

# Francesco Patuzzi – Academic Curriculum Vitae

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## Personal information

### Francesco Patuzzi

Nationality: Italian

E-Mail: francesco.patuzzi@unibz.it

## Education since leaving school

- 2007, Bachelor in Environmental Engineering, University of Trento
- 2010, Master in Environmental Engineering, University of Trento
- 2014, Phd in Management of Mountain Environment, Free University of Bozen-Bolzano

## Present appointment

- Researcher on a fixed-term contract (RTDb, ex art. 24 L. 240/2010), disciplinary sector ING-IND/10 (Thermal engineering and industrial energy systems)
- Start of appointment: 01.10.2019
- Employer: Free University of Bozen-Bolzano, Faculty of Science and Technology
- Area of reseach: the research field deals with the study of the processes of heat transfer and with the thermofluidynamic behavior of combined heat and power systems fed by renewable sources, in particular by biomass.
- Activities: teaching and research activities relevant to the ING-IND/10 sector. This research area aims to the study of distributed cogeneration technologies which are most promising, in order to valorise the local biomass utilization in South-Tyrol, increase the conversion processes' efficiency and contribute to the mitigation of environmental impacts. Novel processes whose aim is solid fuels (biomass and waste) upgrade into intermediate fuels (solid, liquid and gaseous) are of particular significance, as gasification and pyrolysis. The research focuses in particular on: 1) biomass characterization, i.e. analysis of physical-chemical and energetic characteristics; 2) experimental and modelling analysis of energy conversion processes and systems; 3) characterization of the gasification/pyrolysis products and by-product and their valorization to generate heat, electricity and chemicals. The research methods, experimental and theoretical, will be applied both at the laboratory and at the pilot scale. It is foreseen to present the research results both to the scientific audience and as informative paper/speech and also on the media, in the area of the energy generation from biomass.

## Professional experience

*Period:* 01/07/2017 – 30/09/2019

*Employer:*

Free University of Bozen-Bolzano, Faculty of Science and Technology

*Activity:*

Researcher on a fixed-term contract (RTDa, ex art. 24 L. 240/2010), disciplinary sector ING-IND/10 (Thermal engineering and industrial energy systems).

*Area of reseach:*

the research field deals with the study of the processes of heat transfer and with the thermofluidynamic behavior of combined heat and power systems fed by renewable sources, in particular by

biomass.

*Activities:* teaching and research activities relevant to the ING-IND/10 sector. This research area aims to the study of distributed cogeneration technologies which are most promising, in order to valorise the local biomass utilization in South-Tyrol, increase the conversion processes' efficiency and contribute to the mitigation of environmental impacts. Novel processes whose aim is solid fuels (biomass and waste) upgrade into intermediate fuels (solid, liquid and gaseous) are of particular significance, as gasification and pyrolysis. The research focuses in particular on: 1) biomass characterization, i.e. analysis of physical-chemical and energetic characteristics; 2) experimental and modelling analysis of energy conversion processes and systems; 3) characterization of the gasification/pyrolysis products and by-product and their valorization to generate heat, electricity and chemicals. The research methods, experimental and theoretical, will be applied both at the laboratory and at the pilot scale. It is foreseen to present the research results both to the scientific audience and as informative paper/speech and also on the media, in the area of the energy generation from biomass.

*Period:* 15/02/2016-30/06/2017

*Employer:*

Free University of Bozen-Bolzano, Faculty of Science and Technology

*Activity:*

Researcher on a fixed-term contract (RTDa, ex art. 24 L. 240/2010), disciplinary sector ING-IND/10 (Thermal engineering and industrial energy systems). RTD research.

*Area of research:*

study of distributed cogeneration technologies which are most promising, in order to valorize the local biomass production in South-Tyrol, increase the conversion processes' efficiency and contribute to the mitigation of environmental impacts.

*Activities:* the research focuses on the biomass characterization, i.e. analysis of physicalchemical characteristics and reactivity, on the characterization of the gasification/pyrolysis products and by-product and their valorization to generate heat, electricity and chemicals. The research methods, experimental and theoretical, are applied both at the laboratory and at the pilot scale.

*Period:* 01/2015 – 02/2016

*Employer:*

Free University of Bozen-Bolzano, Faculty of Science and Technology

*Activity:*

Post-doc research fellow. Project title: "Thermochemical conversion of biomass: reactivity and process analysis (Conversione termochimica di biomasse: reattività e analisi di processo)"

*Competence area:*

Evaluation, at the particle scale, of the biomass reactivity during a thermochemical conversion process, by means of thermogravimetric analysis and the development of kinetic models. Characterization of biomass gasification process at different levels, by means of on-site monitoring of existing plants and experimental analysis on bench-scale reactors, in order to design a pilot plant to be installed at the Free University of Bozen-Bolzano.

*Period:* 01/2014 – 01/2015

*Employer:*

Free University of Bozen-Bolzano, Faculty of Science and Technology

*Activity:*

Post-doc research fellow. Project title: "Gasification Experiences in South Tyrol: energy and environmental assessment"

*Competence area:*

On-site monitoring of small-scale biomass gasification plant. Characterization of producer gas and engine emissions. Sampling and analysis of liquid (tar) and solid (char) by-products. Assessment of the energy balance of the plants by means of the analysis of the data collected during the monitoring activity. Identification of the criticalities in the analyzed technologies. Proposal and feasibility evaluation of technical improvements on the selected plants.

*Period:* 08/2010 – 12/2010

*Employer:*

Free University of Bozen, Faculty of Science and Technology

*Activity:*

Scientific collaborator in the international research project "Sustainable water management and wetland restoration in settlements of continental-arid Central Asia" (SuWaRest), funded by the Stifterverband für die Deutsche Wissenschaft

*Competence area:*

Research on the use of wetland biomass, in particular reed (*Phragmites australis*) for energy production; characterization of the feedstock (reed) and its energy exploitation starting from the productivity and nutrient uptake data; individuation and feasibility evaluation of different scenarios of energy conversion of reed, according to its characteristics (composition and heating value) and keeping into account both pyrolysis and gasification paths; assessment of the process efficiency, by means of thermodynamic modeling and experimental characterization applied at the process scale.

*Period:* 06/2010 – 07/2010

*Employer:*

University of Trento, Department of Civil and Environmental Engineering (DICA)

*Activity:*

Scientific collaborator in the research project: Analisi sperimentale e modellistica del processo di torrefazione delle biomasse legnose (Experimental and modelling analysis of the torrefaction process of lignocellulosic biomass)

*Competence area:*

Investigation of the different stages of the torrefaction of woody biomass with particular emphasis on modeling analysis of solid, liquid and gaseous phases; assessment of the effectiveness of this process in the increase of the calorific value of biomass; check of the impact on emission's products arising from the use of biomass in the combustion processes and/or gasification.

## **Experience in academic teaching**

*Lectures*

2019 – 2020

Free University of Bozen, Faculty of Science and Technology

- Lecturer of the course "Fundamentals of thermo-fluid-dynamics", within the Master in Industrial and Mechanical

Engineering

- Lecturer of the course "Energetics", within the Bachelor in Industrial and Mechanical Engineering

2018 – 2019

Free University of Bozen, Faculty of Science and Technology

- Lecturer of the course "Fundamentals of thermo-fluid-dynamics", within the Master in Industrial and Mechanical Engineering
- Lecturer of the course "Energetics", within the Bachelor in Industrial and Mechanical Engineering

2017 – 2018

Free University of Bozen, Faculty of Science and Technology

- Lecturer of the course "Fisica tecnica per i processi alimentari 1", within the Bachelor in Agricultural and Agro-Environmental Sciences
- Lecturer of the course "Fisica tecnica per i processi alimentari 2", within the Bachelor in Agricultural and Agro-Environmental Sciences
- Lecturer of the module "Impianti alimentati da fonti rinnovabili", within the Master 2nd level "BEE: Building, Energy and Environment – CasaClima"

2016 – 2017

Free University of Bozen, Faculty of Science and Technology

- Lecturer of the course "Tools for empirical and numerical assessment of energy systems", within the PhD program in Sustainable Energy and Technologies (SET)

2014 – 2015

Free University of Bozen, Faculty of Science and Technology

- Lecturer of the course "Applicazioni delle norme sull'efficienza energetica in edilizia", within the Bachelor in Industrial and Mechanical Engineering
- Lecturer of the module "I sistemi impiantistici per la produzione del caldo e del freddo – Exercise", within the Master 2nd level "Building Energy Performance. Design, Optimization and Service – CasaClima"
- Lecturer of the module "Impianti alimentati da fonti rinnovabili – Exercise", within the Master 2nd level "Building Energy Performance. Design, Optimization and Service – CasaClima"

2013 – 2014

University of Trento, Faculty of Engineering

- Teaching Assistant for the course "Risorse Energetiche del Territorio", within the Master in Environmental Engineering

2012 – 2013

Free University of Bozen, Faculty of Science and Technology

- Teaching Assistant for the course "Fisica", within the Bachelor in Agricultural and Agro-Environmental Sciences

*Thesis supervision, co-supervision and tutoring*

2019 – currently running

- Supervisor of the Ph.D. thesis: "Strategies for the integration of food and energy value chains", Candidate: Jacopo Paini, Ph.D. in Food Engineering and Biotechnology

- Co-supervisor of the Master Thesis: "Recirculation of woodchar in a downdraft open top gasifier: cogasification strategies and optimization", candidate: Giacomo Bonzi, Master in Energy Engineering
- Co-supervisor of the Master Thesis: "Valorisation of residues from parapharmaceutical and herbal medicine production: a case study", candidate: Alessandro Cascioli, Master in Energy Engineering
- Co-supervisor of the Master Thesis: "Energy valorization of wood residues through a small scale open top gasifier", candidate: Boris Brianti, Master in Energy Engineering
- Academic tutor for the internship of Anil Balikci, Master in Industrial and Mechanical Engineering

2018 – currently running

- Co-supervisor of the Ph.D. thesis: "Synergies between Biological and Thermal Treatments for Bioenergy Production: Towards the Bio-refinery Concept", Candidate: Matteo Pecchi, Ph.D. in Sustainable Energy and Technology
- Co-supervisor of the Ph.D. thesis: "Design and operation of biomass to biofuels systems", Candidate: Stefano Piazza, Ph.D. in Sustainable Energy and Technology

2018 – currently running

- Academic tutor within the Study Program in Wood Engineering L-9 prof

2017 – currently running

- Co-supervisor of the Ph.D. thesis: "Valorization of biomass char through use in adsorption and catalytic applications", Candidate: Eleonora Cordioli, Ph.D. in Sustainable Energy and Technology
- Co-supervisor of the Ph.D. thesis: "Enhanced fuel flexibility and load modulation capability of biomass gasification systems", Candidate: Daniele Antolini, Ph.D. in Sustainable Energy and Technology

2017 – currently running

- Academic tutor within the Master in Industrial Mechanical Engineering LM-33

2016 – 2019

- Co-supervisor of the Ph.D. thesis: "Biomass-to-liquid as a strategy to enhance gasification potential in a biorefinery perspective", Candidate: Vittoria Benedetti, Ph.D. in Sustainable Energy and Technology

2016 – 2017

- Co-supervision of the Master Thesis: "Assessment of gasification char potential as energy source in South-Tyrol", candidate: Stefano Piazza, Master in Energy Engineering

2015 – 2018

- Co-supervisor of the Ph.D. thesis: "Char based catalysts development and application assessment for different purposes", Candidate: Junaid Faridi Ahmad, Ph.D. in Sustainable Energy and Technology

2013 – 2016

- Co-supervisor of the Ph.D. thesis: "Small scale biomass gasification for energy production", Candidate: Stergios Vakalis, Ph.D. in Sustainable Energy and Technology

2015 – 2016

- Co-supervisor of the Bachelor thesis: "Valorizzazione energetica di biomasse palustri in Alto Adige", Candidate: Matteo Martinelli, Bachelor in Logistic and Production Engineering
- Co-supervisor of the Master thesis: "Experimental and modelling analysis of char decomposition for potential use as a catalytic gas filtering medium", Candidate: Eleonora Cordioli, Master in Energy Engineering
- Co-supervisor of the Master thesis: "Fuel flexibility for biomass boilers: analysis of the potential of some alternative feedstock in Italy", Candidate: Stefano Prandi, Master in Energy Engineering
- Co-supervisor of the Master thesis: "Analysis of a flat solar air collector system for drying applications in agriculture", Candidate: Nicola Degaspero, Master in Energy Engineering

2014 – 2015

- Academic tutor for the internship of Bernardi Alessandro, Master 2nd level "Building Energy Performance. Design, Optimization and Service - CasaClima"
- Co-supervisor of the Master thesis: "Thermal model of a wind turbine tower", Candidate: Mattia Del Favero, Master in Energy Engineering

2012 – 2013

- Co-supervisor of the Bachelor thesis: "Hydrogen and IC engines: exploitation in CHP systems", Candidate: Andreas Ebner, Bachelor in Industrial and Mechanical Engineering

## **Other academic responsibilities**

### *Institutional activities*

- Member of the Study Council of the PhD Program in "Sustainable Energy and Technology" (A.Y. 2016-17)
- Member of the Study Council of the PhD Program in "Food Engineering and Biotechnology" (since A.Y. 2017-18)
- Member of the Study Council of the Study Program in "Wood Engineering" (since A.Y. 2018-19)
- Member of the Selection Committee for the International PhD in Food Engineering and Biotechnology (XXXIV cycle)
- Member of the Selection Committee of several procedures for teaching contract lecturers and Ars (since 2017)

### *Participation to scientific committees of conferences*

- Member of the Students Tutoring Scientific Committee in the frame of the international conference Building Simulation Applications - BSA 2017 which will be held at the Free University of Bozen-Bolzano from February 8<sup>th</sup> to 10<sup>th</sup> 2017.

### *Participation to organizing committees of conferences*

- Member of the organizing committee of the "EU-Japan biomass seminar" hosted by the 27<sup>th</sup> European Biomass Conference & Exhibition on May 27<sup>th</sup> 2019 in Lisbon,

#### Portugal

- Member of the organizing committee of the "Biomass Study Tour in South Tyrol", held on May 23<sup>rd</sup> and 24<sup>th</sup> in South Tyrol in the frame of the "EU-Japan biomass seminar" hosted by the 27<sup>th</sup> European Biomass Conference & Exhibition on May 27<sup>th</sup> 2019 in Lisbon, Portugal
- Member of the local organizing committee of the 16<sup>th</sup> IBPSA International Conference and Exhibition - BS 2019 which will be held in Rome from September 2<sup>nd</sup> to 4<sup>th</sup> 2019.
- Member of the organizing committee of the international conference Building Simulation Applications - BSA 2019, held at the Free University of Bozen-Bolzano from June 19<sup>th</sup> to 21<sup>st</sup> 2019.
- Member of the organizing committee of the international conference Building Simulation Applications - BSA 2017, held at the Free University of Bozen-Bolzano from February 8<sup>th</sup> to 10<sup>th</sup> 2017.
- Member of the organizing committee of the international conference  $\mu$ CHP 16 – micro cogeneration through biomass gasification, held at the Free University of Bozen-Bolzano on December 2<sup>nd</sup> and 3<sup>rd</sup> 2016.
- Member of the organizing committee of the international conference Building Simulation Applications - BSA 2015, held at the Free University of Bozen-Bolzano from February 4<sup>th</sup> to 6<sup>th</sup> 2015.
- Member of the organizing committee of the international conference Building Simulation Applications - BSA 2013, held at the Free University of Bozen-Bolzano from January 30<sup>th</sup> to February 1<sup>st</sup> 2013.

#### *Participation to editorial boards*

- Member of the editorial board of Building Simulation Applications (BSA) Proceedings, a periodic publication (ISSN: 2531-6702) by bu,press, the publisher of the Free University of Bozen-Bolzano
- Guest editor of the "Proceedings of 2018 EEC/WTERT Conference" published by ASME

#### *Session chair at international scientific conferences*

- 6th International Conference on Engineering for Waste and Biomass Valorisation, Albi, France – May 25<sup>th</sup>, 2016, session C6 – Gasification of sludge
- 8th International Conference on Applied Energy, Beijing, China – October 10<sup>th</sup>, 2016, session 2-J2 – Industrial Energy System
- 7th International Conference on Engineering for Waste and Biomass Valorisation, Prague, Czech Republic – July 2nd, 2018, session D3 – Gasification & pyrolysis I: experimental performance
- 27th European Biomass Conference & Exhibition, Lisbon, Portugal – May 28th, 2019, session IBO.16 – Innovation in combustion plants, ORC cycles and electrolyser development
- 16th Building Simulation 2019, Rome – September 3rd, 2019, session 247: CFD and Airflow – 04: Natural Ventilation
- 16th Building Simulation 2019, Rome – September 4th, 2019, session 334: Energy Storage – 03

*Reviewer for international scientific journals*

- Biomass & Bioenergy
- Waste and Biomass Valorization
- Energy Conversion and Management
- Energy
- Waste Management
- Experimental Thermal and Fluid Science

*Reviewer for international project proposals*

- FONDECYT Regular 2017 grant competition (Chilean National Science and Technology Commission, CONICYT - Chile).

*Activities as recognized external expert*

- Incarico di supporto al RUP, Responsabile Unico del Procedimento, per verifica su impianto di biogassificazione per conto di ICE - Agenzia per la promozione all'estero e l'internazionalizzazione delle imprese italiane, Ufficio Tecnologia Industriale Energia e Ambiente, relativamente al progetto dimostrativo AGROGAS

*Third mission*

- March 2015: presentation of the results of the GAST project during the final workshop, open to a specialized non-scientific public during the fiera Klimaenergy
- September 2015: invited speaker at the Open-day sulla gassificazione, University of Modena and Reggio Emilia, Tecnopolo di Modena: "Analisi degli impianti di gassificazione di piccola taglia in Alto Adige", open to a specialized non-scientific public
- September 2016: participation to the Lange Nacht der Forschung – LUNA, presenting the Bioenergy & Biofuels LAB and running the open top gasifier
- April 2017: thematic lesson "Combustibili alternativi ed efficienza energetica" at IIS Galilei (Bolzano) and presentation of the Bachelor Program in Industrial and Mechanical Engineering offered by the Faculty of Science and Technology at the Free University of Bozen-Bolzano
- October 2017: participation to the inauguration of the NOI Techpark, presenting the activities of the Bioenergy & Biofuels LAB
- May 2018: presentation of the results of the NEXT GENERATION project during the final workshop, open to a specialized non-scientific public
- October 2018: participation to the miniNOI activities, presenting the Bioenergy & Biofuels LAB and the topics related to biomass utilization to groups of children (6-12 years old).

**Qualification**

Abilitazione Scientifica Nazionale (ASN) achieved on 04/04/2017 (II fascia, settore 09/C2)

**Memberships**

- Member of the Association of Engineers of Verona from 2011 to the end of 2014.
- Member of the Italian Association of Technical Physics since April 2016.
- Member of IBPSA-Italy since May 2018.



## Research and scholarships

- 02/2016 – 06/2017
  - Researcher on a fixed-term contract (RTDa, ex art. 24 L. 240/2010), disciplinary sector ING/IND 10 (Thermal engineering and industrial energy systems)
  - Free University of Bozen-Bolzano, Faculty of Science and Technology
  - Area of research: study of distributed cogeneration technologies which are most promising, in order to valorize the local biomass production in South-Tyrol, increase the conversion processes' efficiency and contribute to the mitigation of environmental impacts.
  - Activities: the research focuses on the biomass characterization, i.e. analysis of physicalchemical characteristics and reactivity, on the characterization of the gasification/pyrolysis products and by-product and their valorization to generate heat, electricity and chemicals. The research methods, experimental and theoretical, are applied both at the laboratory and at the pilot scale.
  - Funding body: Autonomous Province of Bolzen-Bolzano (TechPark)
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- 01/2015 – 02/2016
  - Post-doc research fellowship
  - Free University of Bozen-Bolzano, Faculty of Science and Technology
  - Project title: "Thermochemical conversion of biomass: reactivity and process analysis (Conversione termochimica di biomasse: reattività e analisi di processo)"
  - Evaluation, at the particle scale, of the biomass reactivity during a thermochemical conversion process, by means of thermogravimetric analysis and the development of kinetic models. Characterization of biomass gasification process at different levels, by means of on-site monitoring of existing plants and experimental analysis on bench-scale reactors, in order to design a pilot plant to be installed at the Free University of Bozen-Bolzano.
  - Funding body: Autonomous Province of Bolzen-Bolzano (TechPark)
- 
- 01/2014 – 01/2015
  - Post-doc research fellowship
  - Free University of Bozen-Bolzano, Faculty of Science and Technology
  - Project title: "Gasification Experiences in South Tyrol: energy and environmental assessment"
  - On-site monitoring of small-scale biomass gasification plant. Characterization of producer gas and engine emissions. Sampling and analysis of liquid (tar) and solid (char) by-products. Assessment of the energy balance of the plants by means of the analysis of the data collected during the monitoring activity. Identification of the criticalities in the analyzed technologies. Proposal and feasibility evaluation of technical improvements on the selected plants.
  - Funding body: Autonomous Province of Bolzen-Bolzano (GAST project)

- 2011 – 2014
- PhD on Management of Mountain Environment – XXVI cycle
- Free University of Bolzano, Faculty of Science and Technology
- Modeling and experimental characterization of biomass thermal treatment: torrefaction and pyrolysis applied to wetland and grass biomasses; Supervisor: Dr. Ing. Marco Baratieri; Co-Supervisor: Dr. Tanja Mimmo.
- Funding body: Stifterverband für die Deutsche Wissenschaft (within the frame of the international research project SuWaRest, Sustainable water management and wetland restoration in settlements of continental-arid Central Asia)

*International research experiences*

- Period: 22/02-22/06/2013
- Location: City College of New York, New York, USA
- Main activities and responsibilities: Experimental study of biomass reactivity, investigated through the thermal characterization of a particle subjected to pyrolysis and the analysis of the evolved gas.
- Period: 21/10-06/11/2011
- Location: China (Wuliangsu Hai Lake, Inner Mongolia)
- Main activities and responsibilities: Scientific expedition in the frame of the research project Sustainable water management and wetland restoration in settlements of continental-arid Central Asia (SuWaRest): collection of reed samples on the Wuliangsu Hai Lake area that will be processed in the lab scale pyrolysis reactor built at FUB; interviews to local experts and people in order to understand the situation of energy management in the area.
- Period: 07-19/09/2010
- Location: China (oases Xinan at the Wuliangsu Hai Lake, Inner Mongolia, and Wujiang, near to Zhangye, at the Heihe River, in Gansu Province)
- Main activities and responsibilities: Scientific expedition in the frame of the research project Sustainable water management and wetland restoration in settlements of continental-arid Central Asia (SuWaRest): knowledge of the German and Chinese cooperation partners; knowledge of the local stakeholders; visiting and primary analysis of the study sites; collection of some reeds samples.

*List of research grants and contracts as participant*

<b>Period</b>	<b>Funding Body</b>	<b>Title</b>
2018 – today	EFRE 2014-2020	Hydrothermal carbonization of Biogas digestate for hydroPonics: an innovative concept of bio-refinery (HB Ponics)
2018	Third party contract (Municipality of Bozen-Bolzano)	Technical and economic analysis of the district heating system in the Municipality of Bozen-Bolzano (DH-BZ)
2017 - today	FUB internal funding, (ZeFo)	THErmo-fluid DYnamics of Solid fuels Conversion systems: Optimization strategies (THE_DYSCO)
2016 – today	Austrian Research Promotion Agency (BRIDGE Early Stage)	Increased fuel flexibility and modulation capability of fixed-bed biomass gasifiers by means of model based control (FlexiFuelGasControl)

2016 - today	EFRE 2014-2020	Optimization of WOOD gasification chain in South Tyrol to produce bio-energy and other high-value green Products to enhance soil fertility and mitigate climate change (WOODUP)
2016 – 2018	FUB internal funding, (ZeFo)	BIOMass-to-LIQUid as a strategy to enhance gasification potential in a biorefinery perspective (BIO2LIQ)
2016 - 2018	Provincia Autonoma di Bolzano (L.P., 13.12.2006, N. 14)	Novel EXTension of biomass poly-GENERATION to small scale gasification systems in South-Tyrol (NEXT GENERATION)
2013-2015	Provincia Autonoma di Bolzano (L.P., 13.12.2006, N. 14), period: 2012-2014	Experiences in biomass Gasification in South - Tyrol: energy and environmental assessment (GAST)
2015 – 2016	Third party contract (Risanenergy srl)	On-site monitoring and the assessment of a plant for the pyrolysis of sewage sludge
2013 – today	Provincia Autonoma di Bolzano	Sviluppo della ricerca tecnologica: Convenzione programmati-cofinanziaria con la Provincia Autonoma di Bolzano (Nuovo Parco Tecnologico, BZ)
2011 – 2013	FUB internal funding, (ZeFo)	Bench scale pyrolysis and torrefaction of lignocellulosic biomass: process characterization, byproducts analysis and transformation
2010 – 2013	Stifterverband für die Deutsche Wissenschaft (Germany)	Sustainable water management and wetland restoration in settlements of continental-arid Central Asia (SuWaRest)

*List of research grants and contracts as PI or co-PI*

<b>Period</b>	<b>Funding Body</b>	<b>Title</b>
2019 - today	Third party contract (Palazzetti spa)	GASification for improved combustion in a biomass STOVE (GASTOVE), PI: Marco Baratieri, co-PI: Francesco Patuzzi
2019 – today	Italian Ministry of Education, University and Research (PRIN 2017)	BIOMasses Circular Holistic Economy APproach to EneRgy equipments (BIO-CHEAPER), PI: Marco Baratieri, co-PI: Francesco Patuzzi
2018 – today	FUB internal funding (RTD call 2018)	CHAR re-Circulation for improving the Conversion yields in fixed-bed biomass gasification systems (CHAR-RCC), PI: Francesco Patuzzi, co-PI: Stergios Vakkalis
2018	Third party contract (BIT spa)	BIomass planT monitoring (BIT), PI: Marco Baratieri, co-PI: Francesco Patuzzi
2018	Third party contract (Yanmar)	KINetics analysis of char bed Gasification (KING), PI: Marco Baratieri, co-PI: Francesco Patuzzi
2018	Third party contract (Yanmar)	Pre-design assessments of different reactor concepts (PRE-DES), PI: Marco Baratieri, co-PI: Francesco Patuzzi
2017 – 2018	Third party contract (Yanmar)	Analysis of European small scale GASification technologies and identification of new SOLUTIONs (GASSOLUTION), PI: Marco Baratieri, co-PI: Francesco Patuzzi
2017	Third party contract (Synecom)	Analysis of the pyrolysis process applied to tyres and plastic residues Contract for research project (PYROTYRE), PI: Marco Baratieri, co-PI: Francesco Patuzzi

**Publications**

Bibliometrics indexes (08/01/2020)

Google Scholar	95 papers	587 citations	H-index=13
Scopus	59 papers	439 citations	H-index=12
ISI Web of Science	48 papers	365 citations	H-index=10

### *Books – Edited*

1. Baratieri M., Corrado V., Gasparella A., **Patuzzi F.** (edited by), Building Simulation Applications BSA 2013. 1st IBPSA Italy conference, Bozen-Bolzano, 30th January-1st February 2013, 418 pages, University Press, Bolzano, 2013, ISBN:978-88-6046-058-5
2. Baratieri M., Corrado V., Gasparella A., **Patuzzi F.** (edited by), Building Simulation Applications BSA 2015. 2nd IBPSA Italy conference, Bozen-Bolzano, 4th-6th February 2015, 418 pages, University Press, Bolzano, 2015, ISBN: 978-88-6046-074-5
3. Pernigotto G., **Patuzzi F.**, Prada A., Corrado V., Gasparella A., (edited by), Building Simulation Applications BSA 2017. 3rd IBPSA Italy conference, Bozen-Bolzano, 8th-10th February 2017, 590 pages, University Press, Bolzano, 2018, ISBN: 978-88-6046-136-0
4. Castaldi, M.J., **Patuzzi, F.**, Ciuta, S., Tupsakhare, S., Tsiamis, D. (edited by), Proceedings of 2018 EEC/WTERT Conference. ASME, New York (2019), ISBN: 9780791861950, doi: 10.1115/1.861950

### *Chapters in books*

1. Baratieri, M., **Patuzzi, F.**: Reeds as a renewable energy source: Insight into possible conversion pathways. In: Cirella, G.T. and Zerbe, S. (eds.) Sustainable water management and wetland restoration strategies in northern China. pp. 95–117. University Press, Bolzano, 2014, ISBN: 978-88-6046-069-1
2. Köbbing, J.F., Thevs, N., **Patuzzi, F.**, Baratieri, M.: Livelihood and economy of reed wetlands. In: Cirella, G.T. and Zerbe, S. (eds.) Sustainable water management and wetland restoration strategies in northern China. pp. 119–135. University Press, Bolzano, 2014, ISBN: 978-88-6046-069-1
3. Baratieri, M., **Patuzzi, F.**: Laboratory/Demonstration-Scale Developments. In: Ciuta, S., Tsiamis, D., and Castaldi, M.J. (eds.) Gasification of Waste Materials. pp. 37–64. Elsevier (2018), DOI: 10.1016/B978-0-12-812716-2.00003-0

### *Journal Papers in refereed academic journals*

1. **Patuzzi, F.**, Mimmo, T., Cesco, S., Gasparella, A., Baratieri, M.: Common reeds (*Phragmites australis*) as sustainable energy source: experimental and modelling analysis of torrefaction and pyrolysis processes. GCB Bioenergy. 5, 367–374 (2013)  
DOI:10.1111/gcbb.12000  
Journal Impact Factor: 6.151 (2016)
2. **Patuzzi, F.**, Roveda, D., Mimmo, T., Karl, J., Baratieri, M.: A comparison between on-line and off-line tar analysis methods applied to common reed pyrolysis. Fuel. 111, 689–695 (2013)  
DOI:10.1016/j.fuel.2013.03.054  
Journal Impact Factor: 3.611 (2016)
3. **Patuzzi, F.**, Gasparella, A., Baratieri, M.: Thermochemical and Fluid Dynamic Model of a Bench-Scale Torrefaction Reactor. Waste and Biomass Valorization. 5, 165–173 (2014)  
DOI: 10.1007/s12649-013-9236-9  
Journal Impact Factor: 1.056 (2014)

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57. Benedetti, V., Ail, S.S., Cordioli, E., **Patuzzi, F.**, Baratieri, M.: Use of Char from Biomass Gasification as CO<sub>2</sub> Adsorbent and Catalyst Support: Experimental Analysis and Results. In: 27th European Biomass Conference and Exhibition. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)

58. Pecchi, M., Basso, D., Patuzzi, F., **Baratieri, M.**: Effect of Water Formation on the Reaction Enthalpy of the Hydrothermal Carbonization Process. In: 27th European Biomass Conference and Exhibition. pp. 1155–1159. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)
59. Pecchi, M., **Patuzzi, F.**, Baratieri, M.: Evaluation of the Overall Reaction Enthalpy Change of Hydrothermal Carbonization Process by Means of Differential Scanning Calorimetry at High Pressure. In: 27th European Biomass Conference and Exhibition. pp. 1160–1163. ETA-Florence Renewable Energies (2019)
60. Piazzzi, S., Ail, S.S., Benedetti, V., **Patuzzi, F.**, Baratieri, M.: Studies on conversion of syngas to liquid fuels via Fischer Tropsch synthesis. In: 27th European Biomass Conference and Exhibition. pp. 1262–1265. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)
61. Cordioli, E., Vakalis, S., **Patuzzi, F.**, Baratieri, M.: Analyzing the balances of model tar compounds in a char-bed tar cracking reactor. In: 27th European Biomass Conference and Exhibition. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)
62. Antolini, D., Ail, S.S., Vakalis, S., **Patuzzi, F.**, Baratieri, M.: Enhancement of the load modulation capability of a pilot plant gasifier by means of secondary air control. In: 27th European Biomass Conference and Exhibition. pp. 802–806. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)
63. Hollenstein, C., Zemann, C., Antolini, D., **Patuzzi, F.**, Martini, S., Baratieri, M., Gölles, M.: Evaluation of the operational behaviour of fixed-bed biomass gasifiers – a comparison of different approaches for steady-state analysis. In: 27th European Biomass Conference and Exhibition. pp. 849–860. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)
64. Pezzola, L., Mussi, R., Magalotti, V., Baratieri, M., **Patuzzi, F.**, Wakizaka, H.: Alternative measurement methodologies for downdraft gasifier monitoring and control. In: 27th European Biomass Conference and Exhibition. ETA-Florence Renewable Energies, Lisbon, Portugal (2019)

## Awards

2018

- Best Student Poster Award of the WasteEng2018 Conference, attributed to Daniele Antolini for the poster entitled: "Load modulation capability of an open top gasifier by varying the second stage air flow rate (284)"; co-authors: Daniele Antolini, Snehash Shivananda Ail, Carlo Caligiuri, Francesco Patuzzi, Massimiliano Renzi, Marco Baratieri; theme: Thermoconversion & Catalysis

## Further data

### *Oral presentations*

November 2011: Oral presentation at the SuWaRest workshop, Free University of Bozen-Bolzano: "Use of reeds for energy production in Inner Mongolia: biomass-to-energy process scenarios"

June 2012: Oral presentation at 20th European Biomass Conference and Exhibition, Milan, Italy: "Characterization of the tar produced

during pyrolysis of common reed: comparative study between on-line and off-line measuring method approaches"

September 2012: Oral presentation at 4th International Conference on Engineering for Waste and Biomass Valorisation, Porto, Portugal: "CHP gasification systems fed by torrefied biomass: assessment of the energy performance"

September 2012: Oral presentation at FaST2012-Research Day, Free University of Bozen-Bolzano: "Biomass Pyrolysis: advanced thermal characterization and comparative study between online and off-line tar analysis"

February 2013: Oral presentation within the frame of the Joint Research Seminars series, Free University of Bozen-Bolzano: "Modelling and experimental characterisation of biomass thermal treatment: torrefaction and pyrolysis applied to wetland and grass biomasses"

June 2014: Oral presentation at 22nd European Biomass Conference and Exhibition, Hamburg, Germany: "Pyrolysis of a single wooden particle: a numerical model calibrated versus intraparticle gas sampling measurements"

August 2014: Flash Oral presentation at 5th International Conference on Engineering for Waste and Biomass Valorisation, Rio de Janeiro, Brazil: "Thermochemical and fluidynamic model of a wood particle subjected to pyrolysis supported by intraparticle gas sampling"

June 2015: Oral presentation at 23rd European Biomass Conference and Exhibition, Vienna, Austria: "Finite volumes numerical model for the assessment of intraparticle gas sampling during the pyrolysis of a single wooden particle"

May 2016: Oral presentation at 6th International Conference on Engineering for Waste and Biomass Valorisation, Albi, France: "Experiences in biomass gasification in South Tyrol: energy and environmental assessment"

October 2016: Oral presentation at 8th International Conference on Applied Energy, Beijing, China: "Gasification char as a potential substitute of activated carbon in adsorption applications"

October 2016: Oral presentation at 8th International Conference on Applied Energy, Beijing, China: "Experimental and modelling analysis of char decomposition: experiences with real scale gasification systems"

April 2017: thematic lesson "Combustibili alternativi ed efficienza energetica" at IIS Galilei (Bolzano) and presentation of the Bachelor Program in Industrial and Mechanical Engineering offered by the Faculty of Science and Technology at the Free University of Bozen-Bolzano

July 2018: Oral presentation at the at 7th International Conference on Engineering for Waste and Biomass Valorisation, Prague, Czech Republic: "Analysis and interpretation of intraparticle sampling data: assessment of the exothermicity effect during biomass pyrolysis"

May 2019: Oral presentation at 27th European Biomass Conference and Exhibition, Lisbon, Portugal: "Char recirculation for improving the conversion yields in fixed bed gasification systems"

#### *Invited speaker*

September 2015: Invited speaker at the Open-day sulla gassificazione, University of Modena and Reggio Emilia, Tecnopolo di

Modena; title of the oral presentation: "Analisi degli impianti di gassificazione di piccola taglia in Alto Adige"

October 2018: Invited speaker at SKT 2018 conference, 7th Coupling Days on Thermal Analysis Coupled to Evolved Gas Analysis; title of the oral presentation: "Thermogravimetric analysis coupled with FT-IR spectroscopy: advanced thermal analysis applied to the characterization of common reed pyrolysis".

January 2019: Invited speaker at the "EU-Japan small-scale biomass gasification seminar" hosted by the 14th Conference on Biomass Science in Higashiroshima; title of the oral presentations: "Valorization of co-products of small-scale gasification plants (biochar and bio-oil) and importance for overall profitability of the plant".

January 2019: Invited speaker at the "EU-Japan small-scale biomass gasification seminar" hosted by the 14th Conference on Biomass Science in Higashiroshima; title of the oral presentation: "Case study of South Tyrol (Italy) – results of environmental and performance monitoring of gasification plants".

**Language competences**

**Italian:** mother tongue

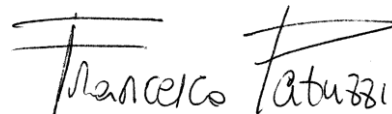
**English:** very good reading, writing and verbal skills (CAE C1 certificate achieved in December 2012, internal unibz C1 certificate achieved in June 2018)

**German:** basic knowledge (A2 Goethe certificate achieved in June 2018)

The undersigned gives his consent to his personal data being processed, within the limits of the legislative decree 196/2003, for formalities connected with the present procedure.

Date 08/01/2020

Signature

Handwritten signature of Francesco Fatuzzi in black ink.