

**professor Umberto Arena, Chem. Eng., Ph.D.**

## **Curriculum vitae**

**Umberto Arena is full professor of Chemical Engineering at the University of Campania “Luigi Vanvitelli”.** He graduated in Chemical Engineering at the University "Federico II" of Naples, where he also obtained his Ph.D. in Chemical Engineering in 1987.

### **TEACHING ACTIVITY**

**Professor of “Solid waste management”, “Industrial Pollution Control Engineering”, and “Life Cycle Assessment of Industrial Processes” at the University of Campania “Luigi Vanvitelli.**

Associate professor of Chemical Engineering at the Turin Polytechnic, University of Perugia, and University "Federico II" of Naples.

**Guest professor at the School of Mechanical Engineering of the Tongji University in Shanghai (China) from October 8<sup>th</sup> to November 9<sup>th</sup>, 2016,** giving a series of lectures about “Thermochemical conversion processes for biomass and wastes”.

**Senior Visiting Scientist at the Residues & Resource Reclamation Centre (R3C) of Nanyang Environment & Water Research Institute (NEWRI) at Nanyang Technological University of Singapore from January 13<sup>th</sup> to January 18<sup>th</sup>, 2019,** attending technical meetings and giving a lecture about “Gasification: a sustainable process for resource recovery from waste”.

**Visiting Scientist at the Waste Management Research Unit (WMRU) del Kuwait Institute of Scientific Research (KISR) of Kuwait City from March 26<sup>th</sup> to April 7<sup>th</sup>, 2019,** in the framework of a consulting activity on innovative options for solid waste management, signed on January 31<sup>st</sup> 2019.

**Lecturer in some international schools, such as:**

- *7<sup>th</sup> Inter. Sotacarbo Summer School on Low Carbon Technologies* (Carbonia, June 2019)
- *2<sup>nd</sup> Summer School on Engineering for Waste and Biomass Valorisation* (Mines Albi-Carmaux, WasteEng2016, May 2016)
- *Course on Waste Management and Conversion* (University of Seville, March 2015)
- *Fecundus Summer School*, (CIEMAT, Madrid, June 2012)
- *Winter School of the Energy from Biomass and Waste Symposium*, (IWWG, Venice, November 2012).

**Referee in some international Ph.D. award committees, such as, in the last years:**

- Muhammad Nasrullah, PhD student in Ph.D. in Chemical Engineering at the Aalto University, Aalto, Finland (2014-2016) with a thesis about “Material and energy balance of solid recovered fuel production”
- AD Engelbrecht, PhD student in Ph.D. in Chemical Engineering at the North-West University, Potchefstroom, South Africa (2013-2015) with a thesis about “Fluidised bed gasification of high-ash South African coals: An experimental and modeling study”

- Veronika Wilk, PhD student in Ph.D. in Energy Process at the Technical University of Wien, Austria (2010-2013) with a thesis about “Extending the range of feedstock of the dual fluidized bed gasification process towards residues and waste”
- Pablo Izquierdo Lopez, PhD student in Engineering Doctorate in Environmental Technology at the University of Surrey, Guildford, United Kingdom (2007-2010) with a thesis about “Integration of energy from waste technologies within building developments: technical, environmental and economic considerations”.

**Supervisor of several Ph.D. students at the University of Campania “Luigi Vanvitelli”.** Those of the last years are:

- Filomena Ardolino, PhD student in Environment, Design and Innovation, with a thesis about “Environmental assessment of integrated units for MSW treatment in a life cycle perspective”; (2015-2017)
- Francesco Parrillo, PhD student in Environment, Design and Innovation, with a thesis about “Fluidized bed gasification as innovative pathway for resource recovery from biomass”; (2015-2017)
- Pierluca Vitale, PhD student in Environment, Design and Innovation, with a thesis about “Life cycle assessment of a multifamily residential building”; (2015-2017)

**Member of committee for a position of full or associate professor in:**

- Residual Resource Engineering, Denmark Technical University (Denmark), Dept. of Environment, associate professor (2018)
- Material Engineering, National Contest for all the Italian Universities (2017)
- Industrial Ecology, Department of Environmental Science, Faculty of Science and Technology, Aarhus University of Copenhagen (Denmark), full professor (2016)
- Energy Engineering, Chalmers University of Technology di Goteborg (Sweden), full professor (2009)
- Energy Engineering, Chalmers University of Technology di Goteborg (Sweden), associate professor (2008)

## **ACTIVITY IN THE INTERNATIONAL SCIENTIFIC COMMUNITY**

**Co-EDITOR-IN-CHIEF of the Waste Management journal of Elsevier,** since 2018.

**Associate Editor** for the same journal from 2012 to 2017, with specific competence in solid waste thermal treatments and LCA studies for integrated waste management. In particular, Guest Editor of some issues, such as “Thermal treatment of solid waste” (30/7, July 2010), “Solid Waste Gasification (32/4, April 2012) and “Waste-to-Energy Processes and Technologies” (37, March 2015).

**Member of Managing Board of the International Waste Working Group ([www.iwmg.eu](http://www.iwmg.eu)),** and, in the framework of this association, **the leader of the IWWG-Task Group on Thermal Treatments.**

**Chair of some international conferences,** such as the:

- Fluidization XI, Present and Future for Fluidization Engineering, Ischia, Italy, May 9-14 2004

- 11<sup>th</sup> Fluidized Bed Combustion Conference, Naples, Italy, June 2011
- WasteLCA\_1, 1<sup>st</sup> Conference on Life Cycle Assessment of waste 2018 - Symposium of Integrated Resource Management and Assessment, Cetraro, Italy, 5-10 June, 2016
- Waste\_LCA2, 2<sup>nd</sup> Conference on Life Cycle Assessment of waste 2018 - Symposium of Integrated Resource Management and Assessment, Copenhagen, Denmark, 18-22 June, 2018

**Member of some international committees for waste management and waste-to-energy**, such as the:

- International Advisory Board of the CRETE-Int. Conference on Industrial and Hazardous Waste Management (since 2017)
- International Advisory Board of the SUM-Int. Symposium on Urban Mining (since 2017)
- International Scientific Committee of the Int. Conf. on Industrial Furnaces and Boilers (since 2016)
- International Scientific Committee of WastEng-Int. Conf. on Engineering for Waste and Biomass Valorisation (since 2015)
- International Scientific Committee of the International Green Process Engineering Congress (since 2015)
- International Scientific Committee of the Int. Conf. on Industrial and Hazardous Waste Management (since 2014)
- International Symposium on Gasification and its Application (i-SGA) (since 2014)
- International Scientific Committee of the Int. Conf. on Fluidized Bed Conversion (since 2012)
- International Advisory Board of the Int. Symposium on Energy from Biomass and Waste (since 2009)
- International Symposium on Urban Mining (since 2012)
- International Expert Group on Life Cycle Analysis for Waste Management (since 2000)
- International Scientific Committee of the Engineering Foundation on Fluidization (since 1994)
- International Advisory Board of the International Conference on Circulating Fluidized Beds (since 1993).

**Keynote speaker at international conferences in the field of Waste-to-Energy and Air Pollution Control systems**, as those in:

- Kuwait City (Kuwait), Products, energy and Fuel Recovery from Solid Waste, November 24<sup>th</sup>, 2019
- Singapore, WtE Research Facility Handover Ceremony, Nanyang Technological University, January 17<sup>th</sup>, 2019
- Kuwait City (Kuwait), Resource-to-Resource International workshop, November 20<sup>th</sup>, 2018
- Prague (Czech Republic), WastEng2018-International Conference on Engineering for Waste and Biomass Valorisation, July 2<sup>nd</sup>, 2018
- Seville (Spain), International project workshop on waste gasification: NETUWAS, May 2017

- Naples (Italy), The Combustion Institute-Italian Sec. Meeting, July 2016
- Shanghai (China), Thermal & Environmental Engineering Institute of the Tongji University, November 2015
- Venice (Italy), 5<sup>th</sup> International Symposium on Energy from Biomass and Waste, November 2014
- Hong Kong (China), 2<sup>nd</sup> International Conference on Solid Waste, May 2013

**Referee for some international research projects, submitted to:**

- Ministry of Science, Technology & Space, Government of Israel
- French-Italian University (Galileo projects)
- FWO-Research Foundation-Flanders (SBO-strategic basic research projects)
- SNSF-Swiss National Science Foundation.

**Referee of several international scientific journals, such as:**

- Waste Management, Waste Management&Research, Resource Conservation and Recycling
- Journal of Cleaner Production, Int. J. of Life Cycle Assessment, Journal of Industrial Ecology
- Fuel, Fuel Processing Technology, Combustion Science and Technology, Energy, Applied Energy
- Chemical Engineering Sciences, The Chemical Engineer Journal, Canadian Journal of Chemical Engineers, Polymer Degradation & Stability, Powder Technology
- Process Safety and Environmental Protection, Journal of Loss Prevention in the Process Industries

mainly for the areas of waste-to-energy processes and technologies, waste management, life cycle assessment, waste-to-feedstock processes.

## **RESEARCH ACTIVITY AND CONSULTANCY SERVICE**

**Long experience in the field of fluidized bed engineering, thermochemical conversion of solid waste, waste management, and life cycle assessment.**

**Scientific responsible and team leader in several Italian projects about energy from biomass and waste, waste management planning, and life cycle assessment of waste management treatments.**

Numerous papers published on international scientific journals described these experiences. The following list reports some of the major recent projects.

- Design and technical, environmental and economic assessment of a medium-scale WtE plant for plastic wastes (2009-2011) - Conai-Italian National Consortium for Packaging
- Industrial waste management planning of Regione Campania (2009-2010)
- Municipal and industrial solid waste management planning of District of Caserta (2009)
- Municipal solid waste management planning of Regione Campania (2010-2011)
- Design and technical, environmental and economic assessment of a WtE plant for SRF-solid recovered fuel (2013)

- Municipal solid waste management planning of Regione Molise (2012 and 2015)
- LIFE+ project “VIRGIN”. Technical, environmental and social assessment of an innovative recycling system for post-consumer absorbent hygiene products (2013-2015)
- Process design of a bubbling fluidized bed gasifier for biomass fuels (2016)
- Technical and environmental assessment of an anaerobic digestion process for bio-methane production (2017)
- Technical and economic assessment of a biowaste gasification process for energy supply to a lime kiln (2018)
- Review of biogas upgrading techniques for biomethane production from biowaste (2019)
- Life Cycle Assessment of last generation waste-to-energy units (2019)
- H2020 project “NONTOX”. LCA, LCC and S-LCA of innovative management schemes of WEEE, EoL, C&DW plastics.

**Expert consultant for Regione Lombardia** (DGR of October 16<sup>th</sup>, 2015-No. X/4192) **to assess innovative industrial projects for resource recovery and/or disposal of municipal and industrial wastes** (B.U. Regione Lombardia, S. O. n. 43, del 22-10-2015). He is also member of the team of experts **for Regione Campania** (DD of March 11<sup>th</sup>, 2016-No. 32-33 and May 17<sup>th</sup>, 2016-No.228) **to assess the environmental sustainability of production processes in IPPC industries.**

**Consultant of several companies and research centres.** In particular, he worked (or still works) with Ansaldo Energia, Asia.biz., ChemTex, CIRA (National Centre for Aerospace Research), CONAI-Italian National Consortium for Packaging, ECO-BAT, Eco-Engineering, ENEA-Environmental Department, ENEL, ENI (Snamprogetti, Enitecnologie, Agip Carbone, Enichem Anic), EUROPOWER, FATER, PRODEVAL, Regione Campania, Regione Molise, Sagit-UNILEVER, SOTACARBO, UNICALCE, Turin Polytechnic.

**Author of about 100 scientific papers published in international scientific journals** (Waste Management, J. of Cleaner Production, Fuel, Fuel Processing Technology, Energy, Applied Energy, Waste Management&Research, Resource Conservation&Recycling, AIChE Journal, Chem. Eng. Sci., Chem. Eng. Journal, Ind.&Eng.Chem.Res., J. of Industrial Ecology, Int. J. of Life Cycle Assessment, Polymer Degradation & Stability, Powder Techn., Combustion Sci. and Techn., Combustion and Flame, Canadian J. of Chem. Engineers, Japanese J. of Chem. Engineering, J. of Loss Prevention in the Process Industries).

Main bibliometric data are, as obtained by Scopus data bank (Author ID: 7005935081; <http://orcid.org/0000-0001-6635-2568>) at December 27<sup>th</sup>, 2019: **JCR articles: 97; total citations: 2736; h index: 30.**

**Author of chapters in some multi-authored books:** “Gas Mixing” in “Circulating Fluidized Beds” (Chapman & Hall, 1997); “Fluidized Bed Pyrolysis of Plastic Wastes” in “Feedstock Recycling and Pyrolysis of Waste Plastics” (J. Wiley&Sons, 2006); “Fluidized bed gasification” in “Fluidized-bed technologies for near-zero emission combustion and gasification” (Woodhead Publishing, 2013).

Umberto Arena's research and professional activity is mainly oriented to several aspects of waste management, with particular attention to:

- Thermal treatments (combustion, gasification and pyrolysis) of different wastes and biomass.
- Design and operation criteria of fluidized bed combustors, pyrolyzers and gasifiers.
- Hot syngas clean-up processes by means of activated carbons.
- Technological, economic and environmental aspects of the different recycling and recovery routes (mechanical recycling, feedstock recycling and energy recovery) of municipal and industrial wastes.
- Life Cycle Assessment, Material Flow Analysis and Substance Flow Analysis for environmental assessment of waste management planning and for optimization of different waste treatments.