



Hydrogen and decarbonization mission  
Torino- July 1<sup>o</sup> 2022

University of Torino

HYDROGEN | H2@UniTo

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In collaboration with



And in collaboration with the Regional  
Innovation Clusters of Piemonte

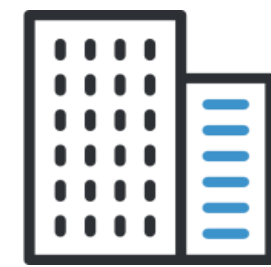


per una crescita intelligente,  
sostenibile ed inclusiva  
[www.regione.piemonte.it/europa2020](http://www.regione.piemonte.it/europa2020)  
INIZIATIVA CO-FINANZIATA CON FESR

# A GLANCE AT THE UNIVERSITY OF TURIN



**3°** in Italy for research achievements | **5%** Italian top departments



**27** departments | all major fields except engineering and architecture



**79,000** students (2020/21) | **6%** foreign students



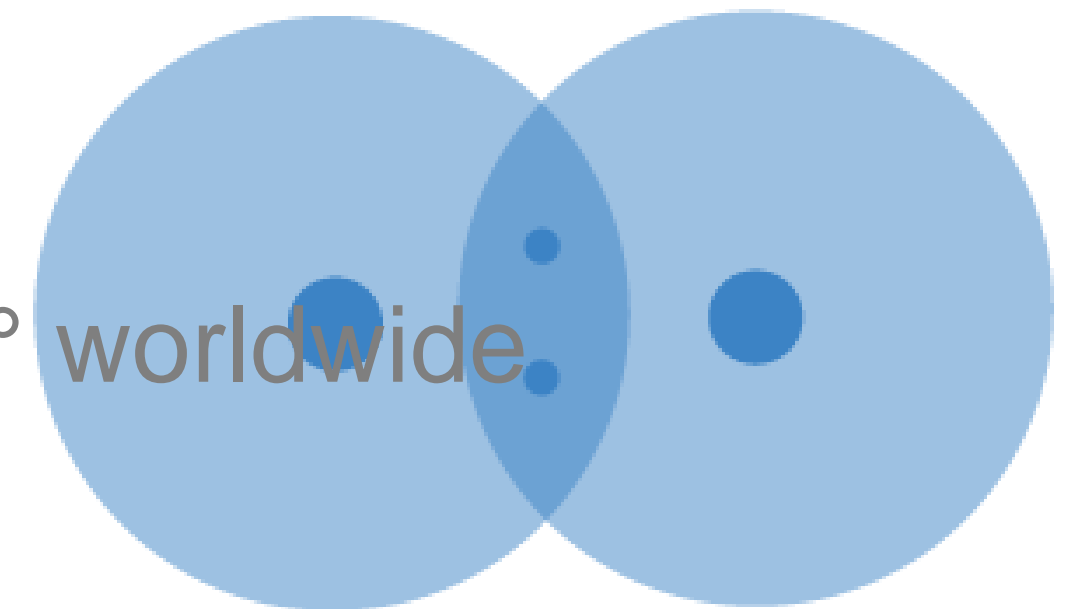
**8,400** scientific publications in 2019



**17** fully-english courses



**2°** Italian university on sustainability ranking, 22° worldwide







# RESEARCH AREAS

## Production

- Electrochemical and photoelectrochemical production by water electrolysis
- Photocatalytic production processes (water photosplitting, semiconductor oxides, reforming of organic compounds)
- Mixtures rich in hydrogen for pyrogasification of organic materials (wood) and plastic
- Biomass enzymes (bacteria, algae) by hydrogenase

## Logistics (purification, distribution, storage, compression)

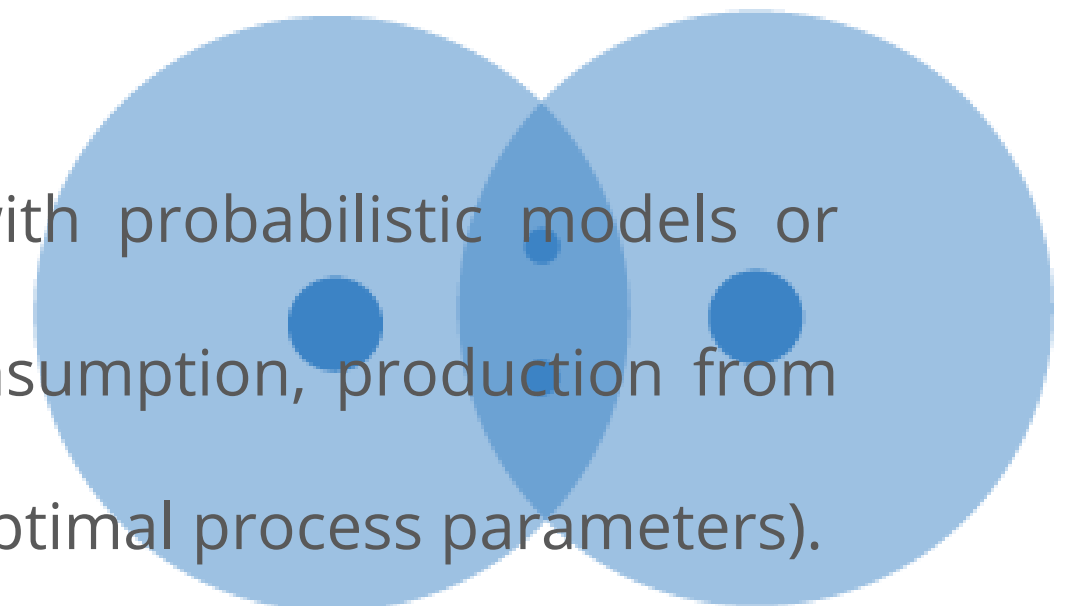
- Identification and study of the geological characteristics (tightness, stability of voids, possible fluid / rock interactions) of sites for the storage of hydrogen in depleted reservoirs (quarries, mines) or ad hoc (salt formations, aquifers, hard rocks), including any effects induced in the facing areas
- Synthesis and characterization of materials (hydrides, LOHC) for the storage of hydrogen
- Compression of hydrogen by hydrides
- LCA of hydrogen compression and storage processes

## Fuel cells

- Polymer membranes for PEM cells
- Oxidic materials for SOFC

## Digitalization

- Data processing and use of data: visualization, statistical analysis and forecasts with probabilistic models or machine learning
- Development of formal models based on data (of production processes, energy consumption, production from renewable sources)
- Analysis, optimization of performance (scheduling based on green energy availability, optimal process parameters).







# RESEARCH AREAS

## Industrial use

- Use of hydrogen for the synthesis of light hydrocarbons by hydrogenation of CO<sub>2</sub>
- Selective hydrogenations for fine chemistry (experiments and modeling)
- Development of highly selective advanced catalysts for saving energy resources and precious materials

## Energy use

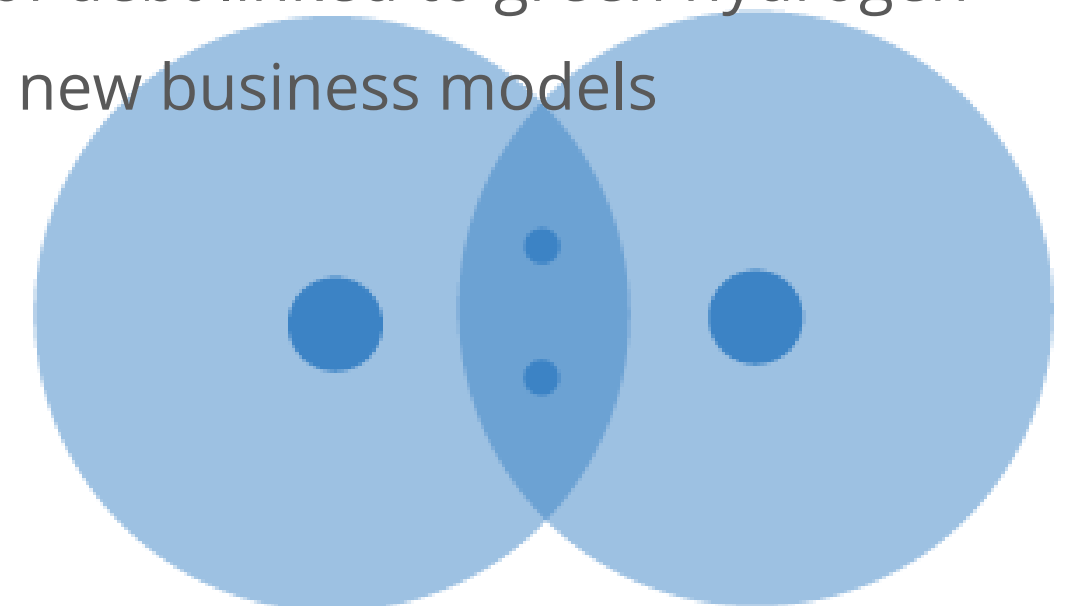
- Integration of hydrogen storage systems based on hydrides with electrolyzers and fuel cells for storage of renewable energy
- Chemical energy storage through the synthesis of light hydrocarbons to be used as fuel or basic chemical molecules and through selective hydrogenation of CO<sub>2</sub>

## Mobility use

- Feasibility studies for the use of hydrogen mobility in the automotive, railway and nautical fields
- Hydrogen storage systems for mobility applications
- Hydrogen-powered fuel cell drones

## Economic-financial, legal and regulatory, social perspective

- Economic impact of the use of hydrogen on the electrical system and for mobility
- Economic analysis of Hydrogen Valleys and EU taxonomy on the reduction of the cost of debt linked to green hydrogen
- Analysis of competition scenarios based on patent portfolios, strategic positioning and new business models
- Business Case on the development of hydrogen technologies
- Analysis and evaluation of laws, incentives, regulations
- Social acceptance of hydrogen-based technologies
- Hydrogen for energy communities







# PROJECTS

Call identifier	Acronym	Project title
FCH2 JU CALL FOR PROPOSALS 2018	HyCARe	An innovative approach for renewable energy storage by a combination of hydrogen carriers and heat storage - Prof. Marcello Baricco
H2020-LC-SC3-2018-NZE-CC	COMETS	COLlective action Models for Energy Transition and Social Innovation– Prof. Dario Padovan
H2020-MSCA-ITN-2018	PARACAT	Paramagnetic Species in Catalysis Research. A Unified Approach Towards Heterogeneous, Homogeneous and Enzyme Catalysis – Prof. Mario Chiesa
H2020-MSCA-ITN-2020	CHASS	Cu-CHA zeolite-based catalysts for the selective catalytic reduction of NOx in exhaust diesel gas: addressing the issue of Sulfur Stability – Prof. Gloria Berlier
MSCA-IF-2020	PLEC	Private Law and the Energy Commons – Prof. Alessandro Quarta
H2020-LCE-2016-RES-CCS-RIA	GEMex	GEMex: Cooperation in Geothermal energy research Europe-Mexico for development of Enhanced Geothermal Systems and Superhot Geothermal Systems – Prof. Giuseppe Mandrone
H2020-LC-SC3-2018-Joint-Actions-3	Impressive	Ground-breaking tandem of transPaRent dyE SenSitisled and peroVskite solar cElls – Prof. Claudia Barolo
H2020-LC-SC3-2018-NZE-CC	COZMOS	Efficient CO2 conversion over multisite Zeolite-Metal nanocatalysts to fuels and OlefinS – Prof. Silvia Bordiga
H2020-LC-BAT-2019	MODALIS2	MODelling of Advanced LI Storage Systems – Prof. Lorenzo Maschio
H2020-LC-SC3-EE-2019	eCREW	establishing Community Renewable Energy Webs - Rolling out a business model and operational tool creating webs of households that jointly manage energy to improve efficiency and renewables uptake – Prof. Dario Padovan
H2020-LC-SC3-2020-Joint-Actions-1	LEAP-RE	Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy – Prof. Alessandro Sciullo
H2020-LC-SC3-2020-NZE-RES-CC	4AirCRAFT	Air Carbon Recycling for Aviation Fuel Technology – Prof. Francesca Bonino
ERC-2019-SyG	CUBE	Unravelling the secrets of Cu-based catalysts for C-H activation – Prof. Silvia Bordiga



# PARTNERSHIP & NETWORK

International and European



SMART SPECIALISATION PLATFORM

Hydrogen valleys

Italian



ASSOCIAZIONE ITALIANA IDROGENO E CELLE A COMBUSTIBILE

Cluster  Energia

Piedmont Region and local



POLITECNICO  
DI TORINO

Industries



FINCANTIERI

+ COMPETENCE  
INDUSTRY  
MANUFACTURING  
4.0



BluEnergy Revolution



JP Fuel Cells and Hydrogen



Hydrogen Europe

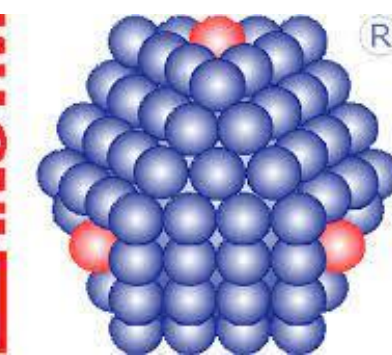
Research



Hydrogen TCP



FUEL CELLS AND HYDROGEN  
JOINT UNDERTAKING





# RESEARCH STAFF

## Chemistry

Claudia Barolo, Giovanni Ghigo, Lorenzo Maschio, Lorenzo Mino, Marcello Baricco, Marco Minella, Marta Corno, Michele Chierotti, Salvatore Baldino, Silvia Bordiga, Valter Maurino

## Computer Science

Andras Horvath

## Cultures, Politics and Society

Alessandro Sciullo

## Economics and Statistics

Massimo Nicolazzi, Valeria Di Cosmo

## Earth Sciences

Chiara Montomoli, Domenico De Luca, Franceco Dela Pierre, Gessica Umili, Giovanna Antonella Dino, Linda Pastero, Manuela Lasagna, Marcello Natalicchio, Nadia Curetti, Salvatore Iaccarino, Sergio Vinciguerra, Simona Ferrando

11 **faculties** 35 **researchers**

## Interuniversity Department of Regional and Urban Studies and Planning

Giuseppe Mandrone

## Law

Anna Porporato

## Life Sciences and Systems Biology

Francesca Valetti

## Management

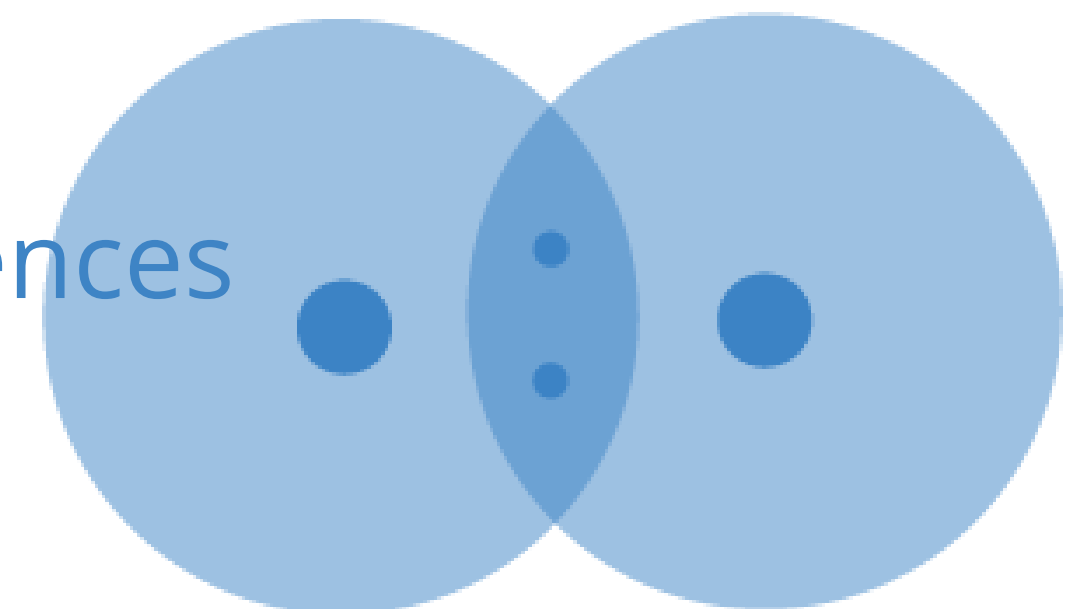
Davide Calandra, Federico Lanzalonga, Paolo Biancone

## Physics

Paolo Gambino

## Veterinary Sciences

Leila Vincenti



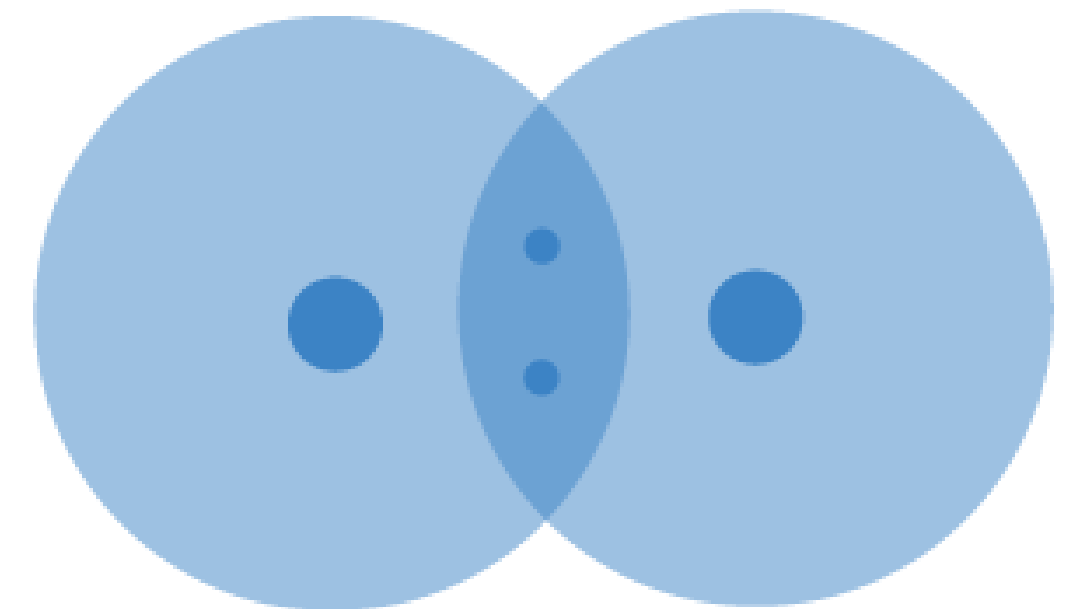




# POSSIBLE COLLABORATIONS

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- joint participation in funded projects
- direct access to Labs and use of research tools
- commissioned research (e.g. feasibility studies, new materials)
- joint publications
- sponsorship of doctoral scholarships
- internships and theses
- joint labs and pilot plants





# CONTACTS

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