

prof. Stefano CONSONNI CURRICULUM VITAE as of August 2023



1. PERSONAL

- Born in Piacenza (Italy), Dec. 8th, 1958
- Living in Fabiano di Rivergaro (Piacenza), vicolo Bellini 8
- Married, three children

2. EDUCATION

- Degree in Mech. Eng. (Energy Conversion) at Politecnico di Milano, 1983, 100/100 with highest honors.
- Master's in Mech. Eng., Princeton University, Dept. of Mech. and Aerospace Eng., Princeton, USA, 1987.
- Ph.D. in Mech. Eng., Princeton University, *ibid.*, 1992, with a Thesis on Performance Prediction of Gas/Steam Cycles for Power Generation. Supervisor prof. R.H. Socolow.
- Lecture Series at von-Karman Institute, Bruxelles (1982, 1985, 1994) and MIT, Cambridge (USA, 1987).

3. ACADEMIC EXPERIENCE

- Research assistant at Princeton University, Center for Energy and Environmental Studies, 1985-90.
- Assistant professor at Dept. of Energy Engineering of Politecnico di Milano, 1990-92.
- Associate professor with tenure, *ibidem*, 1992-01.
- Full professor with tenure, *ibidem*, since 2001.
- Since 1992 has taught "Power Plants", "Hydraulic and Thermal Machinery", "Energy Systems", "Environmental Impact of Energy Production", "Low Carbon Technologies", "Renewable Energy" to students in Environmental, Electrical, Energy, Mechanical, Materials and Transportation Engineering.
- Since 1992: supervisor of over 80 Graduation Theses and Ph.D. Theses of candidates to degrees in Mechanical, Environmental, Electrical, Chemical, Management Engineering.
- 1992-2019: member of the Committee of the Ph.D. program in Energy Eng. of Politecnico di Milano.
- Since 1993: lead investigator and/or participant to researches financed by:

A2A SpA, Milano
Actelios SpA, Milano
AEM Milano
Amer. Forestry & Paper Ass., Wash., USA
Air Liquide Research Center, Parigi
Alstom Power, Milano.
Ansaldo Ricerche, Genova.
ATIG (Italian Gas Technical Ass.), Milano
BP Alternative Energy, Sunbury, UK.
Buzzi Unicem, Casale Monf. (AL)
CCP (Carbon Capture Project)
Edipower SpA, Milano

ENI SpA, Milano
ExxonMobil, USA
Federambiente, Roma
Hera SpA, Bologna
Italcementi SpA, Bergamo
Italian Ministry of University and Research.
Pirelli Ambiente, Milano
Regione Lombardia
Rummo SpA, Benevento.
Tokyo Gas Ltd., Tokyo.
US Agency for Intl. Development, NY, USA
US Dept. of Energy, Washington DC, USA

- for researches on: CO₂ capture, energy from waste and biomass, environmental impact of energy systems, gas turbines, combined cycles, cogeneration, district heating, gasification, residual fuels, fuel cells, etc.
- 1998-2005: Head of the Piacenza Campus of Politecnico di Milano, administering degrees in Mechanical Engineering, Transportation Engineering, Environmental Architecture.
 - Since 1999: Director of Lecture Series held at Politecnico on Waste-To-Energy Systems (1999 and 2005), Energy from Biomass (2006), Technologies for Energy Recovery from Waste (2008).
 - 1999-00: contributing author of the World Energy Assessment, UN Development Program.
 - 2002-03: *Visiting Research Scientist* at the Princeton Environmental Institute, Princeton Univ (USA).
 - 2003-09: contributor to the Master program *RIDEF* of Politecnico di Milano (recovery from waste).
 - 2003-16: contributor to Ph.D. program in *Technologies for Energy and the Environment* of Univ. of Bergamo.
 - Since 2005, President of LEAP (Laboratory for Energy and Environment Piacenza), a non-profit company for research and technology transfer promoted by Politecnico di Milano.
 - 2007: *Visiting Research Scientist* at the Princeton Env Institute (PEI), Princeton Univ (USA).
 - 2007-09: National coordinator of research project PRIN 2006 sponsored by the Italian Ministry of Research on "Comparative analysis of paths for the recovery of materials and energy from waste".
 - 2007-09: Principal Investigator of research project on "Nanoparticles emissions from Waste-to-Energy plants" carried out at LEAP with the support of Federambiente (Roma).
 - 2009-15: Coordinator of graduate course on "Global Change and Sustainability" given at Alta Scuola Politecnica, managed by Politecnico di Milano and Politecnico di Torino.

- 2010-19, component of the Scientific & Technical Advisory Council (STAC) of CEWEP (Confederation of European Waste-to-Energy Plants), Bruxelles.
- Since 2009, coordinator of the international Masters' program in Renewables and Environmentally Sustainability (RES) offered at the Piacenza campus of Politecnico di Milano.
- Since 2011, Director of MatER (Material & Energy from Refuse), a study center established at LEAP with the scientific support of Politecnico di Milano.
- 2017-23, Scientific coordination of CLEANKER, a HORIZON project for testing a Ca-Looping pilot plant to capture CO₂ in cement plants. Project coordinated by LEAP, with EU funding over 9 M€
- 2018: *Visiting Scholar* at Andlinger Center for Energy and Environment (ACEE), Princeton Univ. (USA).
- Since 2021, member of the Strategic Committee and then member of the Board of CMCC (Euro-Mediterranean Center for Climate Change).
- Since 2023, Scientific coordination of HERCCULES, a HORIZON project for the demonstration of the CCUS value chain in Southern Europe. Project coordinated by LEAP, with EU funding over 29 M€
- Invited speaker at meetings and conferences on gas turbines, cogeneration, energy from waste and biomass, gasification, energy scenarios, energy and climate change, CO₂ capture, etc. since 1990.

4. EXPERIENCE AS CONSULTANT, EXPERT, SCIENTIFIC ADVISOR, BOARD MEMBER

- Scientific consultant in the field of energy systems and their environmental impact of A2A, AFPA (American Forestry & Paper Association), AMSA Milano, Ansaldo Genova, ASM Brescia, ASM Piacenza, Chemrec (Sweden), Cofely/Gas de France-Suez, Fiat Power Train, Franco Tosi, General Electric, Hera, Italcementi, Navigant Consulting (USA), Nykomb (Sweden), SNAM, Viscolube, Weyerhaeuser (USA), etc.
- Court-appointed Technical Expert in a number of civil and criminal cases on power plants, combined cycles, district heating plants, waste-to-energy plants, combined cycle plants, biomass-fired plants, biogas plants, steel plants, photovoltaic plants, industrial plants, etc.
- Member of the Board of the Municipal Utility of the city of Piacenza (1995-96)
- President of Tecnoborgo, project company managing the WTE plant in Piacenza (1996-98).
- Member of the Board of the Trust of the cities of Piacenza and Vigevano (2001-2003).
- Member of the Testing Committee of the WTE + District Heating plant in Brescia, 1997-99 and 2003-04.
- Member of the Testing Committee of the WTE + District Heating plant in Milano, 2000-03.
- Member of the Board of SIET SpA (2006-09).
- Member of the Testing Committee of the fluidized bed, WTE plant in Parona (PV), Italy, 2007-08.
- President of the Testing Committee of the de-NO_x system of the WTE plant in Milano, 2007-09.
- Member of the Evaluation Committee of the WTE plant in Torino, Italy, 2007-10.
- President of the Scientific Committee for the realization of the WTE plant in Naples, Italy, 2009-10.
- Member of the Testing Committee of the WTE plant in Parma (2011-14).
- Scientific advisor for the test of the steam generators of the WTE plant in Acerra (Naples, Italy, 2014-16).
- Scientific advisor on emissions and start-up/shut down issues of the WTE plant in Brescia (2016-18).
- President of the Testing Committee for the revamping of the WTE plant in Milano (2016-19).
- Coordinator of the Expert Group supporting the Republic of Italy in an arbitration brought forward to ICSID (International Center for Settlement of Investment Disputes) on waste management systems (since 2020)
- Member of the Strategic Committee (since 2021) and member of the Board (since 2023) of CMCC (Euro-Mediterranean Center for Climate Change).
- Scientific advisor for the test of the new WTE plant in Parona (PV, Italy, since 2022).
- Member of the Evaluation Committee of the WTE plant in Rome (2023).

5. AWARDS

- Fulbright Fellowship Italy-USA (1985).
- 12-months fellowship CNR-NATO, Advanced Fellowship Program (1988/89 and 1990/91).
- Best Paper Award at 38° ASME Turbo-Expo, (Cincinnati, 1993) for paper 93-GT-223: Chiesa P., Consonni S., Lozza G. Macchi E., "Predicting the Ultimate Performance of Advanced Power Cycles Based on Very High Temperature Gas Turbine Engines"
- Best Paper Award at 42° ASME Turbo-Expo, (Orlando, 1997) for paper 97-GT-273: Consonni S., Larson E., Berglin N. "Black Liquor-Gasifier/Gas Turbine Cogeneration"
- Best Paper Award on Future Recovery at the 2007 International Chemical Recovery Conference (Quebec City, Canada, May 2007): Larson E., Consonni S., Katofsky R., Iisa K., Frederick W.J. "Gasification-based biorefining at kraft pulp and paper mills in the United States".

- Recipient (with M. Gatti, D. Di Bona, E. Martelli and F. Viganò) of the *General Electric GHG Ecomagination Innovation Challenge* award on novel ways to target waste heat recovery in Canada's oil sands (Calgary, Canada, 2015).
- Recipient of *Premio Kramer* award, Istituto Lombardo Accademia di Scienze e Lettere, in recognition of *significant practical results based on circular economy principles* (2023).

6. PUBLICATIONS AND PATENTS

- Over 150 papers published on national/international journals or presented at scientific congresses.
- European Patent WO2011089383 *Separation of Gases*, published 28 Jul 2011.
- European Patent WO 2011095759 *Separation of Gases*, published 11 Aug 2011.
- Italian patent MI2012 A00382 *Improved Process for the Production of Cement Clinker and related Apparatus* (in Italian).
- Italian patent MI2012 A00383 *Process and Improved Plant for the Production of Cement Clinker* (in Italian).

7. FIELDS OF ACTIVE RESEARCH

- technologies, processes and strategies to mitigate climate change
- technologies, processes and strategies for managing waste
- CO₂ capture
- energy from waste, biomass and residues
- gas turbines and combined cycles
- non-conventional and synthetic fuels
- cogeneration of heat and power

8. SELECTED PUBLICATIONS

1. Chiesa P., **Consonni S.**, Kreutz T., Williams R.H. (2005), "Co-production of hydrogen, electricity and CO₂ from coal with commercially ready technology. Part A: Performance and emissions. Part B: Economic analysis". *International Journal of Hydrogen Energy*, Vol. 30, Issue 7, pp. 747-784.
2. **Consonni S.**, Viganò F. (2005), "Decarbonized hydrogen and electricity from natural gas", *International Journal of Hydrogen Energy*, Vol. 30, Issue 7, pp. 701-718.
3. **Consonni S.**, Giugliano M., Grosso M. (2005), "Alternative strategies for energy recovery from Municipal Solid Waste. Part A: Mass and energy balances. Part B: Emission and cost estimates". *Waste Management*, Vol. 25, pp. 123-148.
4. **Consonni S.**, Larson, E.D., Katofsky R.E. (2009), "A gasification-based biorefinery for the pulp and paper industry", *Chemical Engineering Research and Design*, Vol. 87, pp. 1293-1317.
5. Larson E.D., Fiorese G., Liu G., Williams R.H., Kreutz T.G. and **Consonni S.** (2010), "Co-production of decarbonized synfuels and electricity from coal + biomass with CO₂ capture and storage: an Illinois case study", *Energy & Environmental Science*, 2010, Vol. 3, pp. 28-42.
6. Viganò F., **Consonni S.**, Grosso M. e Rigamonti L. (2010), "Material and energy recovery from Automotive Shredded Residues (ASR) via sequential gasification and combustion", *Waste Manag.*, Vol. 30, pp. 145-153.
7. E. Martelli, T. Kreutz, M. Carbo, **S. Consonni**, D. Jansen (2011), "Shell coal IGCCs with carbon capture: conventional gas quench vs. innovative configurations". *Applied Energy*, Vol. 88, pp. 3978- 3989.
8. M. Mantovani, P. Chiesa, G. Valenti, M. Gatti, **S. Consonni** (2012), "Supercritical pressure–density–temperature measurements on CO₂-N₂, CO₂-O₂ and CO₂-Ar binary mixtures", *The Journal of Supercritical Fluids*, Vol. 61, pp. 34- 43
9. **S. Consonni**, F. Viganò (2012), "Waste gasification vs. conventional Waste-To-Energy: A comparative evaluation of two commercial technologies". *Waste Management*, Vol. 32, pp. 653- 666.
10. S.Cernuschi, M. Giugliano, S. Ozgen, **S. Consonni** (2012), "Number concentration and chemical composition of ultrafine and nanoparticles from WTE (waste to energy) plants", *Science of the Total Environment*, Vol. 420, pp. 319- 326.
11. M. Gatti, E. Martelli, F. Marechal, **S. Consonni** (2014). "Review, modeling, heat integration, and improved schemes of Rectisol®-based processes for CO₂ capture". *Applied Thermal Engineering*, vol. 70, p. 1123-1140.
12. **S. Consonni**, L. Lombardi, F. Viganò (2017), "Municipal Solid Waste to Energy Technology", in Abraham M.A. (Ed.), *Encyclopedia of Sustainable Technologies*, First Edition, Vol 3, pp. 389-401, Elsevier, ISBN 978-012-8046-77-7.
13. L. Mastropasqua, L. Pierangelo, M. Spinelli, M.C. Romano, S. Campanari, **S. Consonni** (2019), "Molten Carbonate Fuel Cells retrofits for CO₂ capture and enhanced energy production in the steel industry", *International Journal of Greenhouse Gas Control*, Vol. 88 (2019), pp. 195-208.
14. M. Spinelli, D. Di Bona, M. Gatti, E. Martelli, F. Viganò, **S. Consonni** (2020), "Assessing the potential of molten carbonate fuel cell-based schemes for carbon capture in natural gas-fired combined cycle power plants",

Journal of Power Sources, Vol. 448, 1 Feb 2020, pp. 227-223.

15. Quicker, P., **Consonni, S.**, Grosso, M. (2020), "The Zero Waste utopia and the role of waste-to-energy", *Waste Management and Research*, 38 (5), pp. 481-484. DOI: 10.1177/0734242X20918453.
16. **S. Consonni**, L. Mastropasqua, M. Spinelli, T. A. Barckholtz, S. Campanari (2021), "Low-carbon hydrogen via integration of steam methane reforming with molten carbonate fuel cells at low fuel utilization", *Advances in Applied Energy*, Vol 2 (2021), 100010.

9. SELECTED INVITED TALKS

- "Strategies and technologies for climate change mitigation" (in Italian), given at "I Lincei per la Scuola", lecture series organized by Accademia dei Lincei, Genova, Italy, 11 Mar 2022.
- "Waste management between technology and ideology" (in Italian), given at *Catania 2030, Mediterranean Green Expo*, Catania, Italy, 16 Jul 2021.
- "Waste-to-Energy for the sustainable management of waste", given at the TOTeM46 meeting of the International Flame Research Foundation, Pisa, Italy, 21 Nov 2019.
- "Verifying the Potential of Integrated Calcium Looping for Low-CO₂ Cement", given at the VDZ Congress 2018, Dusseldorf, Germany, 27 Sept 2018.
- "Integrated Calcium Looping for low carbon cement", given at the Exxon Mobil Research Center, Annandale, (NJ), US, 31 May 2018.
- "Carbon Capture: Basic Concepts and Novel Technologies", given at Buzzi-Unicem Workshop on *Carbon Capture and Storage Technologies*, Casale Monferrato, Italy, 06 Oct 2017.
- "Carbon Capture & Storage for a tolerable climate change", at *Energy for a Carbon-Constrained World*, a public symposium in honor of Robert H. Williams, Princeton (NJ), US, 03 April 2017
- "From Incineration to Waste-to-Energy: evolution of energy recovery from waste" (in Italian), Workshop on *Waste Treatment* organized by the Italian Association of Chemical Engineering, Palermo, Italy, 30 Jan 2017.
- "Systems and Technologies for Energy Production from Biomass", post-graduate education program of the University of Naples Parthenope, Naples, Italy, 07 dec 2016.
- "Past, present and future of energy recovery from waste" (in Italian), at Symposium on waste treatment organized by the Association of Physicians of Florence, Florence, Italy, 25 nov 2016.
- "Thoughts on the estimation of national waste-to-energy capacity" (in Italian)" at *New frontiers for the recovery from waste*, Ecomondo 2016, Rimini, Italy, 10 nov 2016.
- "Integration of Ca-Looping Systems", at Conference organized by the European Cement Research Academy (ECRA) on *CO₂ capture and reuse in the cement industry: from the lab to the plant*, Univ of Mons, Belgium, 09 Nov 2016.
- "Waste Management Research in Italy", at the 2016 bi-annual meeting of the Global WTER Council, Columbia University, New York, US, 07 Oct 2016.
- "Thoughts on Zero Waste", at meeting of the Scientific and Technical Advisory Committee (STAC) of the Confederation of European Waste-to-Energy Plants (CEWEP), Piacenza, Italy, 12 Apr 2016.
- "Processes and Technologies for Energy Recovery from Waste", at course on *Thermochemical Conversion of Biomass and Residues and Biorefineries*, Univ of Seville, Spain, 22 Oct 2015.
- "Mitigation of Greenhouse Gas Emissions", at *Impacts of Climate Change on Ecosystem Services*, Universities for Expo 2015, Milano, Italy, 23 Jun 2015.
- "Energy Recovery", at *Italy-China Innovation Forum*, China Day at Expo Milano 2015, Milano, Italy, 08 Jun 2015.
- "Comparative Evaluation of waste treatment technologies", at *Energy and Materials from Waste*, 3rd International VDI Conference 2015, Düsseldorf, Germany, 07 May 2015.
- "Evaluating the quality of energy recovery from waste", meeting of International Solid Waste Association (ISWA) Working Group on Energy Recovery, Vienna, Austria, 16 Apr 2015.
- "Calcium-Looping for CO₂ capture in cement plants", at Conference organized by the European Cement Research Academy (ECRA) on *From CO₂ to energy: CO₂ capture and reuse in the cement industry*, Univ of Mons, Belgium, 26 Nov 2014.
- "Energy Recovery from Waste: Combustion, Gasification, Pyrolysis" (in Italian), expert presentation to the Committee for the Environment, Senate of the Italian Republic, 24 Sep 2014.
- "Ultimate energy performances of grate combustor WtE plants", keynote talk at *WasteEng 2014*, Rio de Janeiro, Brasil, 28 Aug 2014.
- "An overview of waste-to-energy technologies: potentials and limitations (for energy production)", International Solid Waste Association (ISWA) 8th Beacon Conference, Malmo, Sweden, 28 Nov 2013.