
SELECT Master Programme’s
POLITO Study Track

POLITECNICO DI TORINO

Engineering

Cittadella Politecnica

Architecture

POLITECNICO
DI TORINO

Politecnico di Torino

~30,000 students:

150 years of higher education

- ✓ Highly selective
- ✓ Strong bases for future career success
- ✓ From engineering to manufacturing: the Polito Incubator was the winner of the world best Science based Incubator award 2004!

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Cittadella Politecnica

- ✓ Research, teaching and training go hand in hand with
  - ✓ local student services
  - ✓ financial activities
  - ✓ cultural activities
- ✓ Business Research Center
- ✓ Polo Venture Capital: from research to business

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Energy Center @ POLITO

Energy Center @ POLITO

ENERGY challenges face a complex framework characterized by various *layers* interacting among themselves and involving the decisions of various actors. These layers include:

- *physical/technological* (conversion, storage, distribution/transmission, end uses)
- *environmental* (effects and impacts)
- *cyber* (data collection, transmission and analysis)
- *economic* (market efficiency, affordability, competitiveness, development, productivity)
- *social* (consumer engagement, behavioral change, inclusion, development, health, prosperity, security).

Moreover, the interactions involve two different scales mutually coupled: a *local scale* (city, region, country) and *global scale* (world-wide).

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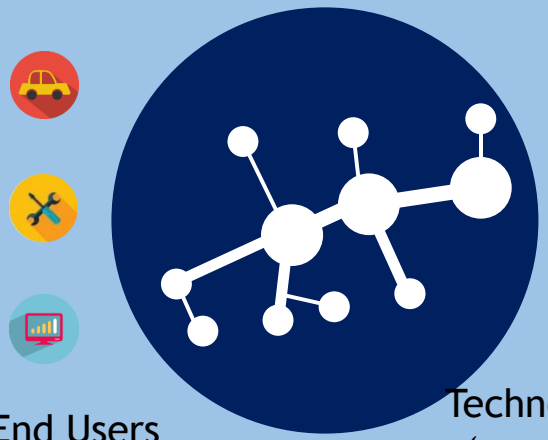
LOCAL SCALE

GLOBAL SCALE

ENERGY NETWORK (NODES & NETWORKS)



End Users

Technologies/Processes (energy conversion & storage)

ENVIRONMENTAL INTERACTIONS
(from local environment to biosphere)

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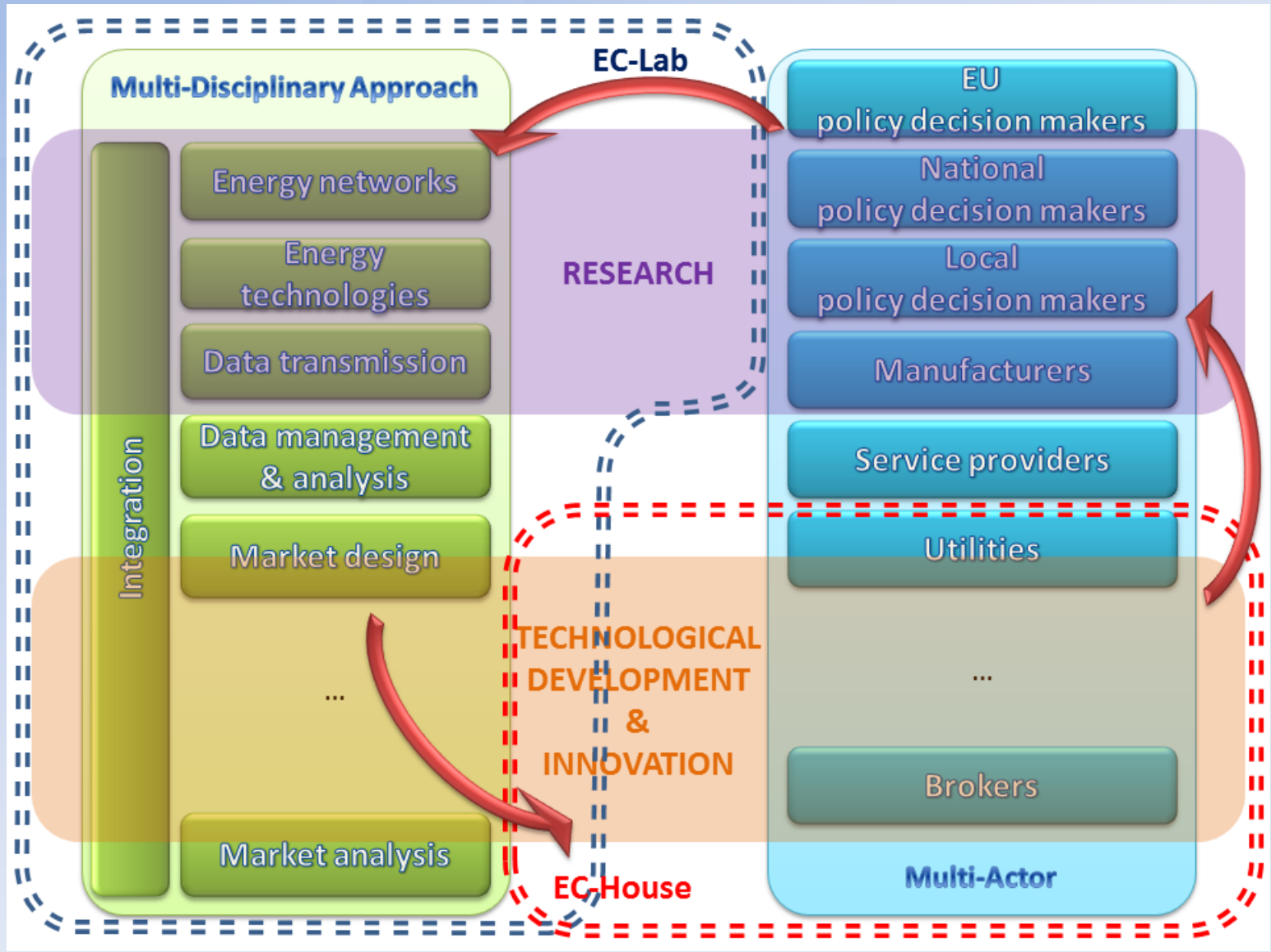
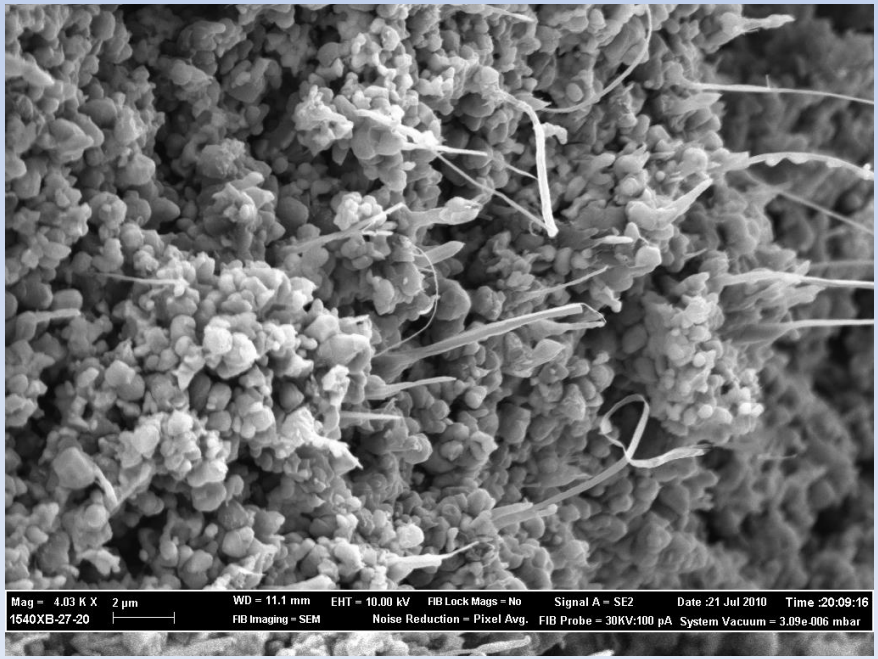


POLITO SELECT year 2: Energy Efficiency

LAB-centered



PROTOTYPES: polygeneration plant (SOFC-CHP, WWTU biogas, CO2 recovery) in Torino (Italy)

SMAT WWTP

Sludge

Anaerobic digester

Biogas

Chiller

Clean-up section

Clean biogas

Demi water

Reformer

Oxygen

District heating

Dry CO_2

Condenser

Oxy-combustor

SOFC

ANODE H_2O H_2

O^{--}

CATHODE O_2

e^-

Air

Blower

Air pre-heater

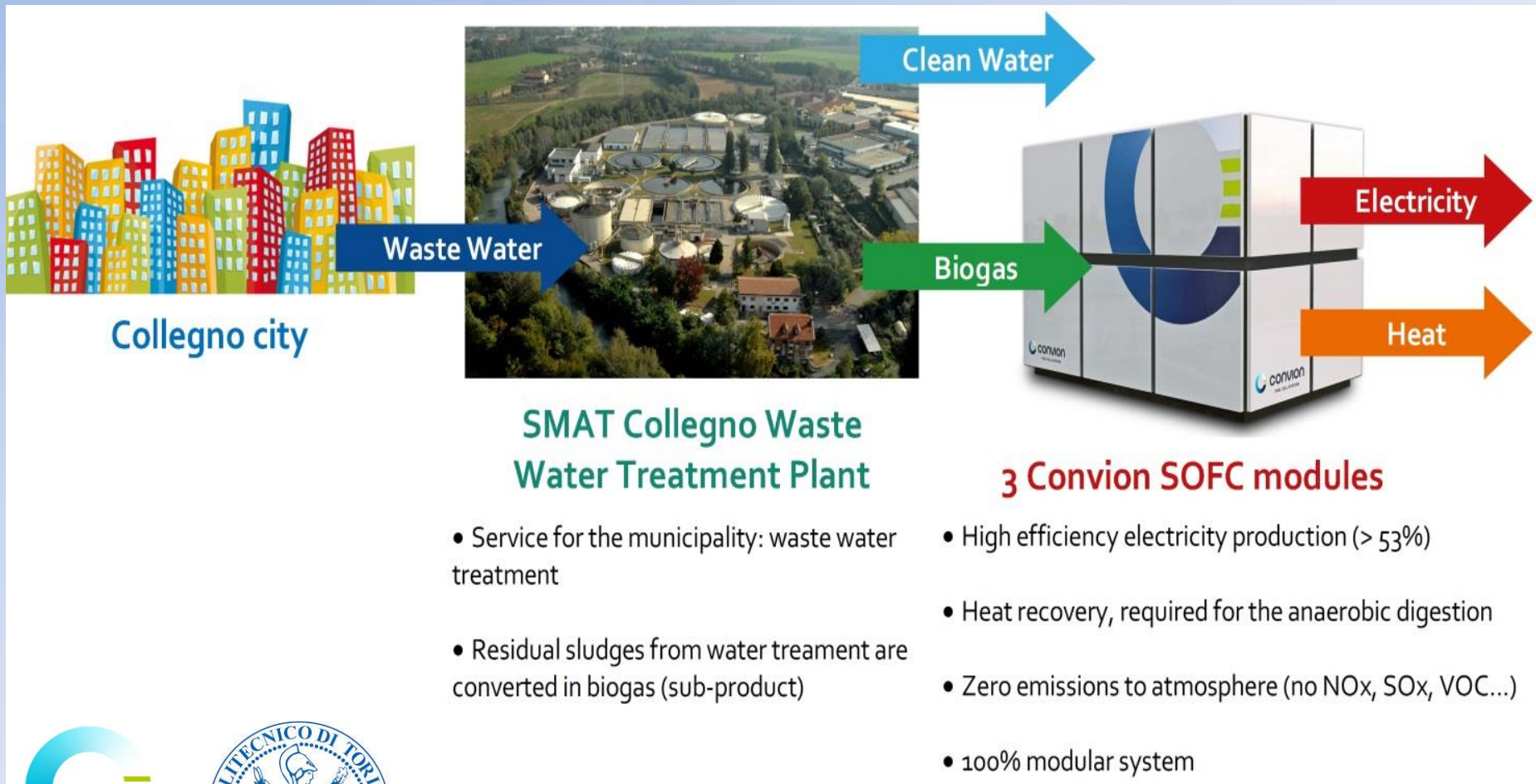
Exhaust

District heating

PROTOTYPES: polygeneration plant (SOFC-CHP, WWTU biogas, CO_2 recovery) in Torino (Italy)

INDUSTRIAL SIZE: Large SOFC-based CHP systems

Design, installation, operation, test and analysis of a new medium size CHP system based on SOFC fed by biogas: 174 kW_e + 90 kW_{th} (**the largest plant in EU so far**)



convion

POLITECNICO DI TORINO 1859 1906

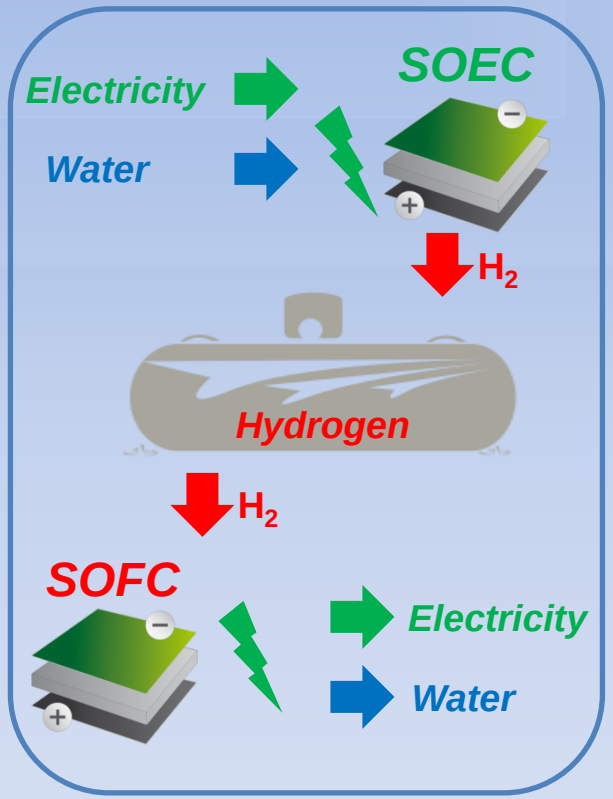
smat

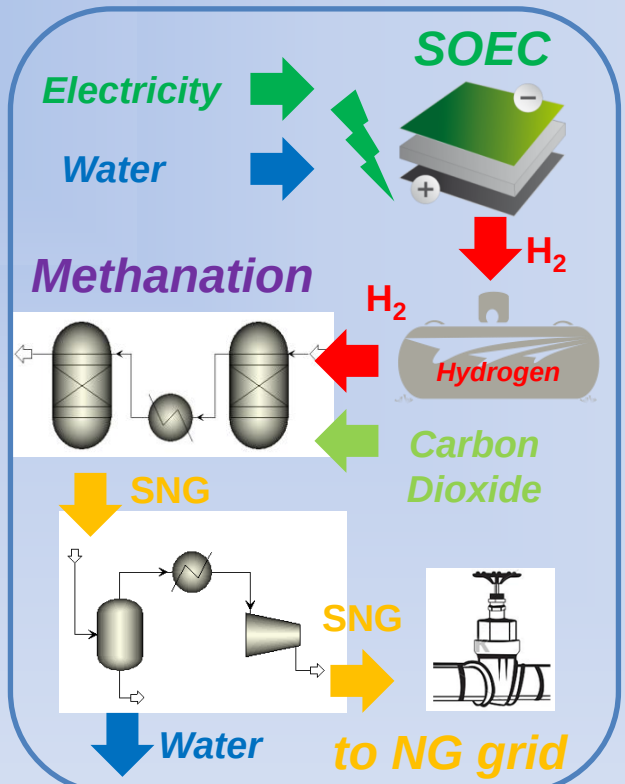
Imperial College London

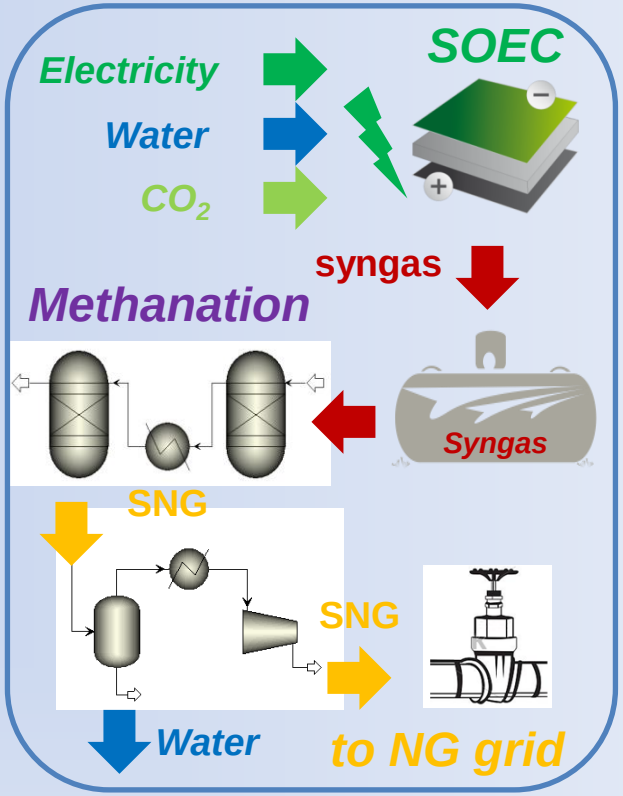
VTT

NEW CONCEPTS

Power-to-gas, power-to-chemicals







Fundamental research: nano-stuctures

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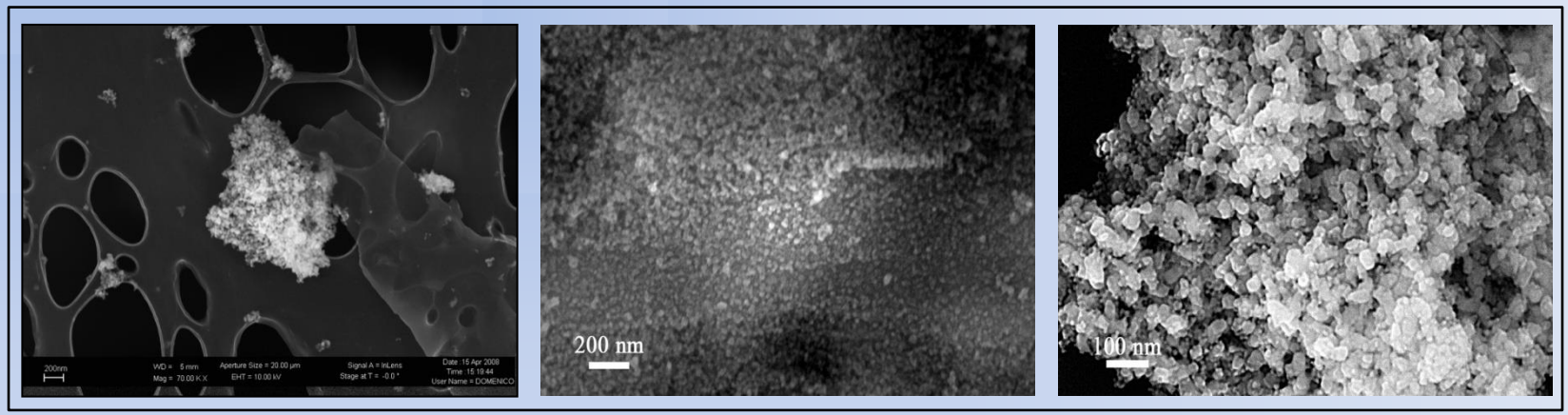
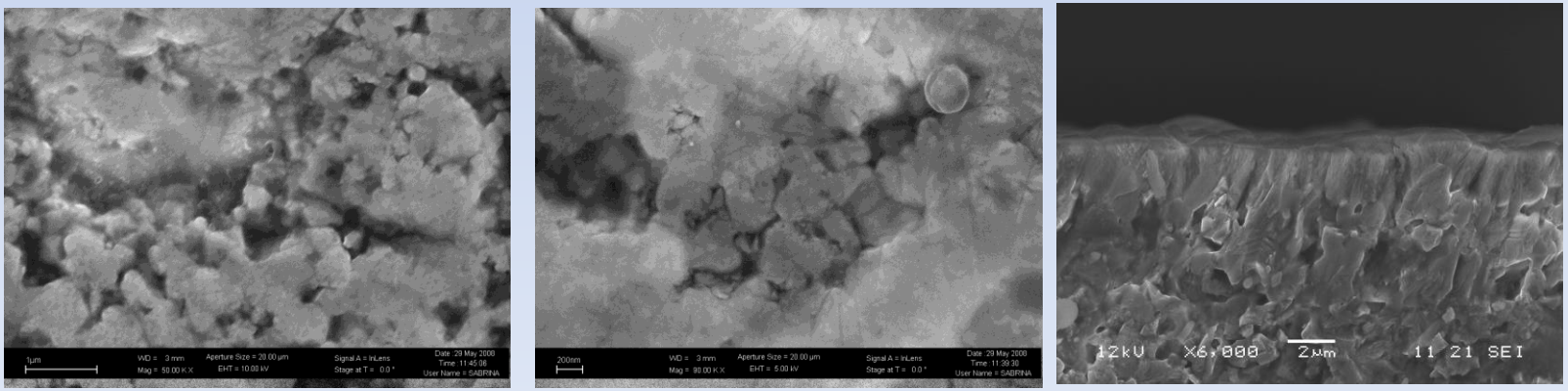
Processes: from nano-powders …



…to nano-structures (anode with PAFES, electrolyte with RF sputtering)



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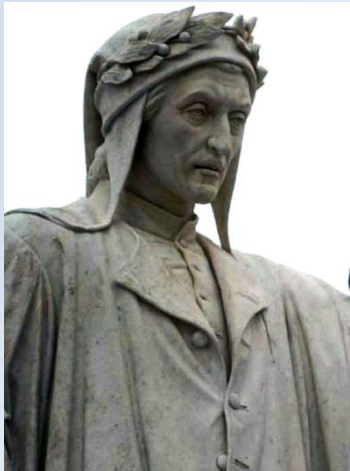
Energy Efficiency track

- ✓ **Fall-winter semester**
  - ✓ 6 ECTS from KTH (iPoY)
  - ✓ At least 24 ECTS from Polito courses
- ✓ **Spring-summer semester**
  - ✓ MSc Thesis work (30 ECTS) high industrial and business oriented relevance.
  - ✓ Notice: end your Thesis before the July MSc graduation session
- ✓ During your 2nd year: pass a simple Italian language exam



Energy Efficiency track

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	SPECIALIZATION	
Code	**Course title**	**ECTS**
SEL071	iPoY	6
	Focus Energy Efficiency*	**24**
01QIZND	Building physics and energy system in architecture	6
01OZMND	Numerical Design of Thermal Systems	8
01QGXND	Polygeneration and advanced energy systems	10
01PQCND	Power generation from renewable sources	6
02OULND	Resources and Environmental Sustainability	8
01OAJQD	Hydraulic and thermal machines testing	10

* 24 ECTS or more have to be chosen among the courses listed above.
IMPORTANT: A first level course of Italian language (6 ECTS) will have to be passed before graduating, but these credits are considered extra-curricular.

Building physics and energy system in architecture

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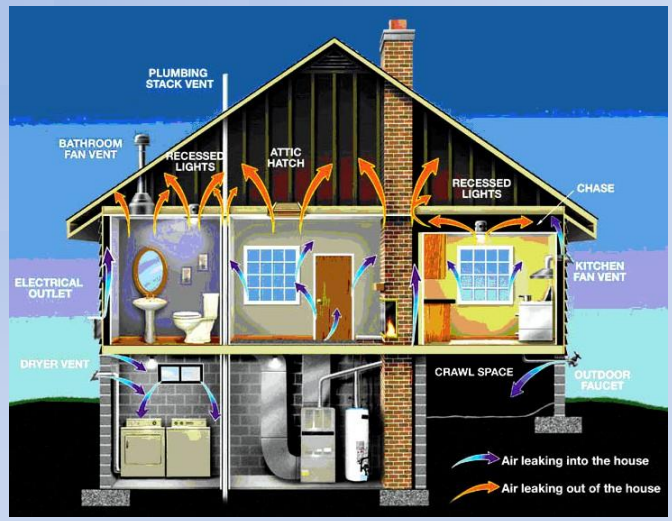
Stefano Corgnati – 6 ECTS



Physical basic concepts of thermal fluid-dynamic, lighting and acoustic phenomena related to indoor environment;

Building design requirements; technical regulations and legislation related to building physics; physical properties of components and materials;

Numerical and analytical methods for building physics and plant design;

Methodologies for experimental verification of building physics requirements in laboratory and in the field.

Numerical design of thermal systems

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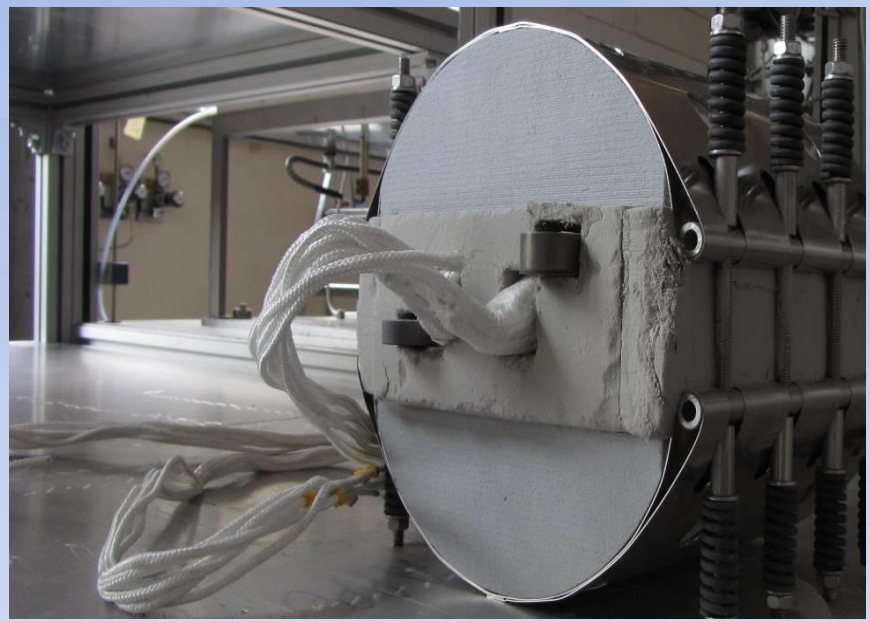
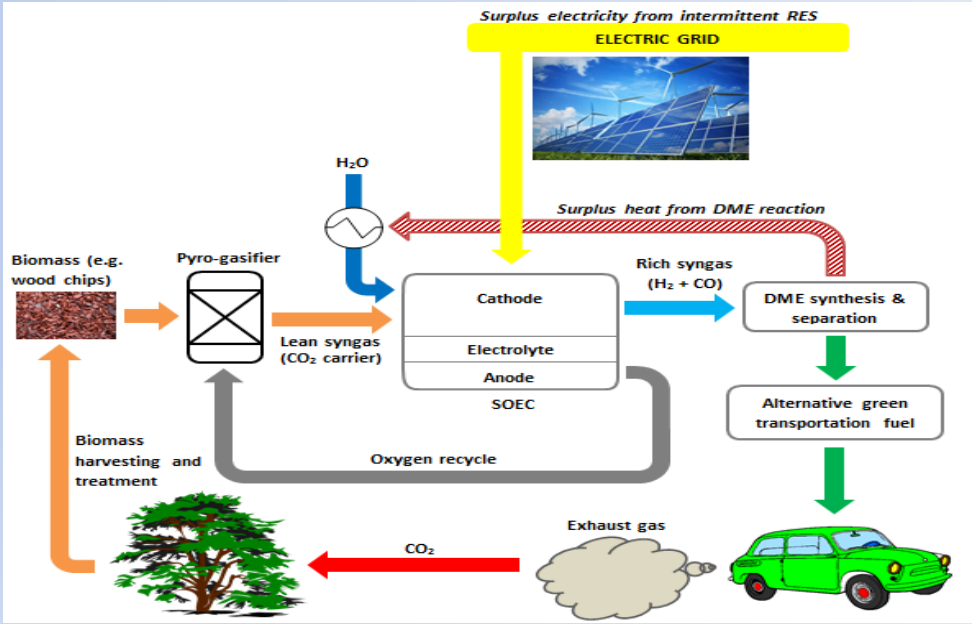
Romano Borchiellini, Marco Masoero, Vittorio Verda – 8 ECTS

- ✓ numerical methods to solve some typical thermal problems
- ✓ analysis and design of combustion systems with particular attention to thermal boilers and to the thermal analysis of fire tubes boilers
- ✓ fluid dynamic and thermal numerical analysis of fluid networks with particular attention on design and operation of district heating systems

Polygeneration and advanced energy systems

Massimo Santarelli – 10 ECTS





Starting from the fundamentals of chemical thermodynamics and electrochemistry applied to energy systems, the course develops topics related to electrochemical systems (fuel cells, electrolyzers, flow batteries), thermo-chemical systems (gasification, production of biogas, chemical looping processes), concepts of chemical storage for the production of synthetic fuels (CO2 recovery, power-to-gas, power-to-liquid processes) and complete this with the analysis of some examples of complex poly-generation systems.

Power generation from renewable sources

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Filippo Spertino – 6 ECTS

The course is devoted to present both the Photovoltaic and Wind power systems, and the methods to correctly design the main components, to evaluate the energy production with the economic analysis of investment.

Resources and Environmental Sustainability

Gian Andrea Blengini – 8 ECTS

The student is expected to gather basic knowledge about the economic characterisation of energy, mineral, and environmental resources. He should gain a basic understanding of resource management issues and their relationship to property rights, externalities, market structure, as well as the economic analysis tools and valuation techniques used in environmental economics. He should understand what is meant by sustainable development and how sustainability concepts are applied to energy, minerals and to production systems and engineering projects.

Hydraulic and thermal machines testing

Claudio Dongiovanni – 10 ECTS

The subject aims at providing the students with the basic theoretical knowledge and practical skills needed to face important technical problems in the experimental measurements of the main physical quantities in the mechanical and energetic fields. More specifically, the focus will be on engines and fluid machines.

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Welcome to the city of Torino!