Curriculum of teaching and research activities

Personal information

Name: Emanuele Martelli
Current position: Associate Professor at Politecnico di Milano (Milan, Italy), Department of Energy

Education

- Bachelor Degree in Mechanical Engineering obtained on October 2004 at the Politecnico di Milano. Degree grade: "110/110 cum laude".
- Master Degree in Mechanical Engineering obtained on December 2006 at the Politecnico di Milano Degree grade: "110/110 cum laude".
- From March to July 2007 "Visiting Student Research Collaborator" at Princeton University (NJ), graduate school - program in Mechanical and Aerospace engineering.
- March 2009, visiting student at Princeton University (NJ), Princeton Environmental Institute.
- PhD degree in Energy Engineering obtained on February 2010 at the Politecnico di Milano. Degree grade: "Cum Laude".

Academic career

- From February 2010 to December 2011, Post-doc ("assegnista di ricerca") at the Politecnico di Milano carrying out research on energy systems for the conversion of coal and biomass into electricity and synthetic fuels with CO_2 capture and storage.
- From September to December 2011, Adjunct Professor ("professore a contratto") at Politecnico di Milano to teach the course of Energy Systems ("Sistemi Energetici LM") for the master degree in mechanical engineering.
- From December the 23rd 2011 to May 2018, Assistant Professor ("ricercatore di ruolo") of "Energy Systems" ("area ING-IND/09, Sistemi per l'Energia e l'Ambiente") at the Politecnico di Milano, Department of Energy. Tenure confirmed from December 2014 ("ricercatore di ruolo confermato").
- Visiting Professor at EPFL (École Polytechnique Fédérale de Lausanne), Lausanne (CH), Institute of Mechanical Engineering, from July to September 2014 (3 months).
- Visiting Professor at ETH (Swiss Federal Institute of Technology), Zurich (CH), Institute of Mechanical and Process Engineering, from June to August 2016 (3 months).
- From May 2018 to today, Associate Professor (permanent/tenured) of "Energy Systems" ("area ING-IND/09, Sistemi per l'Energia e l'Ambiente") at the Politecnico di Milano, Department of Energy.

Teaching activities

- lecturer (fully responsible) of the course "Energy Conversion Technologies" 5 CFUfor the Master level degree in Mechanical Engineering.
- Lecturer (fully responsible) of the course "Low Carbon Technologies" (5 CFU) for the Master level degree in Energy Engineering.
- Lecturer (fully responsible) of the course "Energy Systems Optimization" (3 CFU) for the master level degree in Energy Engineering.

Research activity

The research activity of Prof. Martelli focuses on the study, development, modelling and optimization of energy systems. His primary research goals are directed toward improving the efficiency and reducing the CO2 emissions of energy systems by integrating conventional and novel technologies (such as CO2 capture processes), developing ad hoc thermodynamic cycles or processes, and applying state-of-the-art optimization techniques. Thanks to his background in operations research, gained during the PhD, his activity includes the development of optimization algorithms specific for each application.
His research activity covers the following main fields:

1) Development of optimization algorithms for the design and the operation of complex energy systems (microgrids, multi-energy systems, energy districts, district heating networks, gas networks, etc)
2) Development and optimization of CO_2 capture technologies (oxy-combustion, pre-combustion, post-combustion capture)
3) Novel thermodynamic cycles (hybrid gas turbine-fuel cells, next-generation gas turbines, high temperature heat pumps, etc)

Projects responsibility

Professor Martelli is principal investigator of several research projects funded by leading energy companies, national projects (PRIN) and EU projects (H2020, RFCS).

Publications

Currently professor Martelli is co-author of 128 scientific publications, h-index 31 (source Scopus). The following list reports the selection of the 10 top cited publications.

1. Gabrielli, P., Gazzani, M., Martelli, E., Mazzotti, M. Optimal design of multi-energy systems with seasonal storage (2018) Applied Energy, 219, pp. 408-424.

2. Bischi, A., Taccari, L., Martelli, E., Amaldi, E., Manzolini, G., Silva, P., Campanari, S., Macchi, E. A detailed MILP optimization model for combined cooling, heat and power system operation planning (2014) Energy, 74 (C), pp. 12-26.

3. Scaccabarozzi, R., Gatti, M., Martelli, E. Thermodynamic analysis and numerical optimization of the NET Power oxy-combustion cycle (2016) Applied Energy, 178, pp. 505-526. Cited 150 times.

4. Moretti, L., Martelli, E., Manzolini, G. An efficient robust optimization model for the unit commitment and dispatch of multi-energy systems and microgrids (2020) Applied Energy, 261, art. no. 113859.

5. Gatti, M., Martelli, E., Marechal, F., Consonni, S. Review, modeling, Heat Integration, and improved schemes of Rectisol ®-based processes for CO2 capture (2014) Applied Thermal Engineering, 70 (2), pp. 1123-1140. Cited 100 times.

6. Elsido, C., Bischi, A., Silva, P., Martelli, E. Two-stage MINLP algorithm for the optimal synthesis and design of networks of CHP units (2017) Energy, 121, pp. 403-426.

7. Scaccabarozzi, R., Tavano, M., Invernizzi, C.M., Martelli, E. Comparison of working fluids and cycle optimization for heat recovery ORCs from large internal combustion engines (2018) Energy, 158, pp. 396-416.

8. Martelli, E., Kreutz, T., Carbo, M., Consonni, S., Jansen, D. Shell coal IGCCS with carbon capture: Conventional gas quench vs. innovative configurations (2011) Applied Energy, 88 (11), pp. 3978-3989.

9. Zatti, M., Gabba, M., Freschini, M., Rossi, M., Gambarotta, A., Morini, M., Martelli, E. k-MILP: A novel clustering approach to select typical and extreme days for multi-energy systems design optimization (2019) Energy, 181, pp. 1051-1063.

10. Martelli, E., Kreutz, T., Consonni, S. Comparison of coal IGCC with and without CO2 capture

and storage: Shell gasification with standard vs. partial water quench (2009) Energy Procedia, 1 (1), pp. 607

Patents

P1. European Patent WO2011089383, Title: "Separation of Gases", presentation date: 21- January - 2010, publication date: 28 – July - 2011, inventors: Consonni S., Gatti M., Martelli E., Viganò F. Applicant: BP Alternative Energy.

P2. European Patent WO 2011095759, Title: "Separation of Gases", publication date: 11 – August – 2011, inventors: Bailey M. E.; Consonni S.; Forsyth J. A.; Gatti M.; Martelli E.; Moryi Y.; Ogura K.; Viganò F. Applicant: BP Alternative Energy.

P3. Italian Patent Application number 102019000024162 filed on date 16/12/2019, inventors: E. Martelli, S. Campanari, M. Gatti, R. Scaccabarozzi. Title: "ENERGY CONVERSION SYSTEM".

Reviewer of scientific publications

The applicant has reviewed papers for the following journals:

1. Applied Energy (Elsevier)
2. Energy - The International Journal (Elsevier)
3. Applied Thermal Engineering (Elsevier)
4. Fuel (Elsevier)
5. Journal of Engineering for Gas turbine and Power (ASME)
6. Sustainable Energy Grids and Networks (Elsevier)
7. Journal of Power and Energy (SAGE)
8. Expert Systems With Applications (Elsevier)
9. Engineering Optimization (Taylor and Francis)
10. IEEE Transactions on Smart Grids

Awards

- 2006: Degree award in memory of "Dr. Sesini" for the best academic curriculum and master thesis in Mechanical Engineering.
- 2008: Best graduate award (medal) in Industrial Engineering at Politecnico di Milano (master level) given by prof. Giulio Ballio (Rector of Politecnico di Milano in 2008).
- 2011: PhD Award "Barsanti e Matteucci" for the best PhD thesis in the area "Energy Systems" granted by the Italian association of professors of fluid machines and energy systems ("Comunità Italiana dei professori di macchine e sistemi energetici").
- 2014: Grant "International Short Visits" granted by the Swiss National Science Foundation (SNSF) to collaborate with EPFL (Lausanne) from July to September 2014 (as visiting professor) on the development of novel heat integration techniques.
- 2015: GE GHG Ecomagination award. The applicant was member of the team who won the "GE GHG Ecomagination Innovation Challenge" on novel ways to target waste heat recovery in Canada's oil sands (the award was granted by General Electric).
- 2020: "Highly cited Research Paper" certificate awarded by the journal "Applied Energy" (Elsevier) for the paper entitled "Optimal Design of Multi Energy Systems" Applied Energy vol. 219 (2018), authors: Gabrielli, Gazzani, Martelli, Mazzotti.

Supervision of master and PhD thesis

Prof. Martelli has been supervisor of more than 30 master students and over 15 PhD students at Politecnico di Milano.