

Paolo Iora - Curriculum vitae

Personal data:

- Date of birth: August 30th 1975
- Place of birth: Orzinuovi (BS) - Italy

Role:

- Full professor of Energy Systems at Department of Mechanical and Industrial Engineering at University of Brescia
- Research collaborator in Gruppo di Conversione dell'Energia (Gecos) at Politecnico di Milano

Education:

- Degree in Mechanical Engineering at University of Brescia obtained in 2000, defending the thesis on a theoretical analysis of the integration between Molten Carbonate Fuel Cells and Organic Rankine Cycles
- PhD degree obtained in 2005 at the Politecnico di Milano discussing the thesis “Numerical modelling of various geometries of high temperature fuel cells applied to hybrid, gas turbine-based systems”

Main steps in academic career and work experiences:

- Awarded in 2000 with 12 months fellowship granted by the Italian Government for research activity about large ingot solidification at Department of Mechanical and Industrial Engineering, at University of Brescia.
- Postgraduate Student at Department of Chemical Engineering and Chemical Technology of Imperial College of London (2004), working on the development of numerical models for the simulation of intermediate-temperature solid oxide fuel cells (IT-SOFCs)
- From January 2005, Assistant professor of “Energy Systems” at University of Brescia
- Visiting professor at The Field and Space Robotics Laboratory of Massachusetts Institute of Technology (MIT), Boston from January 30 to April 20 2010
- From December 2010, Associate professor of “Energy Systems” at University of Brescia
- Visiting professor at Mechanical Engineering Department del Massachusetts Institute of Technology (MIT), Boston From September 02 to 22 September 2012
- From June 2018, Full professor of “Energy Systems” at University of Brescia

Personal skills and research interests:

- analysis and optimization of advanced power generation systems
- development of fuel cells simulation models
- Organic Rankine Cycles
- energy policies for the renewable energies
- industrial and distributed cogeneration
- sustainable mobility
- experimental assessment of the thermal stability of working fluid for ORC power plants

Scientific production indicators (accessed on May 2019):

- number of publications: SCOPUS / WOS: 51 / 48
- citations: SCOPUS / WOS: 1089 / 1018
- H-index: SCOPUS / WOS: 15 / 15

Research projects

- SCARABEUS (Supercritical carbon dioxide/alternative fluids blends for efficiency upgrade of solar power plants) funded by European Union (, Budget (Unibs): €480000, Role: Participant, Periodo: 2019-2023.
- “Tesla Expander Chiller” funded by DIMI, University of Brescia, Budget: €16000, Role: Partner, 2016-2018.
- “Health & Wealth project - Brescia 20-20-20” funded by University of Brescia, Budget: €81750, Role: Responsible of Working Package, 2016-2018.
- Convezione Operativa con la Regione Lombardia, Politecnico di Milano e Università di Brescia: “Optimization of ORC engines for low and medium heat source temperatures”, Budget: €13000, Role: Partner, Grant - EN14, 2010-2012.
- Progetto PRIN 2005 “Detailed numerical simulation of various SOFC and MCFC geometries and analysis of hybrid plant with fuel cell integrated with coal and biomass gasification systems”, in collaboration with Politecnico di Milano e Università di Genova, Budget: 156450, Role: Partner 2006-2008.

Current teaching assignments

- “Turbomachinery and Energy systems” Corso di Laurea Magistrale in Materials and product innovation engineering, University of Brescia
- “Technologies for sustainable mobility” Corso di Laurea Magistrale in Mechanical Engineering, Università di Brescia

Awards:

- "Carmelo Caputo" award for the best paper presented at 2008 ATI (Italian Thermotechnical Association) congress in the "Energy systems and machines" sector.
- "Harold Disney Prize 2008" for the best paper on power industries mechanical engineering subject published by the Istituzione of Mechanical Engineers

Patents:

- Italian Patent “Pila di celle ed apparato per generare ossigeno ad elevata purezza” (P02989 IT), filed on 08-05-2008.

Responsibilities:

- Reviewer of technical projects for Cyprus Research Promotion Foundation (RPF) - RESTART 2016-2020 Programmes for Research Technological Development and Innovation.
- Reviewer of technical papers for the following scientific reviews: Journal of Power Sources, Energy, Journal of Fuel Cell Science and Technology, International Journal of Hydrogen Energy, Journal of Engineering for Gas Turbines and Power.
- From 2012: Member of “Commissione Ambiente ed Energia (Environment and Energy Commission)” – IGQ Istituto Italiano di Garanzia della Qualità
- From 2014: Member of Doctoral Research Commission at Department of Mechanical and Industrial Engineering, University of Brescia.
- From 2016: Lecturer in Doctoral Program in Energy and nuclear science and technology, Department of Energy, Politecnico di Milano.

PAOLO IORA – LIST OF PUBLICATIONS

A – Peer review international journals

- A-1. Iora P., Beretta G.P., Ghoniem A.F., 2019. Exergy loss based allocation method for hybrid renewable-fossil power plants applied to an integrated solar combined cycle. *Energy* 173 (2019) 893-901.
- A-2. Iora P. Tribioli L., 2019. Effect of Ambient Temperature on Electric Vehicles' Energy Consumption and Range: Model Definition and Sensitivity Analysis Based on Nissan Leaf Data. *World Electric Vehicle Journal* 2019, 10, 2; doi: 10.3390/wevj10010002.
- A-3. Manzolini G., Binotti M, Bonalumi D., Invernizzi C.M., Iora P., 2019. CO₂ mixtures as innovative working fluid in power cycles applied to solar plants. Techno-economic assessment. *Solar Energy* 181 (2019) 530–544.
- A-4. Binotti M, Invernizzi C.M., Iora P., Manzolini G., 2019. Dinitrogen tetroxide and carbon dioxide mixtures as working fluids in solar tower plants. *Solar Energy* 181 (2019) 203–213.
- A-5. Keulen L., Landolina C., Spinelli A., Iora P., Invernizzi C., Lietti L., Guardone A., 2018. Thermal stability of hexamethyldisiloxane and octamethyltrisiloxane. *Energy* 165, Part B, 15 December 2018, Pages 868-876.
- A-6. Rajabloo T., Bonalumi D., Iora P., 2017. Effect of a partial thermal decomposition of the working fluid on the performances of ORC power plants. *Energy* 133 (2017) 1013-1026.
- A-7. Invernizzi C.M., Iora P., Manzolini G., Lasala S. 2017. Thermal stability of n-pentane, cyclo-pentane and toluene as working fluids in organic Rankine engines. *Applied Thermal Engineering* 121 (2017) 172–179.
- A-8. Tribioli L., Cozzolino R., Chiappini D., Iora P., 2016. Document Energy management of a plug-in fuel cell/battery hybrid vehicle with on-board fuel processing. *Applied Energy* 184 (2016), 140-154.
- A-9. Invernizzi C.M., Iora P., Bonalumi D., Macchi E., Roberto R., Caldera M., 2016. Titanium tetrachloride as novel working fluid for high temperature Rankine Cycles: Thermodynamic analysis and experimental assessment of the thermal stability. *Applied Thermal Engineering* 107 (2016) 21-27
- A-10. Iora P., Bombarda P., Gomez Alaez S.L., Invernizzi C.M., Rajabloo T., Silva P., 2016. Flare gas reduction through electricity production. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 2016, Vol.18 N.21, 3116-3124.
- A-11. Invernizzi C.M., Iora P., Preißinger M., Manzolini G., 2016. HFOs as substitute for R-134a as working fluids in ORC power plants: A thermodynamic assessment and thermal stability analysis. *Applied Thermal Engineering* 103 (2016) 790–797.
- A-12. Rajabloo T., Iora P., Invernizzi C.M., 2015. Mixture of working fluids in ORC plants with pool boiler evaporator. *Applied Thermal Engineering*, Volume 98, 5 April 2016, Pages 1–9.
- A-13. Invernizzi C.M., Iora P., 2015. The exploitation of the physical exergy of liquid natural gas by closed power thermodynamic cycles. An overview. *Energy* 105 (2016), 2-15

- A-14. Spallina V., Mastropasqua L., Iora P., Romano M.C., Campanari S., 2015. Assessment of finite volume modeling approaches for intermediate temperature Solid Oxide Fuel Cells working with CO-rich syngas fuels. *International Journal of Hydrogen Energy* 40 (2015) 15012-15031.
- A-15. Gomez Alaez S.L., Bombarda P., Invernizzi C.M., Iora P., Silva P., 2015. Evaluation of ORC modules performance adopting commercial plastic heat exchangers. *Applied Energy* 154 (2015) 882–890
- A-16. Beretta G.P., Iora P., Ghoniem A.F., 2014. Allocating resources and products in multi-hybrid multi-cogeneration: What fractions of heat and power are renewable in hybrid fossil-solar CHP? *Energy* 78 (2014) 587-603.
- A-17 Pasetti M., Invernizzi C.M., Iora P., 2014. Thermal stability of working fluids for organic Rankine Cycles: An improved survey method and experimental results for cyclopentane, isopentane and n-butane. *Applied Thermal Engineering*, 73 (2014) 762-772.
- A-18. Beretta G.P., Iora P., Ghoniem A.F., 2013. Allocating electricity production from a hybrid fossil-renewable power plant among its multi primary resources. *Energy* 60 (2013) 344-360.
- A-19. Iora P., Silva P., 2013. Innovative combined heat and power system based on a double shaft intercooled externally fired gas cycle. *Applied Energy* 105, pp. 108–115.
- A-20. Iora P., Thangavelautham J., 2012. Design of a mobile PEM power backup system through detailed dynamic and control analysis. *International Journal of Hydrogen Energy* 37, pp. 17191-17202.
- A-21. Iora P., Thaer M., Chiesa P., Brandon N.P., 2012. A one dimensional solid oxide electrolyzer-fuel cell stack model and its application to the analysis of a high efficiency system for oxygen production. *Chemical Engineering Science*, vol. 80, pp. 293-305.
- A-22. Beretta G.P., Iora P., Ghoniem A.F., 2012. Novel approach for fair allocation of primary energy consumption among cogenerated energy-intensive products based on the actual local area production scenario. *Energy* 44 (2012) pp.1107-1120.
- A-23. Invernizzi C.M., Iora P., Sandrini R., 2011. Biomass combined cycles based on externally fired gas turbines and organic Rankine expanders. *Proceedings of the Institution of Mechanical Engineers. Part A, Journal of Power and Energy*, Volume 225, issue 8, 2011, pp. 1066-1075.
- A-24. Iora P., Thaer M., Chiesa. P., Brandon N.P., 2010. A novel system for the production of pure hydrogen from natural gas based on SOFC-SOEC technology. *International Journal of Hydrogen Energy* 35, pp. 12680-12687.
- A-25. Iora P., Campanari S., Salogni A., 2010. Off Design Analysis of a MCFC-Gas Turbine Hybrid Plant. *Journal of Fuel Cell Science and Technology*, April 2010, Vol.7, pp.031022-1 – 031022-7.
- A-26. Iora P., Chiesa. P., 2009. High efficiency process for the production of pure oxygen based on the SOFC-SOEC technology. *Journal of Power Sources*, vol. 190, pp. 408-416.
- A-27. Campanari S., Iora P., Lucchini A., Romano M., 2009. Thermofluidynamic analysis of circular-planar type IT-SOFCs. *Journal of Fuel Cell Science and Technology*, vol. 6, pp.011009-1 – 01109-7.
- A-28. Angelino G., Invernizzi C., Iora P., 2008. Closed versus open cycle energy recovery from solid oxide fuel cells. *Proceedings of the Institution of Mechanical Engineers. Part A, Journal of Power and Energy*, Volume 222, Number 4, 2008 , pp. 371-379

- A-29. Iora P., Campanari S., 2007. Development of a Three-Dimensional Molten Carbonate Fuel Cell Model and Application to Hybrid Cycle Simulations. *Journal of Fuel Cell Science and Technology*, vol. 4, pp. 501-510.
- A-30. Bedogni S., Campanari S., Iora P., Montelatici L., Silva P., 2007. Experimental analysis and modeling for a circular-planar type IT-SOFC. *Journal of Power Sources*, vol. 171, pp. 617-625.
- A-31. Campanari S., Iora P., Macchi E., Silva P., 2007. Thermodynamic analysis of integrated MCFC/Gas Turbine cycles for sub-MW and multi-MW scale power generation. *Journal of Fuel Cell Science and Technology*, vol. 4, pp. 308-316.
- A-32. Invernizzi C., Iora P., Silva P., 2007. Bottoming Micro-Rankine Cycles for Micro-Gas Turbines. *Applied Thermal Engineering*, vol. 27, pp. 100-110.
- A-33 Campanari S., Iora P., 2005. Comparison of finite volume SOFC models for the simulation of a planar cell geometry. *Fuel Cells: From Fundamentals to Systems*, vol. 1, pp. 34-51.
- A-34 Invernizzi C., Iora P., 2005. Heat recovery from a gas microturbine by vapour jet refrigeration systems. *Applied Thermal Engineering*, vol. 25, pp. 1233-1246.
- A-35 Iora P., Aguiar, P., Adjiman, C.S., Brandon, N.P., 2005. Comparison of two IT DIR-SOFC models: impact of variable thermodynamic, physical, and flow properties. Steady-state and dynamic analysis. *Chemical Engineering Science*, vol. 60, pp. 2963-2975.
- A-36 Campanari S., Iora P., 2004. Definition and sensitivity analysis of a finite volume SOFC model for tubular cell geometry. *Journal of Power Sources*, vol. 132, pp. 113-126.

B - Conferences

- B-1. Bombarda P., Di Marcoberardino G., Invernizzi C., Iora P., Manzolini G., 2018. Water Mixtures as Working Fluids in Organic Rankine Cycles. 8th Heat Powered Cycles Conference, Bayreuth University, Bayreuth, Germany, 16 -19 September 2018.
- B-2. Tribioli L., Cozzolino R., Chiappini D., Iora P., 2017. Influence of fuel type on the performance of a plug-in fuel cell/battery hybrid vehicle with on-board fuel processing. SAE Technical paper 2017-24-0174,2017.
- B-3. Binotti M., Invernizzi C.M., Iora P., Manzolini G., 2017. Innovative Fluids for Gas Power Cycles Coupled with Solar Tower Systems, *Proceedings of Solar Paces 2017*, September 26-29 Santiago de Chile.
- B-4. Iora P., Di Marcoberardino G., Invernizzi C.M., Manzolini G., Belotti P., Bini R., 2017. Dynamic analysis of off-grid systems with ORC plants adopting various solutions for the thermal storage. IV International Seminar on ORC Power Systems, ORC2017 13-15 September 2017, Milano, Italy.
- B-5. Keulen L., Landolina C., Spinelli A., Iora P., Invernizzi C., Lietti L., Guardone A., 2017. Design and commissioning of a thermal stability test-rig for mixtures as working fluids for ORC applications. IV International Seminar on ORC Power Systems, ORC2017 13-15 September 2017, Milano, Italy.
- B-6. Rajabloo T., Iora P., Invernizzi C.M., 2015. Comprehensive study on geothermal power

plant by mixture of fluids, the 15th International Congress of CHEMTECH, Istanbul, Turkey, 2015.

B-7. Mastropasqua L., Campanari S., Iora P., Romano M.C., 2015. Simulation of Intermediate-Temperature SOFC for 60+ efficiency distributed generation. Proceedings of the AMSE 2015 Power and Energy Conversion Conference, June 28 – July 2, 2015, San Diego, California, USA.

B-8. Lasala S., Invernizzi C., Iora P., Chiesa P., Macchi E., 2015. Thermal stability analysis of perfluorohexane. Proceedings of the 7th International Conference on Applied Energy – ICAE, March 28-31 2015, Abu Dhabi, United Arab Emirates.

B-9. Iora P., Chiesa P., Campanari S., 2014. Comparison of Pressure Driven Electrolytic Membranes (PDEM) and Solid Electrolyte Oxygen Pumps (SEOP) for small scale oxygen production. Proceedings of the 6th International Conference on Applied Energy – ICAE, 30 May – 2 June 2014, Taipei City, Taiwan.

B-10. Iora P., Beretta G.P., Ghoniem A.F., 2013. What fraction of the fuel consumed by a heat-and-power cogeneration facility should be allocated to the heat produced? Old problem, novel approach. Proceedings of the AMSE 2013 International Mechanical Engineering Congress & Exposition, November 15-21, 2013, San Diego, California, USA.

B-11. Iora P., Beretta G.P., Ghoniem A.F., 2013. What fraction of the electrical energy produced in a hybrid solar-fossil power plant should qualify as ‘renewable electricity’?. Proceedings of the AMSE 2013 International Mechanical Engineering Congress & Exposition, November 15-21, 2013, San Diego, California, USA.

B-12. Iora P., Thangavelautham. J., 2011. Development of dynamic model and control of a PEM fuel cell. European Fuel Cell Forum, Lucerne, 28 June -1 July 2011.

B-13. Taher M.A.A., Adjiman C.S., Iora P., Chiesa P., Brandon N.P., 2011. Model-based Evaluation of the Production of Pure Oxygen through SOFC/SOEC Integration. 12th ECS Meeting Volume 35, Issue 1 pp.2997-3006. May 1 - May 6, 2011, Montreal, QC, Canada, Solid Oxide Fuel Cells 12 (SOFC-XII).

B-14. Spallina V., Romano M.C., Iora P., Campanari S., 2011. Finite volume SOFC model for operation with coal-syngas fuel. Proceedings of EFC 2011, European Fuel Cell – Piero Lunghi Conference & Exhibition, December 14-16, 2011, Rome, Italy.

B-15. Roses L., Bonalumi D., Campanari S., Iora P., Manzolini G., 2010. Simulation comparison of PEMFC micro-cogeneration units with conventional and innovative fuel processing. Proceedings of Asme 2010, Eight International Fuel Cell Science, Engineering and Technology Conference, June 14-16, 2010, Brooklyn, New York, USA.

B-16. Pasetti M., Iora P., Chiesa P., Invernizzi C, Salogni A., 2010. Analysis of incentive systems for photovoltaic power plants in six countries of the European Union. International Conference on Renewable Energies and Power Quality, March 23-25, 2010, Granada, Spain.

B-17. Salogni A., Campanari S., Iora P., 2009. Dynamic analysis and control of a planar IT-SOFC system. Proceedings of Asme FuelCell 2009, Seventh International Fuel Cell Science, Engineering and Technology Conference, June 8-10, 2009, Newport Beach, California, USA.

B-18. Iora P., Chiesa, P., 2008. Processo innovativo per la produzione di ossigeno a ridottissimo consumo energetico. Congresso Nazionale ATI, Palermo, 23-26 Settembre 2008.

- B-19. Campanari S., Iora P., 2008. Assessment of FC Operating Conditions and Cycle Performance in a SOFC+GT Hybrid Cycle. Eighth European Solid Oxide Fuel Cell Forum, Lucerne, 30 June - 4 July 2008.
- B-20. Iora P., Campanari S., 2008. Effect of Radiation in Circular-Planar Type IT-SOFCs Operating in Stack Configuration. Eighth European Solid Oxide Fuel Cell Forum, Lucerne, 30 June - 4 July 2008.
- B-21. Campanari S., Iora P., Lucchini A., Romano M., 2007. Thermofluidynamic Analysis of circular-planar type IT-SOFCs. Fuel Cell Science Engineering and Technology Conference, New York, 18-20 June 2007.
- B-22. Invernizzi C., Iora P., Pietra C., Zaglio M., 2007. Sviluppo di un modello per cella a combustibile IR-SOFC per analisi di impianti ibridi a recupero con cicli a gas. Congresso Nazionale ATI, Salerno, Settembre 2007.
- B-23. Iora P., Campanari S., 2006. Development of a Numerical Model for the Simulation of Anode Supported Tubular SOFCs. Sixth European Solid Oxide Fuel Cell Forum, Lucerne, 3-7 July 2006.
- B-24. Campanari S., Iora P., Magistri L., 2005. Research activities of the Università di Genova and Politecnico di Milano in the project: “High temperature fuel cell hybrid systems with high efficiency and low environmental impact (FISR 2000)”. Congresso Nazionale ATI, Roma, Settembre 2005.
- B-25. Iora P., Campanari S., 2005. Development of a 3D MCFC model and application to hybrid cycle simulations. First European Fuel Cell Technology and Applications Conference, Roma 14-16 Dicembre 2005.
- B-26. Campanari S., Magistri L., Iora P., 2004. Research activities of the Università di Genova and Politecnico di Milano in the project: “High temperature fuel cell hybrid systems with high efficiency and low environmental impact (FISR 2000)”. Congresso Nazionale ATI, Genova, Settembre 2004.
- B-27. Iora P., Campanari S., 2004. Parametric Analysis of a Planar SOFC Model with Geometric Optimization. Sixth European Solid Oxide Fuel Cell Forum, Lucerne, 28 June - 2 July 2004.

C – Italian journals

- C-1 Tribioli L., Iora P. 2016. La transizione verso una mobilità sostenibile: una fotografia al 2016. Unicusano Focus Sport&Ricerca – Allegato a “Corriere dello Sport”, Martedì 26 Gennaio 2016.
- C-2 Belviolandi L., Iora P., 2013. Valorizzazione energetica del gas naturale associato. Energia, 3/2013, pp. 60-65.
- C-3 Iora P., 2012. Consumi di energia primaria tutti da interpretare (meglio se correttamente). Nuova Energia, vol. 6, pp. 66-69.
- C-4 Invernizzi C, Iora P., 2012. Il recupero di calore a bassa temperatura: una risorsa da valorizzare. Nuova Energia, vol. 1, pp. 42-45.

- C-5 Chiesa P., Iora P., 2011. Come “correggere” l’assegnazione delle quote di CO2 – Una proposta per migliorare il meccanismo dell’Emissione Trading. Nuova Energia, vol. 1, pp. 110-113.
- C-6. Iora P., 2009. Il rebound effect gioca a favore dei biocombustibili. Nuova Energia, vol. 4, pp. 62-64.
- C-7. Chiesa P., Iora P., 2007. Ecco presente e futuro dell'auto ecologica con molta strada da fare. Nuova Energia, vol. 1, pp. 86-93.
- C-8. Iora P., 2007. Energy pay back time (EPBT) di impianti fotovoltaici. Nuova Energia, vol. 5, pp. 84-87.
- C-9. Iora P., Chiesa, P., 2007. Certificati bianchi e cogenerazione industriale. Due casi concreti. La Termotecnica, vol. 5, pp. 31-37.
- C-10. Iora P., Chiesa P., 2006. Traffico, "guida" con risposte al problema dell'inquinamento. Nuova Energia, vol. 3, pp. 12-17.
- C-11. Iora P., Chiesa P., Invernizzi C, Salogni A., 2006. Incentivi al fotovoltaico in alcuni Paesi europei. Energia, vol. 4, pp. 80-86.
- C-12. Iora P., Invernizzi C., 2006. Chi ci guadagna o ci perde con gli incentivi stanziati per gli impianti fotovoltaici. Nuova Energia, vol. 1, pp. 74-77.

D – Other publications

- D-1. Invernizzi C., Iora P.G., Zanoni S., Zavanella, L.E., 2009. Anche le piccole e medie imprese al centro dei nostri programmi. Contributo nell’ambito dell’inchiesta “Come e quanto energia ci mette la ricerca universitaria”, Nuova Energia, vol. 6, pag.42-43.
- D-2. Chiesa P., Iora P., 2007. Traffico e inquinamento: quali soluzioni tecnologiche per affrontare il problema nell’immediato futuro? Giornale dell’Ingegnere n°6, giugno 2007.
- D-3. Iora P., Invernizzi C., 2006. Gli incentivi economici per il “solare” e le differenti realtà del nostro Paese. Giornale dell’Ingegnere n°6, giugno 2006.
- D-4. Iora P., 2006. Contributo nell’ambito dell’inchiesta “Quello che pensano gli italiani sulla mobilità nelle città”, Nuova Energia, vol. 4, p. 48.
- D-5. Iora P., 2005. Sviluppo di un codice di calcolo per celle a combustibile ad alta temperatura per analisi di cicli ibridi con turbina a gas. Tesi di dottorato di ricerca in Energetica – Politecnico di Milano, relatore Prof. E. Macchi.

Books

Paolo Giulio Iora, Tecnologie per la mobilità sostenibile – Veicoli elettrici ibridi e a fuel cell. Società Editrice Esculapio, Bologna, 2016.