validating and scaling up hydrogen and battery technologies. Recent examples include collaboration with industrial actors such as UFI Hydrogen and the creation of an applied-research ecosystem aimed at reducing technological risk and shortening the pathway from laboratory research to market deployment.

10. Management of major European collaborative research programmes.

Extensive experience in coordinating and supervising European R&I projects and complex international consortia, from proposal development to scientific, financial and organisational management. This includes coordination of projects such as **EDEN, CH2P, SWITCH and AMON**, as well as strategic participation in large European initiatives and IPCEIs, combining technology development with system integration and industrial exploitation.

11. Development of international research cooperation.

Promotion of international scientific cooperation through bilateral and multilateral initiatives involving Europe and major international partners, including Korea, India and the United States, as well as Mission Innovation. Activities have connected European research organisations with international institutions, industrial actors and policymakers around common clean-energy research priorities.

12. Contribution to Mission Innovation and the global hydrogen research community.

Representation of the European hydrogen research community in **Mission Innovation/Clean Hydrogen Mission** activities, strengthening cooperation between European and international hydrogen research ecosystems. This includes the 2025 MI-10 Ministerial activities and the development of institutional cooperation between Hydrogen Europe Research and the Clean Hydrogen Mission.

13. Building research–policy–industry dialogue at European level.

Promotion and organisation of high-level policy dialogues bringing together researchers, industrial leaders and public authorities to discuss hydrogen R&I, competitiveness and energy security. Recent activities include the HER policy dialogue in Dublin involving representatives of European research and industry and the Irish Minister of State for Climate, Energy and the Environment.

14. Scientific community service through editorial activities.

Long-term contribution to scientific publishing, including service on the **Editorial Board of *Energy, Sustainability and Society* (Springer)** and as **Guest Editor of the *International Journal of Hydrogen Energy* Special Issue “Global Perspectives on Hydrogen Technologies: Innovations, Challenges, and Pathways to a Hydrogen Economy.”** These activities contribute to scientific quality assurance and to identifying emerging research directions in sustainable energy and hydrogen.

15. Doctoral education and research training.

Member of the Academic Board of the PhD Programme in Industrial Innovation, University of Trento, contributing to doctoral education, interdisciplinary research training and interaction between academic research, research organisations and industrial innovation.

16. Mentoring and development of young researchers.

Long-standing responsibility for the supervision and professional development of researchers, PhD candidates and early-career scientists. As Head of Research Unit and subsequently Center Director, activities include scientific mentoring, career development, delegation of scientific responsibility and the involvement of young researchers in European projects and international research networks.

17. Education and outreach in energy technologies.

Contribution to education and public engagement through university teaching, specialist training, summer schools, public events and dissemination activities on energy transition technologies. Recent initiatives include FBK's **Pioneers in Research Summer School** on energy technologies and activities engaging younger generations with scientific research and sustainability.

18. Promotion of interdisciplinary energy research.

Development over more than two decades of interdisciplinary research activities connecting physics, materials science, mechanical and electrical engineering, modelling, energy systems and economics. This approach has enabled research teams to address the complete innovation chain—from materials and components to prototypes, integrated systems, demonstration and techno-economic assessment—and has supported FBK's evolution towards a mission-oriented Sustainable Energy Center.

19. Third mission: translating research into regional and European innovation ecosystems.

Sustained activity in translating scientific knowledge into economic and societal value by connecting **research institutions, companies, public authorities and territorial stakeholders**. This includes technology transfer, industrial partnerships, research infrastructures, contribution to start-up and innovation initiatives, and development of the Trentino hydrogen and battery ecosystem. The current Rovereto Hydrogen Hub is a particularly visible result of this long-term approach, providing a platform spanning research through industrial validation.