



**Un polo per la Transizione Energetica:
Progetto “Components and Systems for Energy Transition”
(CoSyET)**

Fabrizio Pirri
Istituto Italiano di Tecnologia

Components and Systems for Energy Transition (CoSyET)

«Una Infrastruttura al servizio dell'industria nazionale»

Objective of the initiative is the creation of a technological Infrastructure of Innovation (II) to support the Italian Manufacturing Industries, especially SMEs, to access state of the art instrumentation and competences to facilitate efficient R&D, technology transfer, innovation processes and increase their competitiveness in energy transition.

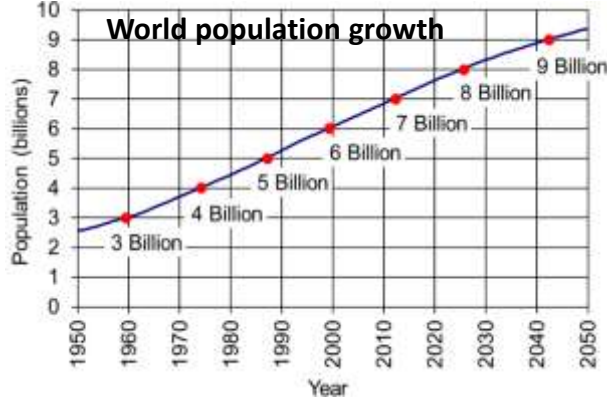
The Infrastructure “Components and Systems for Energy Transition” (CoSyET) will be located in the framework of the “Piemonte Hydrogen Valley” in Environment Park in Torino, where the Research Infrastructures (RI) of the Italian Institute of Technology (IIT) are located. In the same site, RI of Politecnico di Torino, of Regione Piemonte and of MISE, are also located and scientifically managed by IIT.

The proposed Infrastructure is structured in **4 PILOT LINES** focused on:

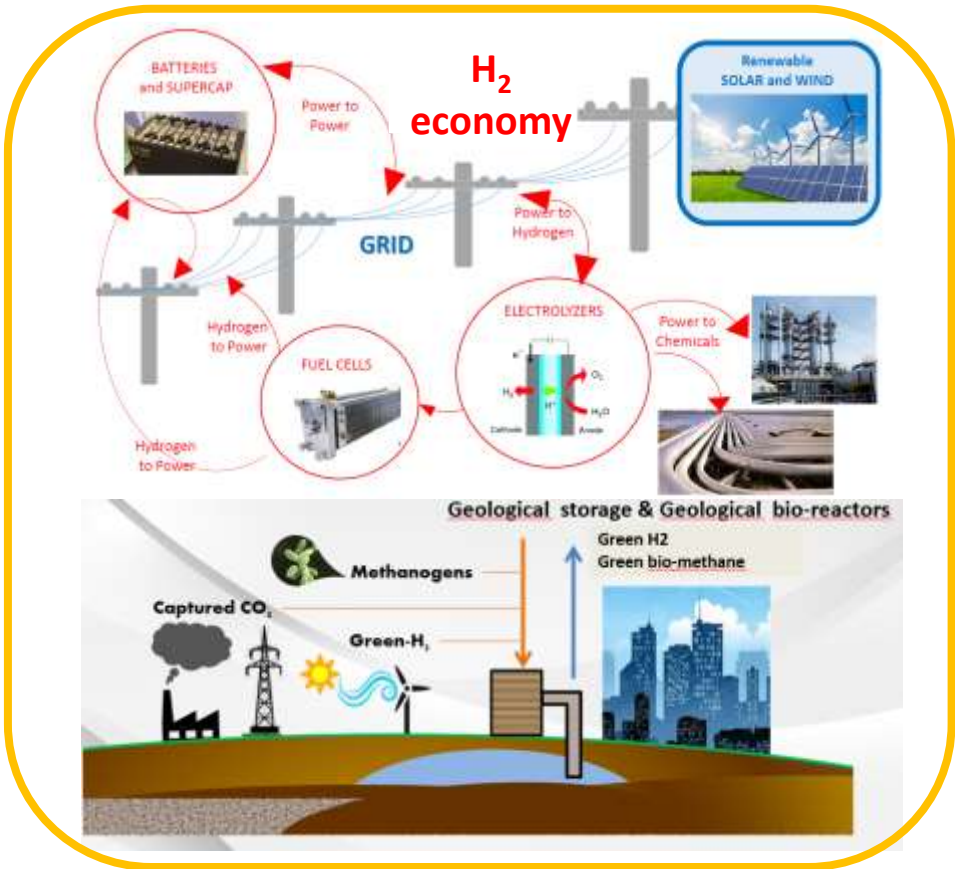
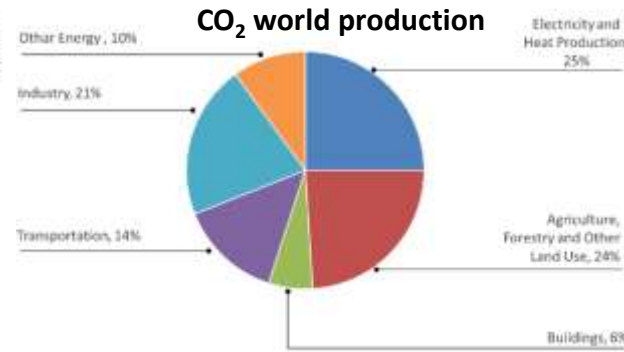
- H2 production, storage and use - devices and systems;
- CO2 capture, storage and valorization systems;
- Renewable energy;
- Electrical storage and management.

*Ministero dell'Università e della Ricerca
PNRR - M4-C2 Investimento 3.1
CONCESSIONE DI FINANZIAMENTI DESTINATI ALLA REALIZZAZIONE O
AMMODERNAMENTO DI
INFRASTRUTTURE TECNOLOGICHE DI INNOVAZIONE*

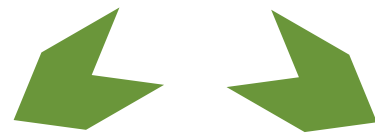
THE ORIGIN OF PROBLEMS



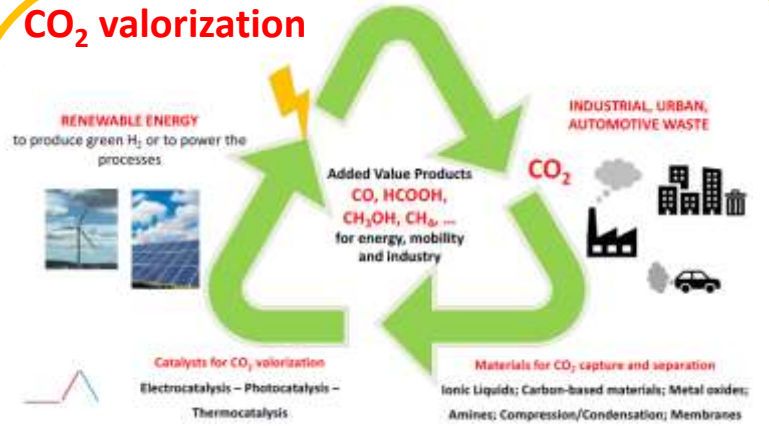
Total world energy consumption: 16 TW y



POSSIBLE TECHNOLOGICAL SOLUTIONS

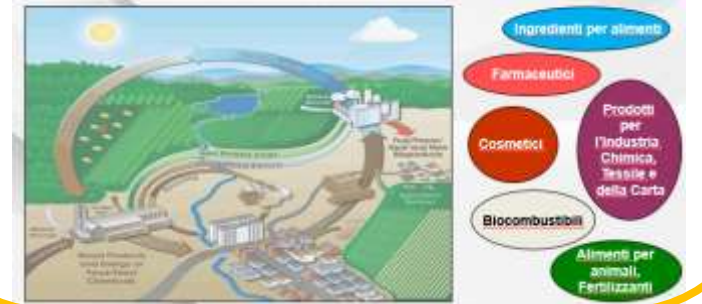


CO₂ valorization



From waste to chemicals: bioeconomy

2.000 Miliardi €/y e 20.0 Milioni di posti di lavoro
 In Italia: 255 Miliardi €/y e 1.7 Milioni di posti di lavoro



THE MAIN CONTESTS OF THE RESEARCH

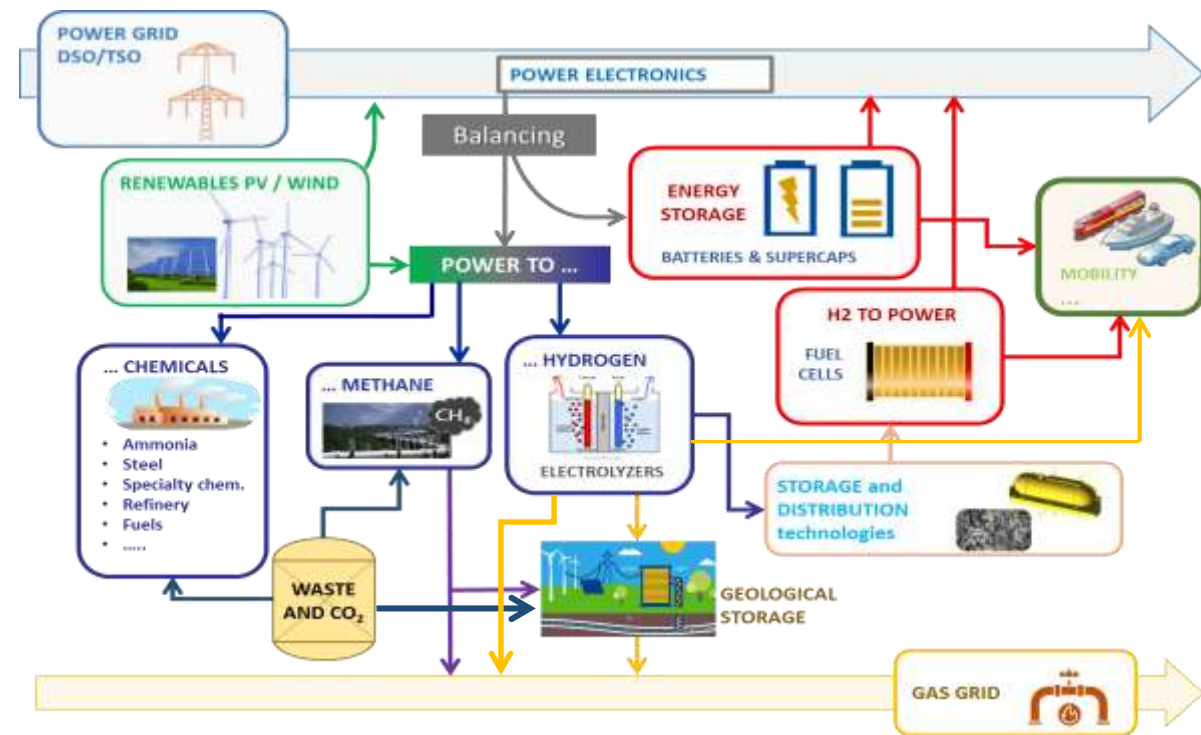
The new 2030 energy system scenario

In the future economic and industrial context, renewables, fuels, energy carriers and **green feedstocks** (in particular **hydrogen** and **e-chemicals**) will play a key role in advanced industrial societies.

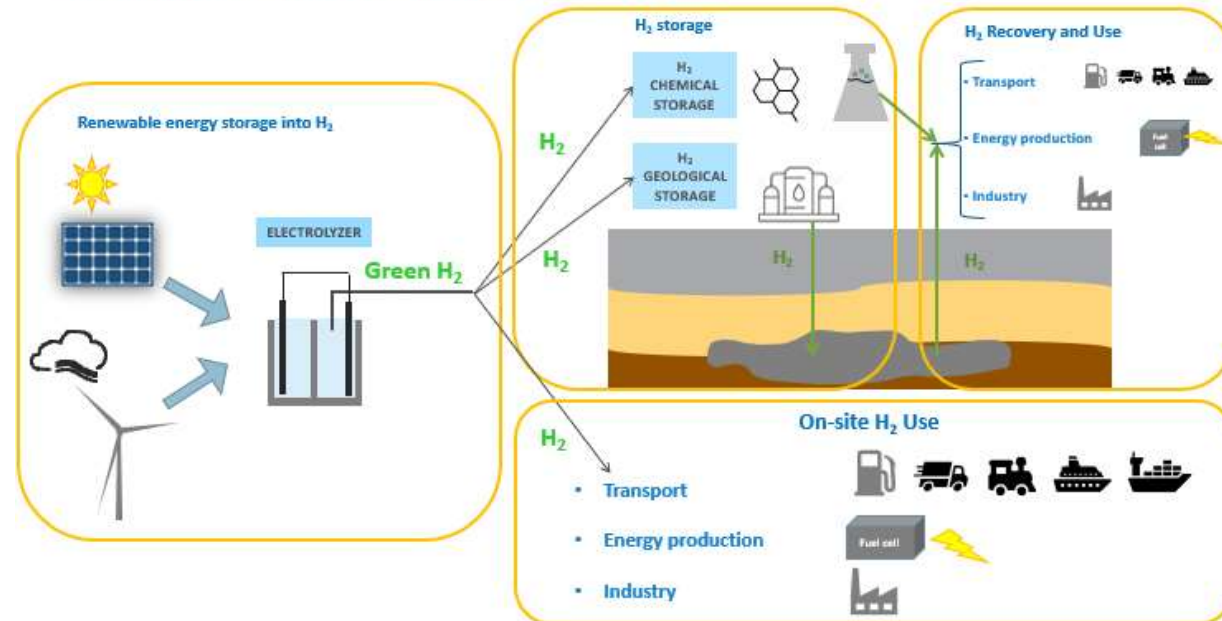
The interconnection of power & gas networks represents a new paradigm of energy production and distribution

From the production of **renewable energies**, the use of **CO₂** and **H₂** it will be possible to derive fuels and molecules that can be used both for energy and industrial use.

Energy storage is the key element that will maximize the efficiency of energy systems, the use of **clean energy in mobility** and a substantial **reduction of the use of fossil fuels**.



GREEN H₂ VALUE CHAIN PERSPECTIVE within 2030





Torino

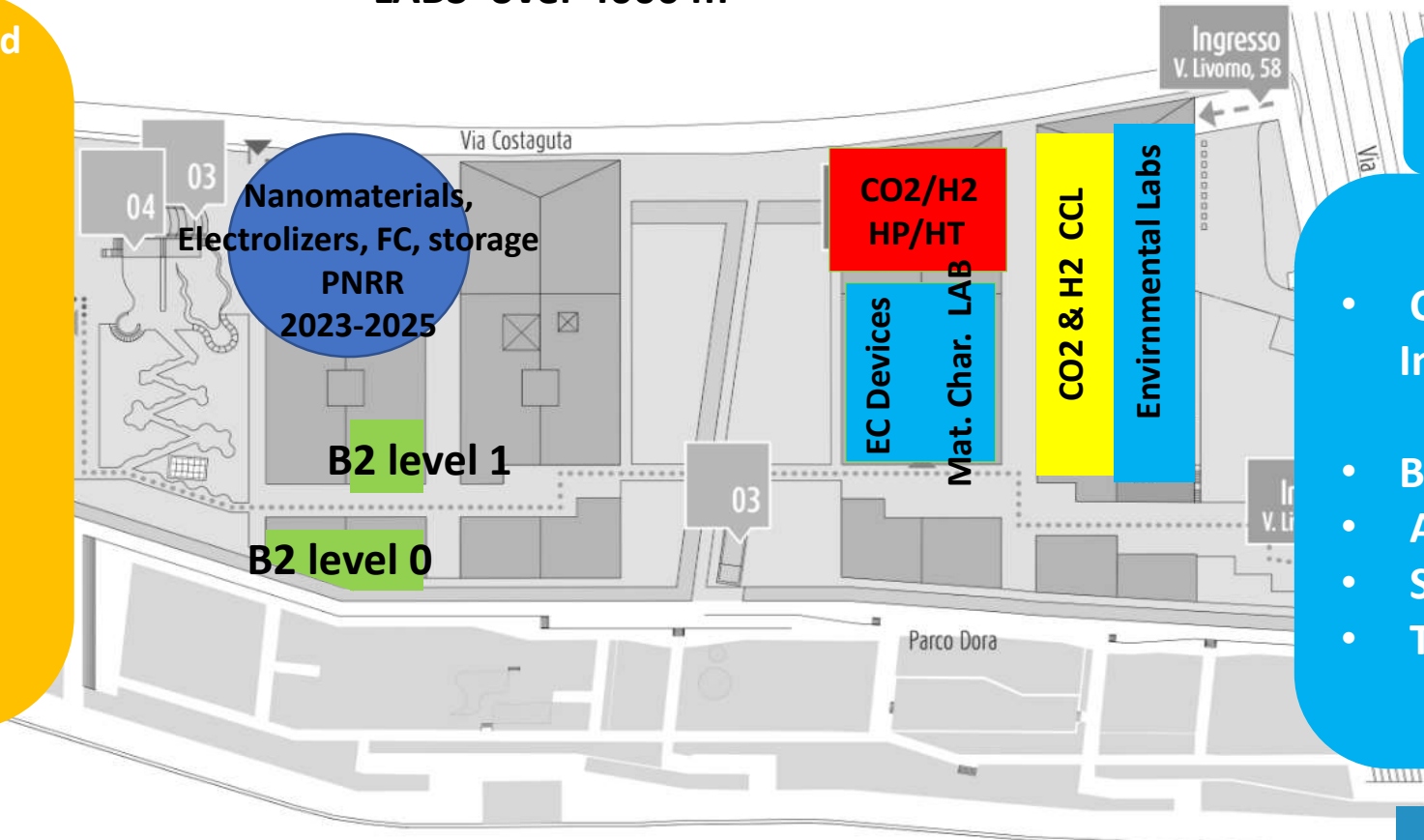
Environment Park



LABS over 4000 m²

RESEARCH ACTIVITIES are focused on materials, technologies and devices for

- CO₂ (CAPTURE & VALORIZATION)
- H₂ (PRODUCTION & USE)
- GREEN FUEL
- WASTE VALORIZATION
- RAW MATERIALS FROM WASTE
- ENERGY STORAGE
- ENERGY TRANSPORT & DISTRIBUTION



Objectives

- Creation of LABS at International Level
- Basic research
- Applied research
- System Integration
- Technology Transfer

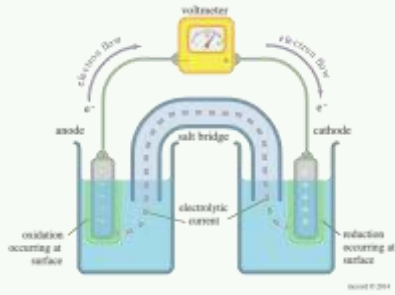
STRATEGIC FOCUS OF THE CENTER:

nanomaterials, processes and systems for production, storage, distribution and use of energy and raw materials from the perspective of a sustainable and circular economy.

IIT Sustainability Initiative supports the Sustainable Development Goals

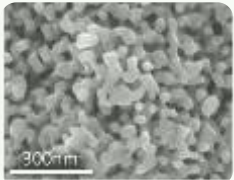
**SUSTAINABLE
DEVELOPMENT**

Materials Circularity and Upcycling



ELECTROCHEMISTRY

Functional nanomaterials for H₂ production and use, and CO₂ valorization



CO₂ capture from flue gas and sea water

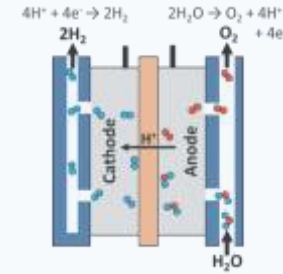


Waste-derived raw and strategic materials

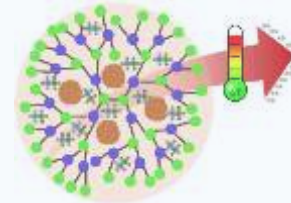


Li from Li-ion batteries electrochemical recovery

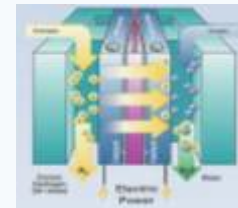
Sustainable Energy



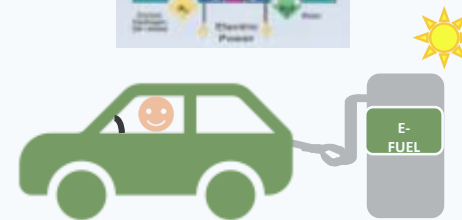
Platforms for H₂ production & use



Hydrogen storage



Nanomaterials and Platforms for energy storage



Sustainable fuels

CHEMICAL SYNTHESIS LABS



ELECTROCHEMICAL LAB CHARACTERIZATION



ELECTROLYZERS



FUEL CELLS



HYDROGEN LABS



FC single cells and stacks

Alkaline and PEM single cells and stacks

H₂ TEMPORARY GEOLOGICAL STORAGE: RESERVOIR AND CAP ROCKS H₂ INTERACTION TESTING UNDER RESERVOIR CONDITIONS

Reservoir microbiology

METAGENOMIC STUDIES for the characterization of the microbial communities in the reservoirs

ASSESSING MICROBIAL ACITIVITIES

in response to insufflation of H₂ mixtures in **multiphase reactor system** at HP-HT mimicking reservoir conditions

Computational fluid dynamics and Biogeochemical modeling at the reservoir scale

to test the reactivity of rock samples



Two-vessels fully customized reactor system to assess microbial activity in reservoir condition



Pilot line for Electrochemical dev. & Electrolyzer & Fuel cells realization & packaging



Membranes

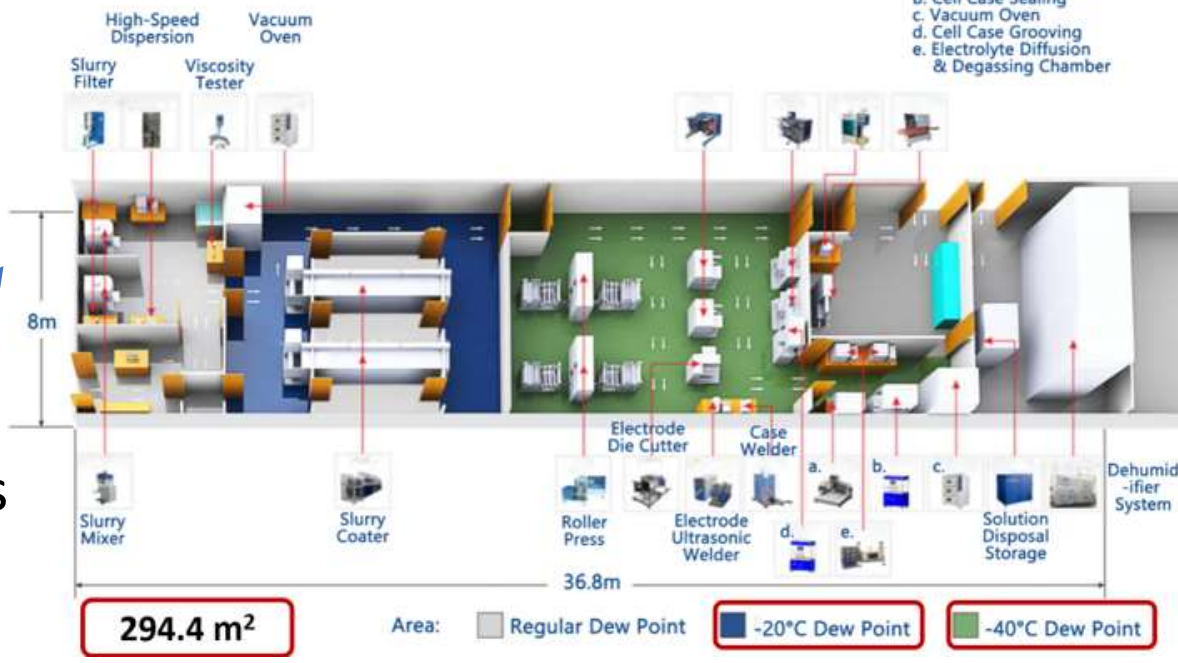


- a. Electrolyte Injection
- b. Cell Case Sealing
- c. Vacuum Oven
- d. Cell Case Grooving
- e. Electrolyte Diffusion & Degassing Chamber

Assembly

Testing

Electrolyzers
Fuel cells





ISTITUTO
ITALIANO DI
TECNOLOGIA



Fabrizio Pirri
fabrizio.pirri@iit.it

