

## PERSONAL INFORMATION

### Massimo Rivarolo



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Sex Male | Date of birth 23/07/1985 | Nationality Italian

## POSITION

### Assistant Professor

Department of Energy and Mechanical Engineering, University of Genoa (DIME-UNIGE)

## WORK EXPERIENCE

From 01/03/2019

### Department of Energy and Mechanical Engineering, University of Genoa (DIME-UNIGE)

Via Montallegro 1, 16145, Genova

- Optimization of innovative energy systems.
- Hydrogen storage and utilization systems (Fuel Cells) for maritime applications.
- Thermoeconomic analysis of energy districts.
- Development of W-ECOMP software for thermoeconomic analysis of energy systems.
- Member of H2IT, Italian society of Hydrogen and Fuel Cells ([www.h2it.it](http://www.h2it.it)) since 2020.
- Member of AHP, African Hydrogen Partnership since 2021.
- Member of TPG, Thermochemical Power Group ([www.tpg.unige.it](http://www.tpg.unige.it)) since 2010
- Assistant in the uniTwin/UNESCO Chair "Innovative, Sustainable and Clean Energy Research and Education" (2021-2024) <https://unitwin.unesco.unige.it/>
- Project management DIME-UniGe in the TecBia National research project (2018 – 2022)
- Responsible of the W-ECOMP software for thermo-economic analysis of energy systems (<http://www.tpg.unige.it/TPG/portfolio-item/w-ecompl/>).
- RES integration in the Italian energy system, with focus on distributed generation and CHP plants.
- Teaching at the Bachelor Course "Systems for energy and environment".
- Teaching at the M. Sc. Course "Power plants for energy".

Sector University, Research, Energy.

From 02/01/2017 to 01/01/2019

### Researcher

Title: "Methods for monitoring and analysis of the electrical national system in presence of high-efficiency CHP plants for distributed generation and renewable energy plants."

### Italian Authority for Regulation of Energy Grids and Environment (ARERA)

Piazza Cavour 5, 20121, Milano

- Technical regulation in terms of energy efficiency.
- Analysis and monitoring of distributed generation plants in Italy.
- Analysis and monitoring of RES and high-efficiency CHP plants in Italy.
- Technical regulation of private electrical grids.

Sector Energy, Regulation.

### Department of Energy and Mechanical Engineering, University of Genoa (DIME-UNIGE)

Via Montallegro 1, 16145, Genova

- Thermo-economic analysis of CHP plants and energy districts.
- Thermoeconomic analysis of power-to-fuel plants in the framework of EU-H2020 Project MEFCO2
- Thermoeconomic analysis of distributed generation solutions for maritime applications in the framework of the Italian National project GEI.

[Sector](#) University, Research, Energy.

From 02/01/2015 to 01/01/2017

[Researcher](#)

**Department of Energy and Mechanical Engineering (DIME), University of Genoa**

via Montallegro 1, 16145, Genoa, Italy

Title: "Development of monitoring and diagnostic systems for cogenerative plants and renewable energy systems"

[Main responsibilities and duties](#)

- Thermo-economic analysis of CHP and renewable energy systems in time-dependent conditions. Integration of renewable generators and traditional plants in energy districts in the Italian energy scenario;
- Responsible of the development of software tools (WTEMP, W-ECOMP) for thermo-economic analysis and optimization of energy systems in time-dependent conditions;
- European Project H2020 Spire 2014 "Synthesis of methanol from captured carbon dioxide using surplus electricity" (MefCO2): development of systems for thermo-economic analysis of systems for methanol synthesis;
- Teaching in advanced energy systems: thermo-economic optimization of power plants (gas turbines, combined cycles), technologies for H<sub>2</sub> production, storage and distribution;
- Teaching in power plants for energy conversion: distributed generation, high efficiency CHP, software for thermo-economic optimization of energy systems.

[Business or sector](#) University, Energy Engineering

**Italian Authority for Regulation of Energy Grids and Environment (ARERA)**

unit "Energy production, renewable energy sources and energy efficiency"

Piazza Cavour 5, 20121 Milano, Italy

- Technic regulation in terms of energy efficiency;
- Technic regulation in terms of electrical energy production, with particular focus on renewable energy sources and high efficiency CHP;
- Data Analysis and monitoring of distributed generation plants;
- Data Analysis and monitoring of renewable energy sources and CHP plants and their effects on the Italian energy market.

[Business or sector](#) Energy.

From 02/01/2013 to 31/12/2014

[Researcher](#)

**Department of Energy and Mechanical Engineering (DIME), University of Genoa**

via Montallegro 1, 16145, Genoa, Italy

Title: "POLYGRID: optimization of poly-generation grids in presence of not controllable renewable energy sources"

- Thermo-economic analysis and optimization of poly-generation smart grids and energy districts;
- Responsible of the development of software tools (WTEMP, W-ECOMP) for thermo-economic analysis and optimization of energy systems in time-dependent conditions;
- Study of the technologies for hydrogen and hydro-methane production from renewable sources and possible applications in transportation and in distributed generation;
- Teaching in advanced energy systems: thermo-economic optimization of power plants (gas turbines, combined cycles), technologies for H<sub>2</sub> production, storage and distribution;
- Teaching at University of Asuncion (Paraguay), Mechanical Engineering Department: 20 hours course on hydrogen and bio-fuels large scale production and thermo-economic optimization.

**Business or sector** University, Energy Engineering

From 02/01/2010 to  
31/12/2012

**PhD Student**

**Department of Energy and Mechanical Engineering (DIME), University of Genoa**

via Montallegro 1, 16145, Genoa, Italy

Thesis title: "Hydrogen production from large size hydraulic plant (14,000 MW) and study of storage systems and sustainable utilization in South America and Europe"

- Study of systems for Hydrogen production, storage and distribution
- Study of processes for the conversion of Hydrogen into Methane and "chemicals" (methanol)
- Application of Hydrogen and Hydrogen-methane mixtures for land transportation sector
- Thermo-economic analysis and optimization of H<sub>2</sub> and power-to-fuel systems
- Teaching activities

**Business or sector** University, Energy Engineering

## EDUCATION AND TRAINING

From 02/01/2010 to 31/12/2012

**European PhD**

**Department of Energy and Mechanical Engineering (DIME), University of Genoa**

Thesis title: "Hydrogen production from large size hydraulic plant (14,000 MW) and study of storage systems and sustainable utilization in South America and Europe"

- Practical skills on H<sub>2</sub> laboratory production, acquired in training period at CERTH Thessaloniki (Greece) from November 2011 to May 2012.
- Study of systems for Hydrogen production, storage and distribution
- Study of processes for the conversion of Hydrogen into Methane and "chemicals" (methanol)
- Application of Hydrogen and Hydrogen-methane mixtures for land transportation sector
- Thermo-economic analysis and optimization of H<sub>2</sub> and power-to-fuel systems
- Teaching activities

From 01/09/2007 to 30/10/2009

**Master Degree, Mechanical Engineering, Energy**

**Department of Energy and Mechanical Engineering (DIME), University of Genoa**

via Montallegro 1, 16145, Genoa, Italy

Grade 110/110

Master thesis title: "Distributed cogeneration from renewable sources: monitoring, management and optimization of a biogas plant from agricultural biomass and zootechnical effluents"

From 01/09/2004 to 30/10/2007

**Degree, Mechanical Engineering**

Department of Energy and Mechanical Engineering (DIME), University of Genoa

via Montallegro 1, 16145, Genoa, Italy

Grade: 100/110

**TEACHING EXPERIENCE**

From 2020

**DIME, University of Genoa**

B. Sc. In Chemical Engineering

Lecturer

Course "Systems for energy and environment" – ID 66021

Main topics: EU energy policies, ETS system, evolution of energy mix in EU and in Italy, RES technologies, hydroelectric and wind plants, hydrogen technologies, power to fuel systems.

From 2014

**DIME, University of Genoa**

M. Sc. In Mechanical Engineering

Lecturer

Course "Advanced energy power plants" – ID 60066

Main topics: renewable energy sources role in the Italian scenario, high efficiency CHP, software for optimization of combined cycles.

From 2016 to 2017

**DIME, University of Genoa**

M. Sc. In Energy Engineering

Lecturer

Course "Power plants for energy conversion" – ID 80053

Main topics: distributed generation, cogeneration, high efficiency CHP, software for optimization of CHP systems.

From 02/11/2013 to 20/12/2013

**ASSEFORM Srl**

Via Cantore 62/5 16149 Genova

Convenor

Formation Course "Energy manager" – ID GE12-EN-M

Total: 12 hours

Main topics: renewable energy technologies (wind, biomass and biogas), energy savings in residential buildings and strategies to increase buildings efficiency.

From 30/09/2013 to 04/10/2013

**Parque Tecnológico de Itaipu (PTI)**

Hernandarias, Paraguay

Convenor

Formation Course "Chemical reactors and catalytic processes for Hydro-methane and methanol generation from renewable sources"

Total: 20 hours

Main topics: technologies for large scale hydrogen production and storage, hydrogen production from renewable energy sources, bio-fuels production from hydrogen, biomass gasification, software for thermo-economic analysis of different power-to-fuel plant lay-outs.

## RESEARCH PROJECTS

From 02/01/2021

**Project name: FLEXnCONFU**

“Flexibilize combined cycle power plant throughout power-to-X solutions using not conventional fuels”

EU project – H2020 (project GA n. 884157 <https://flexnconfu.eu/>)

Main tasks:

- Preliminary analysis and techno-economic feasibility of the plant layout for a P2A2P system integrated with a combined cycle power plant.
- Production and utilization of ammonia in different blends in a micro gas turbine at the UniGe laboratory.

From 02/01/2021 to 30/12/2021

**Project name: ENVISION**

“ENergy harVesting by Invisible Solar IntegratiON in building skin”

EU project – H2020 (GA n. 767180)

Main tasks:

- Participation at WP6: State of the art of district heating networks in Italy and potential for the development of innovative 4th generation networks. Analysis of some representative cases.

From 30/10/2018 to 30/04/2022

**Project name: TecBia**

Technologies at low environmental impact for energy production for maritime application  
Italian National Project (financed by MISE)

Main tasks: project manager for UNIGE activities. More in detail:

- Market analysis and choice of the PEM stacks (30 kW each) for maritime application
- Analysis of the operational conditions of PEM fuel cells and thermal coupling with hydrogen storage system (metal hydrides)
- Design of the system for the thermal management of the PEMFC modules and the hydrogen storage system for different operating conditions.
- Laboratory assessment of the PEMFC and battery modules before installation onboard ships.

From 01/12/2014 to 30/11/2018

**Project name: MefCO2**

“Synthesis of methanol from captured carbon dioxide using surplus electricity”

European Project H2020 – Spire 2014

Project reference: 637016

Main tasks: development of models and algorithms for the thermo-economic analysis of power-to-fuel systems for methanol synthesis from surplus electrical energy and CO<sub>2</sub> captured by large coal plants, influence of energy scenarios and market prices on economic feasibility.

From 02/01/2017 to 31/12/2018

**Project name: GEI**

Italian National Project (financed by MISE)

Main tasks:

- Analysis of operational conditions of cruise ships in terms of electrical and thermal energy demands, evaluating different prime movers (micro GT, fuel cells) and storage systems.
- Time-dependent energy analysis and evaluation of the best operational strategy.
- Energy, environmental and economic comparison of the different solutions.

From 01/10/2010 to 30/11/2014

**Project name: E- Hub**

“Energy-Hub for residential and commercial districts and transport”

European Project FP7

Project reference: 260165

Main tasks: development of models and algorithms for the simulation and the optimization of different energy districts.

From 01/07/2011 to 31/12/2014

**Project name: IDRO-RIN TRAN-GENESI**

“ Study of technologies for large scale hydrogen generation from renewable sources for land and naval transportation and distributed generation”

Italian National Project

Project reference: DM 60644

Main tasks: study of different technologies for large scale hydrogen and hydro-methane production from renewable electrical energy (hydroelectric facilities), development of models for thermo-economic analysis and for the determination of the best size in different energy scenarios. Design and realization of a laboratory for the production and storage of hydrogen and hydro-methane.

**PERSONAL SKILLS**

**Mother tongue(s)** Italian

**Other language(s)**

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2
First Cambridge English (January 2019)					
Spanish	B2	B2	B2	B2	B2
DELE – Cervantes (June 2014)					

Levels: A1/2: Basic user - B1/2: Independent user - C1/2 Proficient user  
Common European Framework of Reference for Languages

**Communication skills** Excellent communication skills gained through teaching experiences and several European Projects and International Conferences where I presented the results of my research activities.

**Organisational / managerial skills** ▪ Excellent organizational and management skills acquired in the framework of the National and European Research Projects reported above, as responsible of different tasks.

**Job-related skills** ▪ Registered at the Engineering Rank, qualification obtained in January 2012, Genoa, Italy.

**Computer skills** ▪ Advanced command of Microsoft Office™ tools;  
▪ Strong experience in the use of Microsoft Excel and Microsoft Access for large data analysis;  
▪ Strong experience in Fortran and C++ languages;  
▪ Advanced experience using online searching engines.

Other skills

- Excellent team work and interpersonal skills also in an international environment perfected during the training period at Centre of Research and Technology Hellas (CERTH) of Thessaloniki (Greece) from November 2011 to May 2012: the collaboration led to a joint publication on International Journal.
- Excellent teamwork and interpersonal skills also in an international environment perfected during the collaboration with Parco Tecnologico de Itaipu (PTI) – Paraguay: the collaboration led to two joint publications on International Journals.

Driving licence

- B

Publications

- 39 publications
- 23 scientific publications on International Journals
- 16 publications at International Conferences
- 1 National patent

Scientific indicators (Scopus)

- H Index: 13
- Publications: 39
- Citations: 585

Peer review activities

Reviewer for the following International Journals: Applied Energy, Energy, International Journal of Hydrogen Energy, Renewable Energy, Applied Thermal Engineering

Genova, 9<sup>th</sup> May 2022





## **LIST OF PUBLICATIONS (International Journals)**

- [1] Rivarolo M., Bogarin J., Magistri L., Massardo A.F., "Time-dependent optimization of a large hydrogen generation plant using "spilled" water at Itaipu 14 GW hydraulic plant", *International Journal of Hydrogen Energy*, 2012 (37), 5434-5443.
- [2] Rivarolo M., Greco A., Massardo A.F., "Thermo-economic optimization of the impact of renewable generators on poly-generation smart-grids including hot thermal storage", *Energy Conversion and Management*, 2013 (65), 75-83.
- [3] Rivarolo M., Massardo A.F., "Optimization of large scale bio-methane generation integrating "spilled" hydraulic energy and pressurized oxygen blown biomass gasification", *International Journal of Hydrogen Energy*, 2013 (38), 4986-4996.
- [4] Rivarolo M., Magistri L., Massardo A.F., "Hydrogen and methane generation from large hydraulic plant: Thermo-economic multi-level time-dependent optimization", *Applied Energy*, 2014 (113), 1737-1745.
- [5] Rivarolo M., Bellotti D., Mendieta A., Massardo A.F., "Hydro-methane and methanol combined production from hydroelectricity and biomass: Thermo-economic analysis in Paraguay", *Energy Conversion and Management*, 2014 (79), 74-84.
- [6] Rivarolo M., Marmi S., Riveros-Godoy G., Magistri L., "Development and assessment of a distribution network of hydro-methane, methanol, oxygen and carbon dioxide in Paraguay", *Energy Conversion and Management*, 2014 (77), 680-689.
- [7] Bellotti D., Rivarolo M., Magistri L., Massardo A.F., "Thermo-economic comparison of hydrogen and hydro-methane produced from hydroelectric energy for land transportation", *International Journal of Hydrogen Energy*, 2015 (40), 2433-2444.
- [8] Efstathiadis T., Kalfas A.I., Seferlis P., Kyprianidis K.G., Rivarolo M., "Geometry Optimization of Power Production Turbine For A Low Enthalpy ( $\leq 100^\circ\text{C}$ ) ORC System", *Energy Procedia*, 75 (2015), 1624-1630
- [9] Rivarolo M., Bellotti D., Magistri L., Massardo A.F., "Feasibility study of methanol production from different renewable sources and thermo-economic analysis", *International Journal of Hydrogen Energy*, 41 (2016), 2105-2116.
- [10] Barberis S., Rivarolo M., Traverso A., Massardo A.F., "Thermo-economic optimization of a real polygenerative district", *Applied Thermal Engineering*, 97 (2016), 1-12.
- [11] Rivarolo M., Cuneo A., Traverso A., Massardo A.F., "Design optimization of smart poly-generation energy districts through a model based approach", *Applied Thermal Engineering*, 99 (2016), 291-301.
- [12] Barberis S., Rivarolo M., Traverso A., Massardo A.F., "Thermo-economic analysis of the energy storage role in a real polygenerative district", *Journal of Energy Storage*, 5 (2016), 187-202.
- [13] Ferrari M., Rivarolo M., Massardo A.F., "Hydrogen production system from photovoltaic panels: experimental characterization and size optimization", *Energy Conversion and Management*, 116 (2016), 194-202.
- [14] Bellotti D., Rivarolo M., Magistri L., Massardo A.F., "Feasibility study of methanol production plant from hydrogen and captured carbon dioxide", *Journal of CO<sub>2</sub> Utilization*, 21 (2017), 132-138.
- [15] Rivarolo M., Improta O., Magistri L., Panizza M., Barbucci A., "Thermo-economic analysis of a hydrogen production system by sodium borohydride ( $\text{NaBH}_4$ )", *International Journal of Hydrogen Energy*, 43 (2018), 1606-1614.
- [16] Rivarolo M., Rattazzi D., Magistri L., "Best operative strategy for energy management of a cruise ship employing different distributed generation technologies", *International Journal of Hydrogen Energy*, 43 (2018), 23500-23510.
- [17] Bellotti D., Rivarolo M., Magistri L., "Economic feasibility of methanol synthesis as a method for CO<sub>2</sub> reduction and energy storage", *Energy Procedia*, 158 (2019), 4721-4728.
- [18] Sorce A., Bellotti D., Rivarolo M., Magistri L., "Techno-economic analysis for the integration of a power to fuel system with a CCS coal power plant", *Journal of CO<sub>2</sub> Utilization*, 33 (2019), 262-272.
- [19] Rivarolo M., Riveros-Godoy G., Magistri L., Massardo A.F., "Clean Hydrogen and Ammonia Synthesis in Paraguay from the Itaipu 14 GW Hydroelectric Plant", *ChemEngineering* 2019, 3(4), 87. <https://doi.org/10.3390/chemengineering3040087>
- [20] Rivarolo M., Rattazzi D., Lamberti T., Magistri L., "Clean energy production by PEM fuel cells on tourist ships: a time-dependent analysis", *International Journal of Hydrogen Energy*, 2020, 45, 25747-25757.
- [21] Rivarolo M., Freda A., Traverso A., "Test campaign and application of a small-scale ducted wind turbine with analysis of yaw angle influence", *Applied Energy*, 279 (2020), 115850.
- [22] Rivarolo M., Rattazzi D., Magistri L., Massardo A.F., "Multi-criteria comparison of power generation and fuel storage solutions for maritime application", *Energy Conversion and Management*, 244 (2021), 114506.
- [23] Cavo M., Gadducci E., Rattazzi D., Rivarolo M., Magistri L., "Dynamic analysis of PEM fuel cells and metal hydrides on a zero-emission ship: A model-based approach", *International Journal of Hydrogen Energy*, 46 (2021), 32630-32644.