

Personal Information

Name and surname Marco Baratieri
Date of Birth 28 July 1975
Address (office) piazza Università 5 (office K0.03), Bolzano
Status married, three children

Contacts

ph. +39 0471 017201
mob. +39 348 7700385
email marco.baratieri@unibz.it

**Academic position**

2015 – date Associate Professor of Industrial Technical Physics ING-IND/10
Faculty of Science and Technology, Free University of Bozen-Bolzano

Past academic positions

2009 – 2014 Assistant Professor of Environmental Technical Physics ING-IND/11
Faculty of Science and Technology, Free University of Bozen-Bolzano

2007 – 2009 Postdoctoral fellow
Department of Civil and Environmental Engineering - University of Trento

Education PhD in Environmental Engineering at the University of Trento
MSc in Environmental Engineering (5 year program) at the University of Trento

Research activity

The activity has been carried out in the frame of the research group of Environmental Technical Physics (coordinator prof. Andrea Gasparella), according to two main topics; *Biomass to energy processes (Topic 1)* and *Energy efficiency of buildings and processes (Topic 2)*.

Topic 1: Biomass to energy processes*1.1 Pyrolysis and gasification processes*

The theoretical study of pyrolysis and gasification processes has been dealt with enhanced multiphase thermodynamic models developed and validated during the PhD period. Further upgrade and integrations have been then implemented to allow the detailed simulation of thermo-fluidynamics of reactors.

The experimental analysis - aimed at the characterization of the process and at the validation of the models - has been carried out in the Technical Physics Lab of FUB, which has been designed and set up for the purpose of this research. A complete thermal analysis system is available, consisting of a simultaneous thermal analyser (STA) coupled with GC-MS and FTIR gas analysers. Moreover a bench-scale pyrolyser equipped with tar sampling system (CEN/TS 15439) and micro-GC analyser for synthesis gas analysis has been set up and operated.

1.2 Potential of biomass torrefaction

Theoretical study of biomass torrefaction has been dealt with kinetic multiphase models in order to estimate the solid, liquid and gaseous products. This analysis has been supplemented with thermodynamic simulations to assess torrefaction impact on cogeneration systems. Scenarios of utilization and post-processing of byproducts (i.e., char and liquids) are also taken into account (collaboration with the Soil Chemistry group at FUB).

1.3 Biomass CHP systems

Multistage thermodynamic models have been implemented, with the purpose of developing engineering tools for the assessment of the performance of biomass combined heat and power (i.e., CHP) generation systems. Considered CHP systems are based on the coupling of gasification stages (fixed or fluidized bed reactors) with internal combustion engines or fuel cells. The analysis of the generation stage is supplemented with energy distribution models, in particular aimed at the simulation of district heating networks and final users (buildings).

The experimental activity is currently carried out in South Tyrol on real scale plants both of medium size (1 MWel) based on biomass combustion and Organic Rankine Cycle (i.e., ORC) and of small scale (50-100 kWel) based on biomass gasification and internal combustion engines.

A steam gasification reactor, coupled with a Solid Oxides Fuel Cell (i.e., SOFC) has been also designed, set up and operated during the post-doctoral period.

1.4 Tar bioremediation

The collaboration with the Microbiology group at FUB allows the development of multidisciplinary studies of tar characterization and remediation by means of bacterial and fungal communities. The effects of the biological transformations on tars are evaluated through microorganisms growth dynamics and tar degradation kinetics, using analytical (HPLC, GC-FID) and microbiological (DNA sequencing) techniques. Tars are obtained both from lab-scale and real scale plants.

Topic 2: Energy efficiency of buildings and processes

2.1 Energy efficiency of buildings

The dynamic performance of opaque envelope components has been analysed using numerical and analytical models in periodic regime (simplified and real forcing boundary conditions). Experimental procedures have been developed for the dynamic parameters estimate using a hot box apparatus (according to EN 1934) designed and set up at FUB Building Physics Lab for the purpose of this activity. The materials thermophysical properties are measured using Laser Flash Analyser, Heat Flow Meter and Differential Scanning Calorimeter. Special focus is on timber materials and envelope components.

2.2 Energy efficiency of processes

The research activity focuses on the characterisation of the main energy losses in thermal systems and in industrial processes and on the evaluation of the relevant energy saving potential. A representative group of companies has been selected through a survey on the territory of South Tyrol. Monitoring and assessment on some case studies (e.g., building, mechanical, timber processing sectors) are currently in progress. A test apparatus for air-to-air heat exchangers is in design phase, but some preliminary analyses have been carried out on an existing facility.

International collaborations:

- The City College of New York (USA), Prof. Marco J. Castaldi, on biomass reactivity characterization (PhD student co-supervision)
- University Erlangen-Nürnberg (Germany), Prof. Jürgen Karl, on experimental on-line procedures for gasification tar analysis (paper on international journal and on international conference proceedings)
- Bioenergy 2020+ (Austria), Dr. Walter Haslinger, on integrated biomass system – building modelling and experimental validation (PhD student co-supervision)
- University of Western Australia, Prof. Hui Tong Chua, Dr. Andrew Guzzomi, on analysis of the energy potential of agricultural waste (paper on international conference proceedings)
- University of Greifswald (Germany), Prof. Niels Thevs, Prof. Volker Beckman, on techno-economic assessment of biomass to energy (paper on international conference proceedings; “Suwarest” project, research expedition in Inner Mongolia, China, 2011)

- KTH, Royal Institute of Technology, Stockholm, Prof. Truls Liliedahl, Dr. Thomas Nordgreen, on biomass gasification in fluidised bed reactors (invited seminar in 2010, paper on international journal and on international conference proceedings)

Scientific committee participation and reviewer activity:

- Member of the editorial board of the *International Journal of Oil, Gas and Coal Technology* (IJOGCT).
- Reviewer for international journals: *Applied Energy*, *Applied Pyrolysis*, *Fuel*, *Energy Conversion and Management*, *Journal of Hydrogen Energy*, *Fuel Processing Technology*, *Applied Biochemistry and Biotechnology*, *Bioresource Technology*, *Environmental Technology*.
- Member of the scientific committee of the *European Biomass Conference and Exhibition*.
- Member of the Organizing Committee of the first *IBPSA Italy* conference *Building Simulation Applications (BSA2013)* which took place in Bolzano (January 30th - February 1st 2013).
- Founder member of the *International Building Performance Simulation Association, Chapter Italy*.

International conferences:

- Chairman:
 - 20th European Biomass Conference and Exhibition (20th EU BC&E), Milano, 2012
 - 4th International Conference on Engineering for Waste and Biomass Valorisation, Porto (Portugal), 2012
 - 21th European Biomass Conference and Exhibition (21st EU BC&E), Copenhagen, 2013
- Oral presentations:
 - 12 oral presentations at international conference (since 2006)

Research project:

List of research project is reported in Annex A.

Teaching activity

2009-2013, Free University of Bolzano:

- Professor of "Energy Systems" (8 ECTS, 80 hours, in English), Bachelor in Logistics and Production Engineering, A.Y. 2009/2010
- Module of "Impianti a basso consumo energetico", (16 hours, in Italian), Executive Master "Klimahaus", A.Y. 2009/2010, 2010/2011
- Module of "Simulazioni energetiche" (24 hours, in Italian), Executive Master "Klimahaus", A.Y. 2009/2010
- Professor of "Renewable Energy" (4 ECTS, 44 hours, in English), Bachelor in Logistics and Production Engineering, A.Y. 2010/2011
- Professor of "Renewable Energy" (6 ECTS, 60 hours, in English), Bachelor in Logistics and Production Engineering, A.Y. 2011/2012
- Professor of "Physics" (5 ECTS, 60 hours, in Italian), Bachelor in Agriculture Science and Technology, A.Y. 2012/2013
- Module of "Heat Transfer" - in "Technical Physics" course (2 ECTS, 20 hours, in Italian), Bachelor in Industrial and Mechanical Engineering, A.Y. 2010/2011
- Module of "Progettazione e materiali per le costruzioni rurali" (10 hours, in Italian), Bachelor in Agriculture Science and Technology, A.Y. 2012/2013, 2013/2014
- Professor of "Power Production, CHP and District Heating System" - Module of "Thermal power production and distribution" (6 ECTS, 60 hours, in English), Master in Energy Engineering, A.Y. 2013/2014

2004-2009, University of Trento (tutoring and didactic support):

- “Technical Physics 1” (A.Y. 2004/05-2005/06-2006/07-2007/08-2008/2009)
- “Technical Physics 2” (A.Y. 2004/05-2005/06-2006/07-2007/08)
- “Technical Physics” (A.Y. 2004/05-2005/06-2006/07-2007/08-2008/2009)
- “Industrial Technical Physics 2” (A.Y. 2004/05-2005/06-2006/07-2007/08)
- “Thermal systems” (A.Y. 2007/08)
- Seminar “Thermal bridges” (in “Thermal systems” course, A.Y. 2007/08)
- “Energy sources management” (A.Y. 2005/06-2006/07-2007/08)
- “Renewable energy” (A.Y. 2005/06-2007/08-2008/2009)
- “Transport phenomena 2” (A.Y. 2004/05-2005/06-2006/07-2007/08)
- “Chemical process dynamics and control” (A.Y. 2004/05-2006/07-2007/08-2008/2009)
- Modules “Heat Transfer” e “Low impact energy systems” (Master Universitario di II livello “IDEE”, A.A. 2008/09)

BACHELOR AND MASTER THESIS

- 2006-2009: co-supervisor of 20 bachelor thesis and 23 Master thesis (University of Trento)
- 2009-2013: supervisor of 2 Bachelor thesis, 3 Master thesis and co-supervisor of 4 Master thesis (Free University of Bolzano)

PHD THESIS

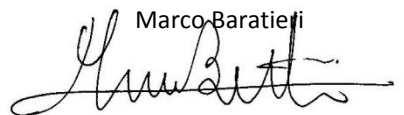
- Supervisor of 4 PhD students (Free University of Bolzano)

Institutional activities

2009-2013, Free University of Bolzano:

- Member of the Study Council of the Bachelor in Logistics and Production Engineering (L9) (A.Y. 2009-10, 2010-11)
- Member of the Study Council of the Bachelor in Industrial and Mechanical Engineering (L9) (since A.Y. 2011-12)
- Member of the Study Council of the Master in Energy Engineering (LM30) (since A.Y. 2012-13)
- Member of the Study Council of the PhD Program in “Sustainable Energy and Technology” (since A.Y. 2011-12)
- Member of the Study Council of the PhD Program in “Management of the Mountain Environment” (since A.Y. 2010-11)
- Member of the Scientific and Didactic Council of the Executive Master “Klimahaus” (A.Y. 2009-10, 2010-11, 2011-12)
- Member of the Scientific and Didactic Council of the Executive Master “Innovation Engineering” (since A.Y. 2010-2011)
- Member of the Faculty Council, as Assistant Professors representative (A.Y. 2009-10, 2010-11, 2011-12)

Bozen-Bolzano, January 2015

Marco Baratieji


Public fund competitive research projects

Title	Duration (months)	Role
"Experiences in biomass GASification in South -Tyrol: energy and environmental assessment (GAST)", funded by: Provincia Autonoma di Bolzano (L.P., 13.12.2006, N. 14), period: 2012-2014	24	Scientific coordinator
"Timber building with enhanced energy and structural performance (TimBeeSt)", funded by: Provincia Autonoma di Bolzano (L.P., 13.12.2006, N. 14), period: 2012-2014	24	Investigator
"ENvelope-LAbs Network dell'Alto Adige per la valutazione prestazionale dell'involucro edilizio (EN-LAN)", funded by: Provincia Autonoma di Bolzano (FESR 2007-2013), period: 2012-2015	36	Investigator
"Development of simplified sensors for continuous monitoring of energy and environmental performances of tractors by a local telemetry network", funded by: FUB, period: 2011-2013	24	Investigator
"Modelling and designing solar barn dryers for forages according to modular approaches (ForSOLARdrying)", funded by: FUB, period: 2011-2014	36	Investigator
"Sustainable use of biomass in South Tyrol: from production to technology", funded by: Provincia Autonoma di Bolzano (L.P., 13.12.2006, N. 14), period: 2011-2014	36	Investigator (WP responsible)
"EuroChar—Biochar for Carbon sequestration and large-scale removal of greenhouse gases (GHG) from the atmosphere", fund FP7-ENV-2010, period: 2011-2013	36	Investigator
"Bench scale pyrolysis and torrefaction of lignocellulosic Biomass: process characterization, byproducts analysis and transformation", funded by: FUB, period: 2011-2013	24	Scientific coordinator
"Air-to-air heat recovery in HVAC systems", funded by: FUB, period: 2011-2013	24	Investigator
"Dynamic performances of envelope structures in buildings: design of a control system", funded by: FUB, period: 2010-2013	36	Scientific coordinator
"Build4Future - Building the Future: Innovative Pathways for Construction Industry", funded by: FUB, period: 2009-2011	24	Investigator
"Sustainable water management and wetland restoration in settlements of continental-arid Central Asia (SuWaRest)", funded by: Stifterverband für die Deutsche Wissenschaft (Germany), period: 2010-2013	36	Investigator (WP responsible)
"Sustainable COastal Land Management: Trade-offs in EcoSystem Services (COMTESS)", funded by: Stifterverband für die Deutsche Wissenschaft (Germany), period: 2010-2015	60	Investigator
"Sustainable chain for the use of biomass in South-Tyrol", funded by: FUB, period: 2009-2011	24	Investigator (WP responsible)

Commercial projects

Title	Duration (months)	Role
"Analisi dello stato dell'arte e degli sviluppi tecnico-normativi relativi ai generatori di calore a biomasse" funded by: Piemmeti Spa (Padova)	12	Scientific coordinator
" χ^2 chi quadrato. Costruire strutture in bioedilizia certificate per attività formative", funded by: Network "Chi Quadrato" (Condino, Trento)	12	Scientific coordinator
"Prove sperimentali su componenti edilizi opachi in legno in doppia camera climatica e termoflussimetro in regime stazionario e dinamico", funded by: ILLE PREFABBRICATI S.p.A. (Trento)	5	Scientific coordinator