ORGANISED BY IWWG - INTERNATIONAL WASTE WORKING GROUP

VENICE 2020

8TH INTERNATIONAL SYMPOSIUM ON ENERGY FROM BIOMASS AND WASTE

16 - 19 November 2020

VIRTUAL EDITION

SYMPOSIUM PROGRAMME / UPDATED ON 16/11/2020

MONDAY NOVEMBER 16

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H.11:45-13:00 UTC+1

OPENING SESSION

Chair / *Presidente:* Raffaello Cossu (IT)

h. 11:45 - 12:15 WELCOME ADDRESSES AND INTRODUCTION

Raffaello Cossu
University of Padova (IT)

William Clarke
University of Queensland (AU)

Jianguo Liu
Tsinghua University (CN)

Michael Nelles
Rostock University (DE)

Jianhua Yan
Zhejiang University (CN)

Rainer Stegmann
Technical University of Hamburg-Harburg (DE)

Anders Lagerkvist
Lulea University (SE)
IWWG International Waste Working Group President

H. 12:15 - 12:45 OPENING LECTURE
THE COPENHILL WASTE TO ENERGY PLANT

PATRICK GUSTAVSSON
Managing Director of the Amarger Bakke Foundation, Copenhagen (DK)

Amager Bakke, also known as Amager Slope or Copenhill, is a combined heat and power waste-to-energy plant and sports facility in Amager, Copenhagen, Denmark. It opened in 2017 and partially replaced the nearby old incineration plant in Amager. The two plants play a major role in Copenhagen's ambitions of being zero carbon by 2025.
The plant opened on 30 March 2017. It is estimated to cost $670 million, and is expected to burn 400,000 tons of municipal solid waste annually. It also houses a sports facility designed by Bjarke Ingels Group with an 85 m (279 ft) tall sloped roof that doubles as year-round artificial ski slope, hiking slope and climbing wall, which opened to the public October 4–6, 2019.
Technically, it is designed to change between operating modes, producing 0-63 MW electricity and 157-247 MW district heating, depending on the local heat

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demand and power price. It produces more clean water than it uses. Because of filtration and other technologies, sulphur emission is expected to be reduced by 99.5% and NOx by about 95% as well as dioxins and HCl and it is claimed to be the cleanest incineration plant in the world.
A special feature of this facility will be that the chimney is intended to not emit its exhaust continuously, but instead in the form of “smoke” rings (consisting of water vapour rather than actual smoke).
The Amager Bakke Foundation is responsible for the realization and administration of the recreational facilities at Copenhill - the combined energy plant and rooftop park. The facilities include Denmark’s largest ski-slope, the worlds tallest climbing wall, a cafeteria and visitor platform with stunning views of the city and region and ski rental/service facilities. Denmark’s new landmark opened in October 2019, within time and budget.

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SESSION A1
BIOMASS AND WASTE CHARACTERIZATION
Chair / *Presidente:* Gabriela Ionescu (RO)

M. Falzarano, A. Polettini, R. Pomi (IT)
Assessment of the characteristics of bio-based plastics in terms of composition and biodegradability

J.M. Brand Betancourt, J.A. Lozano-Moreno, L.M. Flórez Pardo (CO)
Logistic analysis for the coffee mucilage supply to a bioethanol pilot plant

I. Tello Gomez (CO)
Country level analysis of agricultural residues resources potential for biomass energy in South America

SESSION B1
BIOMASS TO ENERGY IN DEVELOPING COUNTRIES I
Chair / *Presidente:* Mert Gulum (TR)

A.N.I. Wijepala Abeysinghe Mudiyanselage, F. Passarini, S. Sorlini (IT)
Feasibility study on municipal solid waste to energy generation technologies in Sri Lanka

N. Sutthasil, T. Ishigaki, S. Ochiai, M. Yamada, C. Chiemchaisri (JP)
Carbon consumption during biodrying of municipal solid waste in tropical Asian condition

J. Fernandes Torres de Souza, S. Almeida Pacca (BR)
The premium cost to enable sustainable charcoal adoption by the Brazilian steel industry

C. Almeida Souza, C. Camolesi Guimarães, A. Ribeiro Machado, R.D. de Aguiar Moraes Amaral, A. Muselli Barbosa (BR)
Definition of future uses for dumpsites based on the approaches of Sustainable Development Goals and environmental services

M.R.R. Sady, N. Zia, V. Grossule, M. Hasan, M. Khalekuzzaman, M.C. Lavagnolo, M. Alamgir (BD)
Performance of nutrients removal from leachate through phytoremediation by Mangrove and Canna Indica planted reactors

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SESSION C1: meet the expert
ENERGY FROM FOOD WASTE
PROF. MICHAEL NELLES, University of Rostock (DE)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

Biogenic waste (kitchen and garden waste, biowaste from the food industry, restaurant waste, biogenic waste in agriculture, etc.) occurs in large quantities worldwide. Current disposal practices lead to significant environmental problems. Possible solutions which are already practiced in many countries are the separate collection and combined material-energetic recycling of biowaste. In his lecture, Michael Nelles will present the current status and the developments with a focus on energetic recovery as the basis for the subsequent discussion.

Michael Nelles is full professor of Waste Management and Material Flow at the faculty of Agricultural and Environmental Science, University of Rostock, Germany. He is the Scientific Director of the German Biomass Research Centre (DBFZ) in Leipzig and Member of Scientific Advisory Boards for different national and international conferences and journals. He is author of over 300 articles, chapters in books and journals. His research activity is oriented to: fundamental and applied aspects of waste management, with focus on technological, environmental and economic aspects to mechanical, biological and thermal treatment systems of waste and biomass in different recycling and recovery routes.

SESSION D1
IWWG REGIONAL BRANCHES - A GLOBAL VISION ON WASTE & BIOMASS MANAGEMENT - THE ENERGY OPTION

Chair / *Presidente:* Marco Ritzkowski (DE)

In this critical review session, representatives of the IWWG Regional Branches will share their points of view and experiences on Waste & Biomass management, describing the situation in their own country or geographic area. The session aims at providing a global vision on the current issues related to topics such as biogas from landfills, biogas from anaerobic digestion, energy from waste thermochemical plants.

A. Tsybina (RU): IWWG Regional Branch for Russia and New Independent States (IWWG-RUNISRB)

M.A. Gandini (CO): IWWG Regional Branch for Latin America (IWWG-LARB)

A. Ben Hassen Trabelsi (TN): IWWG Regional Branch for the Middle East and Northern Africa Region (IWWGMENARB)

C. Trois (ZA): IWWG Southern African Regional Branch (IWWG-SARB)

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SESSION A2
DECISION TOOLS AND STRATEGIES
Chair / *Presidente:* Cora Bulmau-Gheorghe (RO)

F. Gievers, A. Loewen, M. Nelles (DE)
Life cycle assessment of sewage sludge pyrolysis – Environmental impacts of biochar as carbon sequestrator and nutrient recycler

S. Masi, I.M. Mancini, M. Caivano, D. Caniani (IT)
Bioenergy chains from wastewater reuse: technological aspects and environmental sustainability

S. Piippo, E. Pongrácz (FI)
Sustainable biomass production, bio-waste management and land use through cascade use of biomass

P. Llanquileo-Melgarejo, M. Molinos-Senante (CL)
Assessing eco-productivity change in Chilean municipal solid waste services

SESSION B2
WORKSHOP - WHAT SHOULD DEVELOPING COUNTRIES LEARN FROM DEVELOPED COUNTRIES
Chair / *Presidente*: Jianguo LIU (CN)

To be announced

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SESSION C2: meet the expert
WASTE TO ENERGY / INCINERATION (MSW, HAZARDOUS WASTE, SLUDGE)
PROF. JIANHUA YAN, Zhejiang University (CN)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

Professor Jianhua Yan is the vice president of Zhejiang University, director of National Engineering Laboratory for Waste Incineration Technology and Equipment, and chair professor of the Cheung Kong Scholars Award Program.
His major research interests include clean combustion, pyrolysis and gasification, pollutant control, combustion acquisition, environmental protection in the energy conversion process and waste derived energy, etc.
He has published 305 scientific papers and eight books. He owns 57 Chinese invention patents.
He got one State Technology Invention Award (second prize), three State Science and Technology Progress Awards (second prize) and one State Innovation Team Award. Professor Yan served as co-chair of the Association of Chinese Graduate School (ACGS) from 2012 to 2016.
He is a member of the Discipline Appraisal Group under the State Council. He is vice chairman of the National Alliance of Innovative Waste to Energy.

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SESSION D2 / ITALIAN SESSION
WORKSHOP: BIOFEEDSTOCK - SVILUPPO PIATTAFORME TECNOLOGICHE INTEGRATE PER LA VALORIZZAZIONE DI BIOMASSE RESIDUALI I

Chairs / *PresidentI:* Salvatore Masi, Università degli Studi della Basilicata, Piero Salatino, Università degli Studi di Napoli, Federico II (IT)

La sessione riporterà agli intervenuti i principali risultati del progetto PON-Ricerca "BIO-FEEDSTOCK" a poco più di metà del suo stato di avanzamento e si svolgerà nella forma di una Tavola Rotonda con brevi interventi mirati di ricercatori coinvolti nel progetto e con interazione con il pubblico.
Gli interventi rispondono alla finalità di fornire risposte e di presentare e commentare indirizzi scientifico-tecnologici con riferimento ad alcuni temi centrali rispetto alla valorizzazione energetica delle biomasse, partendo dalle specifiche esperienze e conoscenze sviluppate nell'ambito del progetto.
Tra i temi che saranno affrontati: inventari delle biomasse residuali su scala territoriale quantitative effettivamente disponibili; criticità ed adattabilità agli scenari operativi delle tecnologie di conversione delle biomasse solide ed ad alto tenore di umidità; valorizzazione dei sottoprodotti e la gestione degli effluenti; creazione di filiere economicamente ed ambientalmente sostenibili.

Lista degli argomenti:

- Valorizzazione delle biomasse residuali e bioraffineria
- Disponibilità e qualità delle biomasse residuali nelle Regioni Basilicata, Campania e Sicilia
- Stato e prospettive della liquefazione idrotermale
- Bio-oli di qualità da pirolisi veloce
- Percorsi integrati di valorizzazione dei fanghi da depurazione civile
- La valorizzazione delle biomasse lignocellulosiche attraverso percorsi idrolitico-fermentativi: stato e prospettive
- La valorizzazione dei sottoprodotti e la gestione degli effluenti
- Selezione, integrazione ed ottimizzazione delle filiere di valorizzazione: strumenti di supporto alle decisioni

Nel corso della Tavola Rotonda saranno stimolati interventi e domande dal pubblico.

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SESSION A3
PROCESS MODELING I
Chair / Presidente: Vincenzo Torretta (IT)

T. Rymarz, M. Dudynski, K. Kwiatkowski (PL)
CFD simulation of biomass gasification with OpenFOAM solver biomassGasificationFoam

A. Coppola, R. Migliaccio, G. Ruoppolo, R. Solimene, M. Urciuolo, P. Brachi, R. Chirone, P. Salatino, E. Tinashe Ganda, F. Scala (IT)
Technological pathways for high quality bio-oil production via fast pyrolysis in fluidized bed

E.S. Dogbe, M. Mandegari, J. Gorgens (ZA)
Towards energy efficiency improvement: exergy analysis of a typical sugar mill

A. Mas Herrador, J. Schuster, Y. Fu, M. Petranikova, B. Ebin (SE)
Thermodynamic process modeling and experimental validation of fluorine recovery from spent pot lining (SPL) used in aluminium smelting

J. Rivas, M.C. Sadino-Riquelme, I. Garcés, A. Carvajal, A. Donoso-Bravo (CL)
CFD modeling of an abiotic UASB reactor. Validation through DTR analysis

SESSION B3
BIOFUELS
Chair / *Presidente:* Umberto Arena (IT)

J. Kannengiesser, A. Vogt, I. Steinberg, L. Schebek (DE)
Production potential of carboxylic acids from different waste fractions for a subsequent generation of biobased products

K.A. Vogt, J. Kannengiesser, I. Steinberg (DE)
Optimisation of the treatment method for biological waste to produce biobased products

F. Asunis, G. De Gioannis, G. Francini, L. Lombardi, M. Magnatta, A. Muntoni, A. Polettini, R. Pomi, A. Rossi, D. Spiga (IT)
Bioproducts and biofuels from sheep cheese whey: environmental benefits evaluations

A. Roubaud, B. Lacaze, G. Haarlemmer (FR)
Bio-oil production from biogenic wastes, the hydrothermal conversion step

M. Gülüm, A. Bilgin (TR)
Numerical study on the effect of injection pressure and ambient-density on spray penetration of biodiesel and diesel fuel

M. Gülüm, A. Bilgin (TR)
Comparison of models in predicting viscosities of biodiesel-diesel fuel blends

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SESSION C3: meet the expert
CONCEPT OF WASTE-DRIVEN FACTORY AND CIRCULAR ECONOMY

PROF. ABDUL-SATTAR NIZAMI
Government College University, Lahore, Pakistan

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

A waste-driven factory is intended to valorize waste sources as renewable feedstock to recover value-added chemicals, materials, alternative fuels, and energy. This concept aims to integrate waste treatment, resource recovery, alternative fuels, and energy generation to shift from fossil-based linear economies to circular economies. Although the traditional linear economies have resulted in rapid economic growth, but at the cost of increasing energy demands, environmental pollution, and climate change. Recently, the Paris COP21 summit has set out a roadmap to reduce greenhouse gases (GHGs) emissions to keep global warming to 'well below 2°C'. Like global warming, the tremendous waste generation and its unsustainable disposal have emerged as a potential threat to our civilization. It is estimated that the current waste generation rate would escalate by three times by 2025. Traditional waste remediation methods are concerned with waste removal from collection points and their disposal in designated dumping sites where waste valorization to generate energy and other value-added products are rarely performed. These sites have become a major source of GHGs emissions contributing to climate change. As a result, nations are now focusing on treating or refining wastes instead of disposing, striving to recover energy and value-added products from waste to achieve a circular economy. In better words, using closed-loop waste bioprocessing units, the inherent net positive energy contained in solid, liquid, and gaseous wastes is harnessed and utilized as energy carriers. Despite their promising features, these individual processing technologies are incapable of handling the huge volume of waste at a single platform to achieve zero waste concept.
They suffer from limited efficiencies and high capital and maintenance costs. Therefore, if these waste processing or waste-to-energy technologies could be integrated through the under-one-roof concept of a waste-driven factory, a significant part of wastes can be treated by various specialized techniques, while their outputs (heat, power, and fuel) could suffice the operating requirements of each other.

Dr. Abdul-Sattar Nizami has a Master of Science in Engineering from the Chalmers University of Technology, Göteborg, Sweden. He has a Ph.D. in Sustainable Gaseous Biofuel from the School of Civil and Environmental Engineering, University College Cork, Ireland. He served as an Assistant Professor and Head of Solid Waste Management Unit at the Center of Excellence in Environmental Studies (CEES) of King Abdulaziz University, Jeddah, Saudi Arabia. He is currently working as a Professor (Associate) at Sustainable Development Study Centre, Government College University, Lahore, Pakistan.
He has published more than 100 papers on renewable energy, alternative fuels, waste-to-energy, catalytic pyrolysis, anaerobic digestion, and resource recovery. His work is cited more than 5220 times in the peer-review press, with a total impact factor of more than 500 and H-index of 39.

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SESSION D3 / ITALIAN SESSION
WORKSHOP: BIOFEEDSTOCK - SVILUPPO PIATTAFORME TECNOLOGICHE INTEGRATE PER LA VALORIZZAZIONE DI BIOMASSE RESIDUALI II

Chairs / *PresidentI:* Salvatore Masi, Università degli Studi della Basilicata, Piero Salatino, Università degli Studi di Napoli, Federico II (IT)

Durante la sessione D3 continuerà la Tavola Rotonda iniziata nella sessione precedente.

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- La valorizzazione delle biomasse lignocellulosiche attraverso percorsi idrolitico-fermentativi: stato e prospettive
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WASTE ARCHITECTURE PLATFORM

VIRTUAL TECHNICAL TOUR

COPENHILL WASTE TO ENERGY PLANT AND SKI SLOPE - COPENHAGEN (DANIMARCA)

Chair / *Coordinatore:* Marco Ragazzi, Scientific Secretary Venice 2020
Guests: Dr. Patrick Gustavsson, Managing Director Amarger Bakke Foundation
Dr. Niccolò Bertocchi, Chief Executive Officer of Neveplast
Dr. Ole Hedergaard Madsen, Technology director in B&W Vølund

The technical tours of this digital edition, will be organized as virtual tours inside the plants, in live streaming or with pre-recorded videos. The Virtual Technical Tours will allow for live interaction between speakers and participants: using the Q&A tool, delegates will be able to send questions which will be answered live by the coordinators and the invited guests. Attendees may also be invited to join the discussion with camera and microphone.

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It is a unique project that adds an important page to the history of technology applied to sustainability, design and sports culture. Amager Bakke has been renamed Copenhill, which refers to this 'hill' in Copenhagen, because that is basically what Copenhill is: an ultramodern waste-to-energy plant, as well as a mountain measuring almost 90 metres in height, where it is now possible to ski 365 days a year. Copenhagen's state-of-the-art Amager Bakke sets new standards for environmental performance, energy efficiency and waste treatment capacity.
Just across the bay from the queen's palace, it includes a roof-top ski slope and a hiking trail, with trees growing on landscaped sections. The plant was constructed by Amager Ressourcecenter, owned by five Copenhagen municipalities.
Amager Bakke is equipped with two furnace lines and a joint turbine and generator system. Each line burns 35 tonnes of waste per hour and is designed to:

- Treat approximately 400,000 tonnes of waste annually produced by 600,000 inhabitants and at least 46,000 companies
- Supply a minimum of 50,000 households with electricity and 120,000 households with district heating
- Supply 440 °C steam at 70 bar, which doubles the electrical efficiency compared to the former plant
- Emit much lower emissions than the EU's stringent 2019 Best Available Techniques Reference Document for Waste Incineration

The craziest ski resort in the world boasts a 400-metre long ski slope, served by four lifts, including ski lifts and conveyor belts, and is entirely made in Italy. The dry ski slope was produced by Neveplast, a company based in Bergamo, world leader in the field of artificial ski slopes.

SPECIAL THANKS TO THE AMARGER BAKKE FOUNDATION

The Amager Bakke Foundation is responsible for the realization and administration of the recreational facilities at Copenhill.

FONDEN AMAGER BAKKE

THE TECHNICAL TOUR IS ORGANISED WITH THE SUPPORT OF NEVEPLAST

Contact: Camilla Ronchi
Via Galvani 18, 24061 Albano
Sant'Alessandro (BG) Italy
neveplast@neveplast.it
www.neveplast.com

artificial snow fun neveplast

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PLENARY SESSION

PUBLISHING A PEER REVIEWED JOURNAL ARTICLE ON WASTE MANAGEMENT - WHAT ARE EXPECTATIONS AND WHAT ARE REVIEWERS LOOKING FOR?

Chair / *Presidente:* Raffaello Cossu (IT)

It is known that, when compared to journal papers, Symposium papers are normally shorter and are structured to attract the attention of Symposium delegates, who need an idea of what the presentation will look like. Therefore, not all symposium papers should be submitted to a scientific journal, and in most cases will require improvements to be considered. Additionally, the restructuring should be done based on the requirements set by specific journals.
For this reason, as a special feature of 2020 Edition of Venice Symposium, a plenary session is scheduled with the participation of Editors-in chief of some of the main journals in the area of waste management.
After introductory presentations by the Editors-in chief, we will have an open discussion with potential Authors and Referees.
The focus will be on the characteristics that a journal paper should have (What are the editor and the reviewer looking for in a manuscript? Is the topic within the scope of the journal and of interest for the journal? Journals require novelty: what is new? Are the results robust and transparent?) and what an editor can expect from a reviewer (Why should you do a review? Professional responsibility, positive attitude and be constructive in comments).

Introductory lectures:

Prof. RAINER STEGMANN, *Technical University of Hamburg-Harburg (DE)*
Publishing: are we on the right track?

Prof. SOTERIS KALOGIROU, *Cyprus University of Technology (CY)*
Editor in Chief of Renewable Energy, Elsevier
Ethics in publishing

Confirmed Speakers:

Prof. UMBERTO ARENA, *University of Campania Luigi Vanvitelli (IT)*
Editor in Chief of Waste Management Journal - Elsevier

Prof. RAFFAELLO COSSU, *University of Padova (IT)*
Editor in Chief of Detritus - Multidisciplinary Journal for Waste resources and Residues, CISA Publisher

Prof. GERASIMOS LYBERATOS, *National Technical University of Athens (GR)*
Editor in Chief of Journal of Hazardous Materials, Elsevier

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SESSION A4
PROCESS MODELING II
Chair / *Presidente:*

V. Messerle, A. Ustimenko, O. Lavrichshev, R. Baimuldin, N. Slavinskaya, Z. Sitdikov (KZ)
Numerical and experimental investigation of medical and biological waste plasma gasification in different media

R. Pujan, H.A. Preisig (NO)
Systematic modelling of a butanol fermentation equipped with in-situ gas stripping

X. He, D. Chen (CN)
Prediction of MSW pyrolysis product distributions with an Artificial Neural Network model based on relational database

D. Piazzullo, M. Costa, F. Calise, M. Vicidomini, M. Dentice d'Accadia (IT)
Technical, economic and environmental feasibility of a real hybrid mCHP system based on residual biomass gasification and solar PV: a transient numerical study

SESSION B4
ANAEROBIC DIGESTION - PROCESS OPTIMISATION I
Chair / *Presidente:* Marco Schiavon (IT)

C. Eden, R. Eden, M. Moulden (GB)
Optimisation of anaerobic digestion by removing, recovering and reusing ammonia

C. Lee, M. Ju, J.Y. Kim (KR)
Chronic effect of chlortetracycline antibiotics on methane generation of lab-scale anaerobic continuously-stirred tank reactors treating swine manure

J.O. Ogwang, M. Kalina, A. Jegede, N. Mahdjoub, C. Trois (ZA)
The development of an optmised small scale anaerobic digester design for rural South African areas

E. Rossi, I. Pecorini, R. Iannelli (IT)
Comparison of semi-dry and wet anaerobic digestion of food waste in a pilot scale approach

G. Ferrari, F. Marinello, A. Pezzuolo (IT)
A comparison of performance indices of biogas plant feedstock

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SESSION C4: meet the expert
GRATE SYSTEM PERFORMANCES
CHRISTOPHE CORD'HOMME, CNIM Group (FR)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

As engineer of "Mines Paris Tech", Christophe Cord'Homme began his career at the National Agency for Nuclear Waste Disposal (ANDRA). From 1988 to 1993 he served as project manager for ENTROPIE S.A. to build thermal desalination plants and absorption chillers. Since 1993, he has been working for CNIM group, initially as commercial manager for waste and flue gas treatment. He joined LAB in 2001, first to serve as sales director, and evolved as project director and finally in the position of General Manager Delegate of LAB S.A. Member of the board of LAB, he became in 2011, Development Director for the Environment and Renewable Energies sector of CNIM Group.

SESSION D4
BIOMASS TO ENERGY IN DEVELOPING COUNTRIES II

Chair / *Presidente:* Mert Gülüm (TR)

N. Nijhum, N. Zia, V. Grossule, P. Datta, M. Khalekuzzaman, M.C, Lavagnolo, M.Alamgir (BD)
Comparison of the leachate phytotreatment performance by using Heritiera Fomes and Canna Indica

S. Aldjia, M.N. Ait Aoudia (DZ)
Domestic waste management issue in Bejaia City

L. Santa, Y. Areiza, N. Montes, O. Gutiérrez (CO)
Physicochemical characterization of natural clinoptilolite for potential use as a catalyst

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SESSION A5
HYDROTHERMAL AND OTHER PROCESSES
Chair / *Presidente:* Nicole Berge (US)

L. Lombardi, S. Fabrizi, T. Foschi, B. Mendecka, F. Tuci (IT)
Environmental assessment of hydrothermal carbonization of mechanically separated organic fraction from mixed MSW on industrial scale

S. Pinto Altamiranda, J. Aristizabal Restrepo, C. Barrera Causil, O. Gutiérrez, M.E. Gonzalez (CO)
Microwave-assisted hydrothermal carbonization: a review

S.Z. Tarhana, A.T. Kocera, D. Ozcimena, I. Gokalp (FR)
Cultivation of green microalgae by recovering aqueous nutrients in hydrothermal carbonization process water of biomass wastes

C.S. Costa, M.R. Ribeiro, J.M. Silva (PT)
Hydrocracking of HDPE over H-USY and mesostructured acidic materials: Accessibility and Acidity effects

G. Costa, R. Garavaglia, F. Sciommarella, F. Lombardi (IT)
Analysis and treatment options for different size fractions of dry-discharged RDF incineration bottom ash in view of recycling

SESSION B5
ANAEROBIC DIGESTION - PROCESS OPTIMISATION II
Chair / *Presidente:* Kazuei Ishii (JP)

S.P. Lohani (NP)
Seasonal performance of a simple urban biodigester

S. Matassa, S. Papirio, G. Esposito, F. Pirozzi (IT)
New bioenergy perspectives from anaerobic digestion of cheese whey and hemp biomass residues

B. Dhungana, D. Paudel, S.P. Lohani (NP)
Startup of anaerobic digester fed with cattle manure

J.-R. Bastidas-Oyanedel, J.E. Schmidt (DK)
Alternatives to increase economic profit in anaerobic digestion

A. Chiumenti, S. Tedesco, F. da Borso (IT)
Anaerobic digestion of spent mushroom cultivation substrate (compost and peat)

W. Peng, H. Zhang, F. Lü, L. Shao, P. He (CN)
Biochar from anaerobically digested food waste digestate for nutrients retention

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SESSION C5: meet the expert
THE HTC PROCESS FOR RESIDUAL BIOMASS VALORIZATION
LUCA FIORI, University of Trento (IT)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

The talk presents a general overview of the hydrothermal processes, and then it focuses on hydrothermal carbonization (HTC).
How does HTC work, which the suitable waste, which the HTC products and their potential uses, which the prospects and challenges of this appealing technology for residual biomass valorization.
Finally, the EU project C2Land funded by the EIT Climate-KIC - centered on OFMSW valorization through coupling anaerobic digestion, HTC and composting - is outlined.

Luca Fiori is Associate Professor of Chemical Engineering at the University of Trento. His research interests deal with the valorization of residual biomass and organic waste for energy and material recovery. He is passionate about the biosphere and the circular economy which he declines in terms of innovation in process engineering.
In the last years Luca Fiori research group become an international reference as regard to hydrothermal processes, hydrothermal carbonization (HTC) in particular.

TUESDAY NOVEMBER 17
H.14:45-16:00 UTC+1

SESSION D5
PHD RESOURCES AND DISSEMINATION

Chair / *Presidente:* Gabriela Ionescu (RO)

The session is open for all master and PhDs students, Postdocs, researchers, and experts who are interested to share their knowledge and experiences related to the different resources and dissemination practices. Depending on each professional stage, several questions will be raised, presented and discussed, such as:

- Which platforms can I use for my documentation?
- How can I get in contact with other research groups and how can I approach them?
- What PhD thesis in the international cotutela regime means and what implies?
- Why is dissemination important?
- Which are the methods, tools, and good practices for research dissemination?
- How can I find the right dissemination tool?
- How can I get my research more visible?
- From where could I obtain a grant for participation at conferences, seminars, workshops, scientific events?
- Where can I find funding schemes for my research and how can I get one? Should I pursue a postdoctoral fellowship or not?
- What are my or the coordinator hopes, fears, and expectations during my *Ph.D./Postdoc?*

Introductory Lecture:

Gareth Dyke
Publishing in a peer reviewed journal: managing rejection as an author

THE SESSION IS ORGANISED WITH THE SUPPORT OF REVIEWER CREDITS SRL
Via Giosuè Carducci 8, 20123 Milano (IT)
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TUESDAY NOVEMBER 17
H.16:15-17:30 UTC+1

SESSION A6
HYDROTHERMAL PROCESSES
Chair / *Presidente:* Anders Lagerkvist (SE)

N.L. Taufer, V. Benedetti, Y. Matsumura, M. Baratieri (IT)
Coupling HTC of digestate and SCGW: from liquid waste to hydrogen

V. Bendetti, M. Pecchi, S. Celletti, D. Basso, F. Patuzzi, T. Mimmo, S. Cesco, M. Baratieri (IT)
Digestate valorization by hydrothermal carbonization

C. Prestigiacomo, V.A. Laudicina, A. Siragusa, O. Scialdone, A. Galia (IT)
Hydrothermal liquefaction of municipal sludge in sub- and super- critical water

J. Paini, V. Benedetti, M. Baratieri, F. Patuzzi (IT)
Towards a food waste integrated biorefinery: Investigation of apple pomace valorisation through a cascade processing

D. Arapoglou, I. Karalis, G. Markou, C. Eliopoulos, S. Papanicolaou (GR)
Ethanol production using cladodes of prickly pear cactus as feedstock

SESSION B6
ANAEROBIC DIGESTION - BIOGAS POTENTIAL
Chair / *Presidente:* Margherita Ferrante (IT)

F. Gavagnin (IT)
Biomethane production from OFMSW an innovative technology for the waste pretreatment and “dry” anaerobic digestion

J. Sprafke, N. Lajewski, M. Nelles (DE)
Influence of co-substrates from industrial and agricultural origin on the continuous fermentation of biowaste

M. Carchesio, M. Di Addario, F. Tatàno, S. de Rosa, A. Gambioli (IT)
Biochemical methane potential of intermediate and final outputs from biostabilisation MBT

TUESDAY NOVEMBER 17
H.16:15-17:30 UTC+1

SESSION C6: meet the expert

HEALTH RISK ASSESSMENT FROM THE EMISSIONS OF THERMOCHEMICAL WASTE-TO-ENERGY PLANTS

MARCO SCHIAVON University of Trento (IT)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

At present, the thermochemical treatment of waste represents a fundamental step in integrated waste management. Thermochemical waste treatments, such as incineration, gasification and pyrolysis, give the advantage of reducing the amount of waste to landfill, converting the waste into inert material and, meanwhile, recovering energy. Thermochemical waste-to-energy (WtE) plants have been subjected to more and more stringent regulations over the last decades, concerning the emission limit values of a large range of hazardous substances. Stricter regulations, combined with the definition of the best available techniques for this sector, have determined a significant decrease in the emissions of air pollutants from the waste sector, with specific regards to dioxin. On the other hand, this has let other contaminants emerge as primary pollutants of concern for public health, such as heavy metals. Among metals, chromium should receive specific attention. Its hexavalent form (Cr VI) has the maximum carcinogenic potency among heavy metals. Recent literature studies demonstrate that thermochemical WtE plants could be an important source of Cr VI in the atmosphere. Since inhalation represents the major route of exposure, the issue of Cr VI emissions should be considered carefully when assessing the potential health risk from WtE plants, for instance during the environmental impact assessment procedure. In addition, in the European Union, the current legislation does not consider the role of Cr VI, but only sets one overall stack concentration limit value for the sum of the concentrations of a large group of heavy metals, including total Cr. In the light of the importance of this topic and on the potential consequences for public health, this work has the following targets:

- to present a methodology to carry out a complete health risk assessment when dealing with existing or planned thermochemical WtE plants;
- to highlight the potential role of the different air pollutants, with a specific focus on Cr VI;
- to provide insights into new criteria that the environmental legislation should consider not to underestimate the potential role of heavy metals for human health. To facilitate the understanding of the topic, an example based on a real case study will be provided.

Marco Schiavon graduated at the University of Trento (Italy) in 2010 and obtained his PhD in Environment Engineering in 2016
His research activity focuses on environmental pollution, health risk estimation, waste management, air quality monitoring and modeling, and air pollution control technologies. He took part as a speaker in 13 international conferences. He is the author and co-author of 49 peer-review publications indexed in the Scopus database.

TUESDAY NOVEMBER 17
H.16:15-17:30 UTC+1

SESSION D6
POSTER DISCUSSION I

Posters will be provided as PDF files, accessible at all times and easily downloadable. Delegates will be able to comment and ask questions to the authors via Q&A and chat.
Three poster discussion hubs will be held during the symposium, where poster presenters and other delegates can meet, network and discuss the poster topics and findings.
Poster discussions will be highly interactive sessions: authors will have the chance to present their poster, providing additional information, highlighting key points and answering questions in a live Q&A discussion.

A. Karaeva, M. Schiavon, V. Torretta, F. Conti, M. Ragazzi, E. Magaril, E.C. Rada (IT)
Perspectives of green energy development in an industrial region under a circular economy vision

G. Vinti, M. Vaccari (IT)
PM10, PM2.5 and CO concentration in smokes from inefficient cooking systems in rural communities of Ghana and health implications

C. Hartung, V. Dandikas, H. Heuwinkel, T. Eickenscheidt, C. Zollfrank, M. Drösler (DE)
Influence of the harvest date on the specific biogas production from Typha latifolia and Phalaris arundinacea

C. Camolesi Guimarães (BR)
Is encouraging behaviour intentions an effective way to promote household recycling?

J.L. Toro-Trochez, E.S. Carrilo-Pedraza, D. Bustos-Martínez, L. Sandoval Rangel (MX)
Catalytic pyrolysis of soybean hulls: a focus on obtaining oil and char

F. Di Lauro, M. Balsamo, R. Solimene, F. Montagnaro, P. Salatino (IT)
Hydrothermal liquefaction for the production of energetic vectors from residual materials: literature analysis and characterisation of a tannery sludge

TUESDAY NOVEMBER 17
H.17:45-18:30 UTC+1

VIRTUAL TECHNICAL TOUR

CADINO PLANT: ANAEROBIC DIGESTION, COMPOST, BIOGAS PRODUCTION - ITALY

Chair / Coordinatore: Marco Ragazzi, Scientific Secretary Venice 2020
Guest: Dr. Michele Zorzi, Technical Manager at Bioenergia Trentino

The technical tours of this digital edition, will be organized as virtual tours inside the plants, in live streaming or with pre-recorded videos. The Virtual Technical Tours will allow for live interaction between speakers and participants: using the Q&A tool, delegates will be able to send questions which will be answered live by the coordinators and the invited guests. Attendees may also be invited to join the discussion with camera and microphone.

TUESDAY NOVEMBER 17
H.17:45-18:30 UTC+1

Since 2012, Bio Energia Trentino (BET) srl treats 75% of the organic waste produced annually in the Trentino area. Currently, the plant is in the organizational process to receive the remaining part of the waste produced in the area. The company is currently authorized to collect and recover 40,000 tons/year of organic waste resulted from the municipal solid waste stream and 14,500 tons/year of green waste.
The company's purpose is to recover these materials by transforming them into by-products, which can be useful and ecologically compatible resources. Briefly, the wet waste is transformed into a first section (this phase is called anaerobic digestion), inside two hermetically sealed containers and isolated from the outside (digesters), by anaerobic microorganisms, which in the absence of oxygen degrade the organic matter contained in the waste and at the same time produce biogas.
The latter is a gas composed of 60% methane, which is captured and used in a cogeneration engine, in which it is transformed into renewable electricity then fed into the grid. The digested substance is sent to the aerobic stabilization section (composting) where aerobic microorganisms finish degrading the organic substance until obtaining a top-quality soil conditioner (compost).
Currently, the BET is building a new section for the transformation of biogas into biomethane. The project will allow BET to produce about 450 Sm^3/h of biomethane that will be pressurized (at 70 bar) and, through the national network, transported to the filling station of the region, to power the current fleet of 42 methane buses (which will be expanded to 64). The UpGrading plant will consist of a biogas purification system, to raise the CH_4 content from 60% to a minimum value of 97%, removing the unwanted components (mostly CO_2 and H_2S) from the biogas.

THE TECHNICAL TOUR IS ORGANISED WITH THE SUPPORT OF BIOENERGIA

Loc. Cadino 18/1
38010 Faedo (TN), Italy
Tel. +39 0461 669008
info@bioenergiatrentino.it
bioenergiatrentino.it

BIOENERGIATRENTINO

WEDNESDAY NOVEMBER 18

WEDNESDAY NOVEMBER 18
H.11:45-13:00 UTC+1

SESSION A7
THERMAL TREATMENTS: COMBUSTION
Chair / *Presidente:* Elena Cristina Rada (IT)

C. Cord'Homme (FR)
Energy-from-Waste (EfW): a sustainable pillar of Circular Economy and resource management

S. Andersson (SE)
Continuous PCDD/F sampling utilizing an ADIOX scrubber

K. Ishii, R. Kizuka, S. Ochiai, M. Sato (JP)
Improvement of logistics efficiency and combustion behavior for rice straw pellets by torrefaction and mixing with wood chips

C. Velis (GB)
Safeguarding post-production quality assurance of solid recovered fuels: an affordable and accurate sub-sampling laboratory scheme

A. Znidarcic, T. Katrasnik, T. Seljak (SI)
Small scale incineration system for localized sewage sludge treatment

SESSION B7
ANAEROBIC DIGESTION - BIOGAS EXPLOITATION
Chair / *Presidente:* Costantinos Psomopoulos (GR)

A. Lukanin, E. Klevanova, A. Kurbatova, M. de Martino, P. Kozhevnikova (RU)
Processing landfill gas into gas motor fuel using methane gas hydrates

J. Lindorfer, D. Cenk Rosenfeld, K. Fazeni-Fraisl (AT)
Analysis of renewable gas potential from residual biomass and power-to-gas in Austria by 2040

J.V. Mercado, M. Koyama, K. Nakasaki (JP)
Short-term changes in the anaerobic digestion microbiome and pathways with changes in organic load

D. Panepinto, V. Riggio, M. Ravina, G. Campo, A. Cerutti, M.C. Zanetti (IT)
Analysis of different solutions for by-products management and valorization

WEDNESDAY NOVEMBER 18
H.11:45-13:00 UTC+1

SESSION C7: meet the expert
PYROLYSIS OF PLASTIC WASTES: PRODUCT, REACTORS AND POLLUTION CONTROL
DEZHEN CHEN, Tongji University (CN)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

About 40 % of plastic products end their lifespan in 1-2 years and become wastes, therefore dealing with the plastics wastes is a common task worldwide. From 1950 to 2015, according to statistics, around 8.3 billion tons of plastics products had been produced, of which 2.5 billion tons of them are still in service while 4.9 billion tons of them were abandoned as waste plastics going to landfills or dumping sites. In China the generation of plastics wastes is about 33 million tons annually, the effective measures for dealing with waste plastics are urgently demanded. In 27 Eur opean union countries, 25 million tons of consumed plastics wastes are generated annually. And this number is 150 million tons worldwide. Waste plastics account for 13 % of MSW in USA and 13.5 % in 20 big cities in China. From 2019 the "Zero waste city" plan and municipal solid waste segregation started in China, but when the waste plastics have been segregated as "recyclable wastes", there is none proper destination for them. Incineration treatment of waste plastics is wasting resources as plastics are made from petroleum. For example, 2.3 tons of petroleum is consumed when producing 1 ton of PP. Recycle oil and chemicals from plastics wastes through pyrolysis can be an economic and convenient solution. Oil from plastics is a good substitute for petroleum to refinery plant. The profit can be 1500-3000 Yuan RMB dependent on product quality. Also, pyrolysis achieves high levels of pollution control compared to incineration. In this review, sometime important issues about recycling oil from plastics including products, reactors and pollution control were discussed. [Read more...]

Professor Dezhen Chen is the director of the Institute of Thermal & Environmental Engineering in Tongji University since 2013 and had been promoted to be professor since 2005. Since 1992 Dezhen Chen has been working with municipal solid waste (MSW) incineration and the related pollution control when she began her master thesis, since then she has been working in the WM area with the similar topics for 26 years. Her research interests include innovative waste to energy technology development, incineration flue gas cleaning, MSWI fly ash disposal, life cycle assessment (LCA) of waste management and technologies. She has published about 130 papers in Chinese & international journals and own more than 20 patents, including 2 American patents.

WEDNESDAY NOVEMBER 18
H.11:45-13:00 UTC+1

SESSION D7
POSTER DISCUSSION II

Posters will be provided as PDF files, accessible at all times and easily downloadable. Delegates will be able to comment and ask questions to the authors via Q&A and chat.
Three poster discussion hubs will be held during the symposium, where poster presenters and other delegates can meet, network and discuss the poster topics and findings.
Poster discussions will be highly interactive sessions: authors will have the chance to present their poster, providing additional information, highlighting key points and answering questions in a live Q&A discussion.

A. Karaeva, M. Schiavon, V. Torretta, F. Conti, M. Ragazzi, E. Magaril, E.C. Rada (IT)
Perspectives of green energy development in an industrial region under a circular economy vision

S. Ochiai, M. Ueda, M. Sato, K. Ishii, T. Furuichi (JP)
Study of combustion characteristics of energy crop Miscanthus giganteus using a small biomass burner

J. Mankasem, P. Prasertcharoensuk, A. Phan (GB)
Gasification of waste biomass for hydrogen production: effects of gasification parameters

J. Reichelt, G. Pfrang-Stotz, B. Bergfeldt, M. Ricker (DE)
Small scale-simulation of mineral reactions during the formation of slags in the combustion chamber of biomass heat and power plants

B. Bergfeldt, J. Reichelt, G. Pfrang-Stotz (DE)
Systematic investigation of solid residues from three German biomass power plants

G. Tassinato, S. Della Sala, M. Turatello, C. Cavinato, A. Vania (IT)
I-CHO: carbon cage process for CO2 conversion from biogas

G. Tassinato, P. Miana, A. Stoppato, M. Ballarin, M. Turatello, L. Spicci (IT)
PHOENIX – P2G: Platform for advanced biomethanation research

WEDNESDAY NOVEMBER 18
H.13:15-14:30 UTC+1

PLENARY SESSION

IWWG CRITICAL REVIEW SESSION: WASTE AND COVID-19

Chair / *Presidente:* Anders Lagerkvist (SE)

The COVID-19 pandemic has placed considerable pressure on the waste management system and has challenged the Circular Economy, highlighting the already clearly evident contradictions and fragilities of the system.
The slowing down of a series of industrial activities and the shutting down of yet others, together with the closure of foreign markets have prevented separately collected wastes from finding an appropriate collocation. This in turn has led to a saturation of storage both in recycling plants and, in some cases, in thermal treatment plants. An inverse situation has been created with regard to medical wastes, which in some contexts have increased threefold, with the related management being on the verge of collapsing due to the unexpected deluge of volumes to be handled.
The most important consequence is that our waste management system can be unprepared and, therefore, it can be necessary to rethink our consolidated beliefs regarding plants in particular, and circular economy in general.
The health emergency is not the only emergency that results in a significant variation in the quantity and quality of waste to be disposed of. Developing effective emergency plans for extraordinary waste management, in relation to any possible emergency, is of crucial importance.
In this critical review session, participants will share their point of view and discuss the critical issues that have emerged during the pandemic in their own country, with the aim of reflecting on the future of waste management and its social/environmental impacts.

Introductory lectures

G. Mondelli, E.R. Silva, C.G. Souza, L.H.S Oliveira (BR)
Perspectives of the MSW management in Brazil after COVID-19

M. Alamgir (BD)
Waste Management in the Emergency Settlements: Rohingya Camps in Cox's Bazar

Roundtable confirmed speakers:

Dezhen Chen, Tsinghua University (CN)
Mohamed Osmani, Loughborough University (GB)
Maria Cristina Lavagnolo, University of Padova (IT)
Lidia Lombardi, Niccolò Cusano University (IT)
Aldo Muntoni, University of Cagliari (IT)
Alessandra Polettini, Sapienza - University of Rome (IT)

WEDNESDAY NOVEMBER 18
H.14:45-16:00 UTC+1

SESSION A8
THERMAL TREATMENTS: GASIFICATION AND PYROLYSIS
Chair / *Presidente:* Umberto Arena (IT)

H.E. Nasr, K. Ramzy, T.M. Ismail, S.I. Abdel-Mageed (EG)
Syngas production from biomass using gasification process: an experimental study for diesel engine

M. Dudyński (PL)
Wood gasification. Influence of process parameters on the tar formation and gas cleaning

R. Schu (DE)
Chemical recycling - 30 years of research and development - Status today

O. Sosa Sabogal, S. Valin, S. Thiery, S. Salvador (FR)
Pyrolysis and gasification of solid waste and its components in a lab scale inductionheating reactor

F. Thevenon, M. Marchand, M. Grateau, H. Demey, A. Chatroux, A. de Ryck, T. Melkior (FR)
Continuous torrefaction of resinous wood chips in multiple hearths furnace: mass and energy balances

SESSION B8
IWWG TASK GROUP ON WASTE BIOREFINERY
Chairs / *Presidenti: Luca Alibardi (GB), Aldo Muntoni (IT)*

Keynote speaker:

Luca Alibardi, *Cranfield University (GB)*
Hydrogen in a circular economy

Introductory lectures:

I. Pecorini (IT)
VFA production from pilot scale reactions

A. Polettini, R. Pomi (IT)
Cheese whey fermentation

L. Lombardi (IT)
LCA applied to cheese whey fermentation

WEDNESDAY NOVEMBER 18
H.14:45-16:00 UTC+1

SESSION C8: Meet the expert

A TRACER EXPERIMENT TO VALIDATE AIR POLLUTION DISPERSION MODELS FOR WASTE-TO-ENERGY PLANTS

LORENZO GIOVANNINI, University of Trento (IT)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

The simulation of pollutant dispersion over complex terrain is much more complicated than over flat areas, as dispersion processes are affected by atmospheric interactions with the orography at different spatial scales. Moreover, only few suitable observational datasets are available to be used as benchmark for testing dispersion models over complex terrain.
This contribution presents results from a study aiming at characterising dispersion processes from the incinerator of Bolzano, located in a basin in the Italian Alps. The experiment included a modelling chain, simulating both meteorological processes and pollutant dispersion, and field campaigns, performed to validate the simulated concentration fields against ground measurements of a gas tracer released from the incinerator stack. Two controlled releases of a passive gas tracer were performed in order to investigate the dispersion processes under two typical wintertime meteorological conditions. The first release was performed in the early morning, under stable atmosphere and northerly winds, while the second release was performed in the early afternoon, under weakly unstable atmosphere and southerly winds. Samples of ambient air were collected at several sites, and then analysed by means of a mass spectrometer with a detectability limit of 30 pptv.
Results from the dispersion simulations were analysed and compared against tracer concentration measurements, in order to evaluate the model performance and to get valuable information for the use of the modelling chain for the characterization of the environmental impact of the incinerator.

Lorenzo Giovannini is assistant professor at the Department of Civil, Environmental and Mechanical Engineering of the University of Trento (Italy), where he received his PhD in Environmental Engineering with the thesis "Urban scale phenomena and boundary layer processes in mountain valleys". His research activity focuses mainly on the analysis of atmospheric processes typical of mountainous regions and on the evaluation of microclimatic alterations induced by urban areas, by means of both experimental campaigns and numerical meteorological models. He is involved in different research projects, covering several aspects of applied meteorology, such as pollutant dispersion, support to agricultural practices, estimation of renewable energy sources and optimization of building energy consumption. On these topics he is author of several articles published in international peer-reviewed scientific journals.

WEDNESDAY NOVEMBER 18
H.14:45-16:00 UTC+1

SESSION D8
EU PROJECTS - RESOURCES FROM WASTE: ENERGY AND MATERIALS I

Chair / *Presidente:* Fabio Poretti (IT)

Dissemination and exploitation are integral part of the European research and innovation funding, and certain obligations in this regard arise even at the project proposal. By sharing their results with the rest of the scientific community, researchers contribute to the progress of science in general. Nevertheless, experience shows it's not always easy to meet these goals. In this regard, the combination of SUM 2020 with the Venice 2020 Symposium provides the perfect stage for dissemination of EU projects focusing on the recovery of waste, both in terms of new materials and energy. During the session selected projects will have the chance to present what they have discovered, how they tackled the challenges they encountered and what are the next research steps in the fields covered by their activities.
In this session the following projects will be presented:

J. Rutkowski (GB)
IRS-CESC Project - The role of the informal recycling sector on closing the loops to sustainable cities

M. Smol (PL)
MonGOS - Monitoring of water and sewage management in the context of the implementation of the circular economy assumptions

O. Marzouk (FR)
RE-MED: Apply innovation for the development of circular economy for sustainable construction in the Mediterranean

N. Vincenti (IT)
PolyCE: give a second life to WEEE plastics

A. Castellano (IT)
InnoWEEE: Innovative WEEE traceability and collection system and geo-interoperability of WEEE data

WEDNESDAY NOVEMBER 18
H.16:15-17:30 UTC+1

SESSION A9
RESIDUES FROM WASTE TO ENERGY
Chair / *Presidente:* Deborah Panepinto (IT)

V. Benedetti, M. Scatto, P. Riello, M. Baratieri (IT)
Biomass gasification char: from a waste to an effective filler for polymers

J. Schuster, B.-M. Steenari, B. Ebin (SE)
Recovery of Antimony and other Hazardous Metals from MSWI Fly Ash by Leaching with Tartaric Acid

R. Chaiuppala, A. Saffarzadeh, T. Shimaoka (JP)
Adsorption of heavy metals from MSW incineration fly ash leachate using rice husk ash (RHA) and silica gel derived from rice husk ash

J. Luo, D. Chen, L. Yin, Y. Feng, X. Dai (CN)
Producing methane-rich gas with syngas over MSW pyrolysis char-carried Ni catalysts

H.B. Bahar, A. Saffarzadeh, M. Nag, T. Shimaoka (JP)
Immobilization of heavy metal ions in incineration fly ash-contaminated leachate using processed fishbone: a simulation study

SESSION B9
ANAEROBIC DIGESTION PERSPECTIVES
Chair / *Presidente:* Cristopher Eden (GB)

C. Eden, R. Eden, M. Moulden (GB)
Removing ammonia to optimise anaerobic digestion

C. Eden, R. Eden (GB)
Closing the circle: the anaerobic digestion of palm oil mill effluent

C.B. Arenas, J. González, M. Chiappero, S. Fiore, X. Gómez, E.J. Martínez (ES)
Treatment of vinasse and lees by advanced oxidation processes coupled with anaerobic digestion

A. Gallipoli, A. Gianico, S. Crognale, S. Rossetti, M. Masi, V. Piemonte, P. Pagliaccia, C.M. Braguglia (IT)
3-Routes Platform for recovery of high value products, energy and bio-fertilizer from urban biowaste: the REVENUE project

WEDNESDAY NOVEMBER 18
H.16:15-17:30 UTC+1

SESSION D9
EU PROJECTS - RESOURCES FROM WASTE: ENERGY AND MATERIALS II

Chair / *Presidente:* Fabio Poretti (IT)

Dissemination and exploitation are integral part of the European research and innovation funding, and certain obligations in this regard arise even at the project proposal. By sharing their results with the rest of the scientific community, researchers contribute to the progress of science in general. Nevertheless, experience shows it's not always easy to meet these goals. In this regard, the combination of SUM 2020 with the Venice 2020 Symposium provides the perfect stage for dissemination of EU projects focusing on the recovery of waste, both in terms of new materials and energy. During the session selected projects will have the chance to present what they have discovered, how they tackled the challenges they encountered and what are the next research steps in the fields covered by their activities.
In this session the following projects will be presented:

M. Notarfonso, G. Sabbatini (IT)
REINWASTE - REmanufacture the food supply chain by testing INNovative solutions for zero inorganic WASTE

T. Lolos, G. Tavoularis, C. Tsompanidis, G. Konstantinopoulos, L. Streff (GR)
Improvement of Waste Management in Georgia through the application of an effective **EPR system** for selected products

M. Soto-Herranz, M. Sánchez-Báscones, E. Gómez (ES)
Development of membrane devices to reduce ammonia emissions generated by manure in poultry and pig farms

A. Gallego (ES)
SUSTAINOLIVE Project (PRIMA 2020)

A. Rimpiläinen (FI)
Biogas for Future Electric and Gas Grids (**BIOFEGG**)

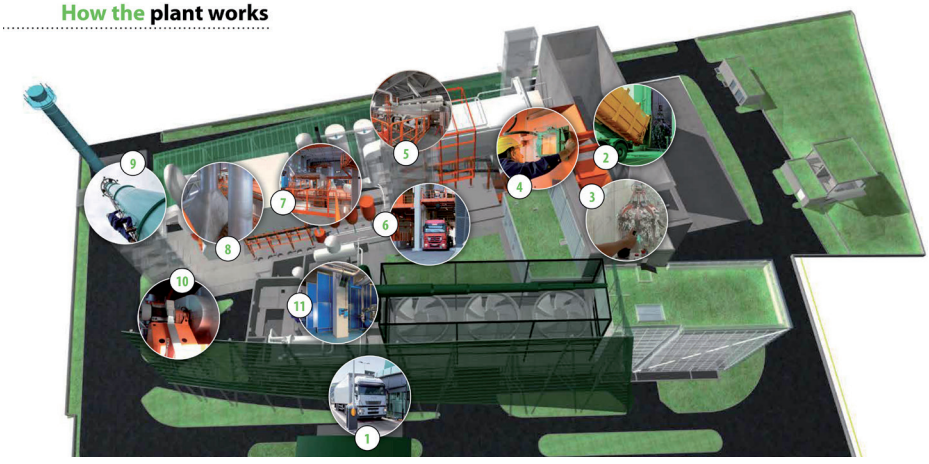
WEDNESDAY NOVEMBER 18
H.17:45-18:30 UTC+1

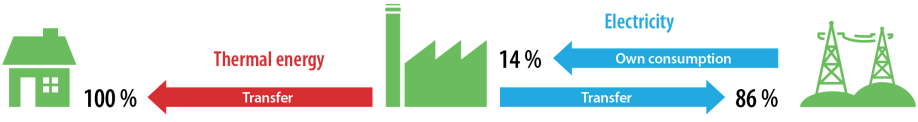
VIRTUAL TECHNICAL TOUR
BOLZANO WASTE-TO-ENERGY PLANT, ITALY

Chair / Coordinatore: Marco Ragazzi, Scientific Secretary Venice 2020
Guest: Dr. Marco Palmitano, General Manager of Eco-center

The technical tours of this digital edition, will be organized as virtual tours inside the plants, in live streaming or with pre-recorded videos. The Virtual Technical Tours will allow for live interaction between speakers and participants: using the Q&A tool, delegates will be able to send questions which will be answered live by the coordinators and the invited guests. Attendees may also be invited to join the discussion with camera and microphone.

How the plant works





WEDNESDAY NOVEMBER 18
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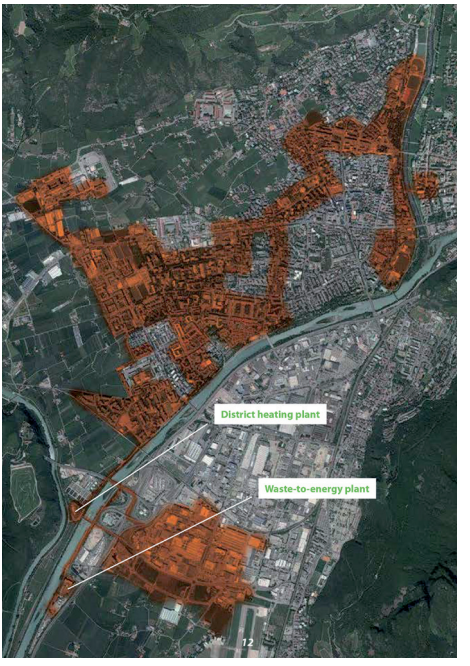
The Bolzano waste to energy incineration plant can treat 130,000 tonnes/year of municipal solid waste. The plant recovers the heat produced by the combustion of waste by converting it into steam and by means of this produces thermal and electrical energy. The plant has a total area size of 25000 m2, a nominal thermal and electric power of 59 MW and 15 MW, respectively, and a maximum heat output recovery of 32 MW. The calorific value of the treat waste, which is about 13 MJ/kg, allows the production of about 95,000 MWh/year of electrical energy and 240,000 MWh/year of thermal energy. Most of the electricity produced is sold to the national grid, while only a minimal amount is used for plant services. The steam that is not converted into electricity is supplied as thermal energy into the district heating network of the city of Bolzano. The ferrous metals present in the slag are recovered and recycled (2,000 t/year), while the 15,000 t/year of heavy ash, light ash, slag are destined for recovery plants in Italy and abroad.

Most of the electricity produced is sold to the national grid, while only a very small quantity is used for plant operation. The quota of steam that is not converted into electricity provides thermal energy to the district heating system of the city of Bolzano: To date (2016) 3,500 homes and 100 shops are being served by this system, and the future expansion of the network will allow to heat another 10,000 homes and many public buildings, including Bolzano's central hospital. In this way, over one third of the co-ownership heating units of Bolzano will be eliminated, resulting in an over 20% reduction in air pollutants exhausted into the atmosphere in the Bolzano area.
The Bolzano waste-to-energy plant is "open" to the citizens in order to build awareness regarding the correct management of waste and to allow them to see up front how it works. Students and technicians are also invited to visit the plant for furthering their studies and research.



THE TECHNICAL TOUR IS ORGANISED WITH THE SUPPORT OF ECO-CENTER

Via Lungo Isarco Destro 21/A
39100 Bolzano, Italy
Tel. +39 0471 089500
info@eco-center.it
www.eco-center.it

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SESSION A10
DIGESTATE MANAGEMENT AND HUMAN HEALTH
Chair / *Presidente:* Alberto Pivato (IT)

One of the main concerns for human health regarding the spreading of biosolids (in particular compost and digestate) on agricultural land is the potential uptake of contaminants into plants which may bio-transfer into grazing animals or directly consumed by humans. The workshop context will contribute to establish a network of experts able to deepen the knowledge about digestate management alternatives, legal aspects, chemical and ecotoxicological characterisation and human risk analysis with the focus on the protection of human health.

A. Pivato (IT)
Human health risk assessment of the use of digestate as soil fertilizer: the case of Veneto Region

SESSION B10
NEW EXPERIENCES AND DEVELOPMENTS I
Chair / *Presidente:* Elena Cristina Rada (IT)

R. Schu, K. Schu (DE)
Hydrogen Harvest Cycle - Waste recycling by removing organic and inorganic pollutants from the waste by wet mechanical separation

A. Dell'era, M. Pasquali, A. Polettini, R. Pomi, A. Rossi, T. Zonfa (IT)
Bio-electrochemical production of hydrogen and electricity from organic waste

A. Salladini (IT)
Waste to Hydrogen: the innovative NextChem's technology and its application at the ENI biorefinery in Venice

M. Moglie, B. Marchetti, F. Corvaro (IT)
Wastewater remediation from olive oil mill using microalgae: a techno-economic analysis

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SESSION C10: meet the expert
ECOTOXICOLOGICAL ISSUESS. HOW MUCH SHOULD BE SPENT ON MANAGING EMERGING CONTAMINANTS?

WILLIAM CLARKE, The University of Queensland (AU)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

The rate that new artificial contaminants are entering the environment is escalating. The effect of these chemicals on bio- or physicochemical pathways is generally not known, nor is the potential for these chemicals to disrupt global regenerative processes. There are precedents of ubiquitous alien chemicals having unanticipated impacts beyond those associated with local contamination, such as the impact of CFCs on the ozone layer. The global effects of persistent non-degradable contaminants such as perfluorocarbons or microplastics in the environment is not known, even though the biological toxicity of many of these compounds is known.
The waste management sector, both water and solid waste, is expected to act as society's filter and sink for unwanted materials and chemicals. The significance of this role, compared to for example, the significance of the waste management sector in abating greenhouse emissions or preserving natural habitant can be put into context by comparing these roles with the roles that other sectors (e.g., water, food, shelter, energy, transport) might play in achieving a sustainable society. In what environmental impact category might each sector optimally focus, possibly at the expense of sub-optimal performance in some categories, to achieve the best overall sustainable outcome for society? This is a crucial question for assessing the extent to which the waste management sector should focus on capturing and managing emerging artificial contaminants.

Bill Clarke has 20 years of experience as researcher in bioengineering processes for solid organic waste. He has been one of the pioneers in intensive landfill based treatment processes, publishing extensively on leach-bed technology and the solubilisation of solid organic waste. His research group was one of the first to characterise the microbial colonisation and degradation processes for solid organic waste. He is Professor and Remondis Chair in the Schools of Civil and Chemical Engineering at the University of Queensland. Professor Clarke is also the Director of the Centre for Solid Waste Bioprocessing, a collaboration between Remondis Pty Ltd, leading Australian environmental services company, and University of Queensland. The Centre has 3 research programs: Landfill Research, Bio-covers and Utilisation of Waste in the Resource Industry. He has over 100 journal and conference publications. He is also active in consulting, particularly in assessing the energy value of organic resources. He teaches in the Schools of Civil Engineering and Chemical Engineering programs solid waste management and environmental systems modelling.

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SESSION D10
POSTER DISCUSSION III

Posters will be provided as PDF files, accessible at all times and easily downloadable. Delegates will be able to comment and ask questions to the authors via Q&A and chat.
Three poster discussion hubs will be held during the symposium, where poster presenters and other delegates can meet, network and discuss the poster topics and findings.
Poster discussions will be highly interactive sessions: authors will have the chance to present their poster, providing additional information, highlighting key points and answering questions in a live Q&A discussion.

Y. Hua, C. Cai, X. Dai, S. Chen (CN)
Biomethane production by typical Chinese straw anaerobic digestion: deep insights of material compositions and surface properties

A. Taskin, O. Nesterova, S. Ivannikov (RU)
Waste-free disposal of sewage in small settlements of the Russian Federation

T. Bauer, A. Lagerkvist (SE)
Finding new sewage sludge treatment solutions for the arctic city of Kiruna

T. Miranda, F.J. Sepúlveda, P. Romero, J. I. Arranz, I. Montero (ES)
Determination of carbon footprint for cork industry waste

S. Masi, P. Mazziotta, S. Lofiego, D. Tanico, I.M. Mancini, M. Caivano, D. Caniani (IT)
Qualitative characterization of sewage sludge for a better management: towards a sludge-to-fuel approach

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SESSION A11
RECOVERY OF REFUSE DERIVED FUELS (RDF)
Chair / *Presidente:* Costas Velis (GB)

C. Cord'Homme (FR)
Energy recovery of refuse derived fuel

M. Sol (PL)
Use of residues from waste-to-energy as a way towards circular implementation

S. Petters, K. Mauthner (AT)
Striving for climate neutral hydrogen economy

M. Calero, A. Pérez, Á. Gálvez-Pérez, M.Á. Martín-Lara, G. Blázquez (ES)
Experimental investigation on the air gasification of olive cake at low-medium temperatures

SESSION B11
NEW EXPERIENCES AND DEVELOPMENTS II
Chair / *Presidente:* Mihail Busu (RO)

A. Regnier, L. Ricci (FR)
Improving WtE or biomass plant performances and operation by using a Process Digital Twin

G.C. Faussone (IT)
From Marine Litter to Marine Fuel: lessons learned from marGnet project

S.F. Corsino, D. Di Trapani, M. Capodici, P. Greco Lucchina, M. Torregrossa, G. Viviani (IT)
Assessment of biopolymers production from citrus wastewater under different operating conditions

G. Prosser, F. Olita, G. Palladino, M. Bentivenga, F. Agosta, A.S. Masi, D'Angola (IT)
The low-enthalpy geothermal resource in the Tramutola area (Southern Apennines): geological setting and possible uses for desiccation of biomass feedstocks

N. Montes, O. Gutiérrez (CO)
Catalytic activity of acidified HZSM-5 zeolites for its application in chemical recycling of polypropoylene wastes

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SESSION C11: meet the expert
WASTE TO ENERGY AND ECONOMY
ANTONIO MASSARUTTO, University of Udine (IT)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

Antonio Massarutto is an Associate Professor of Applied Economics at the University of Udine (IT) and Research Director at IEFE – Bocconi University, Milan (IT). He has a long expertise as a researcher in the field of applied environmental economics and public utility regulation and liberalization, with special focus on water policy and comparative international studies. Author of many publications in the field of water policy, waste management and public utilities, with special focus on economic evaluation, economic instruments, finance of water infrastructure, competitive tendering, liberalization and PPP in the water utility sector. His intense academic and research networking is confirmed by the continuous participation to international workshops and conferences. He is responsible of many nationally-funded research project in the field of water policy and water services.

SESSION D11
COMPANIES FORUM
Chair / *Presidente:*

The primary goal of the forum is to create a balance in the event between the scientific content and the industry contributions, in order to foster exchanges between practitioners and the academics, and promote novel solutions to today's challenges in the area of waste management and circular economy.
Companies and startups will have the chance to present their own products and services, in order to gain visibility and meet new potential clients. Ample time will be allowed for discussion and networking.

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SESSION A12
DIRECT TEST METHODS FOR THE CLASSIFICATION OF HAZARDOUS PROPERTIES OF WASTES

Chair / *Presidente:* Alberto Pivato (IT)

Correct hazard classification of waste is crucial to provide sustainable and lawful management plans, from transport to final disposal. Especially in the case of waste classified as "mirror entry" in the European List of Waste, the choice of the specific assessment tool or method is a key step to ensure the transparency and reliability of the process. Directive 2008/98/EC defines waste as hazardous if characterized by at least one of the 15 hazardous properties (HPs). The assessment of the specific HP can be based on the measured content of potentially hazardous substances or on the result of a test of a given property. Here, a tiered assessment is recommended:

- 1st tier: Waste should be classified according to the European List of Waste (LoW) as "hazardous", "non-hazardous", or as "mirror entry". In this latter case:
- 2nd tier: Some HPs can be assessed as through the so-called expert judgment;
- 3rd tier: The remaining HP can be assessed according to the total concentration of specific waste constituents under a "worst realistic case" hypothesis.
- 4th tier: If the "worst realistic case" approach leads to unsatisfactory or unrealistic results, a 4th tier can be performed by carrying out direct analytical methods, specifically developed for the target HP. In this context, the session will discuss the current drawbacks and challenges posed by the current direct test procedures implemented in the 4th tier. In particular, the following Hazard Properties will be debated, being identified as the most discriminating or controversial ones: HP 4 Irritant; HP 8 Corrosive; HP 10 Toxic for reproduction; HP 14 ecotoxic.

P. Hennebert (FR)
Waste hazard properties HP 4 'Irritant' And Hp 8 'Corrosive' By Ph And Acid / Base Buffer Capacity

L. Maggi (IT)
Classification of waste: state of the art of direct testing and later challenges in the Italian scenario

S. Giardina (IT)
HP10 Classification of waste: experimental strategies by in vitro testing approach

P. Grenni (IT)
Ecotoxicological testing for HP14 Classification of Waste: state of the art and current challenges

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SESSION B12
NEW EXPERIENCES AND DEVELOPMENTS III
Chair / *Presidente:*

P. Falabella, R. Salvia, C. Scieuzo, A. Franco, I.M. Mancini, D. Caniani, S. Masi (IT)
Enhancement of livestock waste using innovative technology based on the use of the bioconverting insect Hermetia illucens

K. Kuhn, I. Steinberg, D. Stanojkovski, J. Kannengiesser (DE)
Production of medium-chain carboxylic acids from secondary composting intermediates

D. Gamboa-Santana, P. Mijaylova Nacheva, E.B. Estrada-Arriaga, J.A. Bañuelos-Diaz (MX)
Electricity generation in biocathode microbial fuel cells using sewage sludge as substrate

R. Burch, S. Sipes, D. Cha, M. Chajes (US)
On-site aerobic biodegradation of food waste: analysis and applications of aerobic digesters

M.S.T. Amândio, A.M.R.B. Xavier, J.M.S. Rocha (PT)
The effect of solids loading, working volume and operational

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SESSION C12: meet the expert
LOW TEMPERATURE CONVERSION PROCESSESS
NICOLE BERGE, University of South Carolina (US)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

Low temperature thermal conversion processes have been gaining significant attention over the last few decades as means to sustainably convert biomass or wastes to value added products. In this talk, an overview of low temperature conversion processes, defined as processes occurring at temperatures below the critical point of water (374 °C), will be given, including the discussion of the following conversion processes: hydrothermal carbonization, hydrothermal liquefaction, and torrefaction. Information associated with the operating conditions, conversion mechanisms, and products generated from these processes will be discussed.

Dr. Nicole Berge is an Associate Professor in the Department of Civil and Environmental Engineering at the University of South Carolina. She received her BS and MS in Civil and Environmental Engineering from the University of South Carolina in 1999 and 2001, respectively. She received her PhD in Environmental Engineering from the University of Central Florida in 2006. Prior to joining the faculty at the University of South Carolina, Dr. Berge worked as a postdoctoral associate at Tufts University. She is a co-leader of the IWWG task group on "Engineered Nanomaterials in Waste" and an IWWG board member. Dr. Berge's research focuses on improving our understanding of how physical, chemical, and biological processes can be manipulated to promote sustainable waste treatment techniques that lead to carbon sequestration, energy generation, and/or value-added product production. Specific areas of exploration include: the fate of disposed nanomaterials, pharmaceuticals, personal care products and endocrine disrupting compounds in bioreactor landfills; thermochemical conversion of municipal solid waste; increasing the energy yield from waste streams; resource recovery from waste streams; leachate treatment processes; and the development and subsequent evaluation of innovative groundwater remediation technologies.

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SESSION D12: meet the expert
RISCHIO INCIDENTE NEGLI IMPIANTI PER LA PRODUZIONE DI ENERGIA DA BIOMASSE E RIFIUTI

VINCENZO TORRETTA, University of Insubria (IT)

The new "Meet the Expert" sessions are live sessions featuring keynote speeches delivered by highly reputed scientists who will examine specific topics in great depth and answer questions from delegates.

Biomasse e rifiuti sono una fonte rinnovabile di energia le cui caratteristiche principali sono: 1) essere intrinsecamente legate al territorio, sono infatti disponibili ovunque e largamente diffuse; 2) essere uno degli strumenti indicati per la riduzione delle emissioni di gas serra in atmosfera: il bilancio della CO_2 relativo alla conversione delle biomasse e dei rifiuti in energia è considerato neutro. Proprio per la loro diversità sono disponibili numerose tecnologie di conversione che producono altrettante forme finali di energia: energia elettrica (e/o termica), combustibili liquidi, biogas, gas di sintesi, ecc.
Tuttavia, le tecnologie attualmente disponibili per la conversione di biomasse e rifiuti in forme utili di energia comportano delle criticità dal punto di vista dell'operabilità degli impianti e della salute dei lavoratori in essi impiegati. Pertanto, anche per queste tipologie di impianto, non è possibile trascurare la conduzione di un'accurata valutazione dei rischi. Tecniche di identificazione dei pericoli universalmente accettate quali l'HAZOP risultano però troppo dispendiose sia in termini di denaro, sia di personale impiegato, sia di tempo dedicato all'analisi stessa. Inoltre, non risultano prettamente mirate alla tipologia di impianto in analisi. In questo lavoro verrà perciò presentata l'applicazione di una tecnica di identificazione dei pericoli, chiamata Analisi di Operabilità Ricorsiva Avanzata (AORA), che, accoppiata con altre note tecniche di qualificazione dei modi di guasto (FMEA) di un impianto e di quantificazione della probabilità di accadimento di eventi incidentali (Albero dei Guasti o FTA), permetterà sia di condurre un'analisi di rischio completa sia di identificare le aree ATEX attorno alle apparecchiature in modo automatico.
La tecnica AORA è stata applicata a titolo esemplificativo a due differenti processi di valorizzazione delle biomasse e dei rifiuti: 1) un processo di gassificazione di rifiuti e, 2) un processo di produzione di biogas (mediante gasometro e fermentazione anaerobica di reflui animali). I risultati hanno evidenziato, attraverso limitati sforzi di analisi, le principali criticità di queste due tipologie di impianto rendendo inoltre molto semplice e strutturata l'eventuale identificazione delle zone ATEX attorno alle apparecchiature.

Vincenzo Torretta is Associate Professor at the University of Insubria (Varese, Italy). His work focuses on air pollution control technologies, waste treatment and energy recovery and environmental impact assessment. He has been author and co-author of several ISI/Scopus-indexed publications.

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CLOSING / IN THE RING SESSION

BALANCED WASTE MANAGEMENT IN CIRCULAR ECONOMY (MINIMIZATION, RECYCLING, THERMAL TREATMENT, SUSTAINABLE LANDFILLING)

Chair / *Presidente:* Jurate Kumpiene (SE)

The aim of this session is to kick start discussion among scientists with expertise in different aspects of waste management, of potential controversies for the purpose of clarifying the issues involved in the hope of reaching a mutual conclusion. This is a new session format geared toward stimulating discussion and insight, whilst distancing people from a so-called "football supporters" approach, in which waste management options are often seen as irrational alternatives, in the same way as the teams in a football championship.
The panel of experts is as follows:

JURATE KUMPIENE, Luleå University of Technology (SE)
Moderator
Jurate Kumpiene is a Professor in Waste Science and Technology at Luleå University of Technology, Sweden. She has been implementing research and education in the area of waste management, with particular focus on waste properties, characterization and treatment, as well as risk assessment and remediation of contaminated soil. She has published 50+ scientific papers and book chapters and 50+ conference publications. Member of the International Waste Working Group (IWWG) and an Associate Editor of the journal Waste Management. R&D and innovation projects include close cooperation with national waste management companies, consultancies and entrepreneurs.

RAFFAELLO COSSU, University of Padova (IT)
Full Professor of Solid Waste Management, he has retired since September 2018 from the University of Padova where he led the Research Center of Environmental Engineering. Former President of the School of Environmental and Engineering at the same University from 2000 to 2013. From 2009 to 2017 he was Editor in Chief of Waste Management, the IWWG international scientific journal on waste management published by Elsevier. Since 2018 he is Editor in Chief of DETRITUS, published by CISA Publisher. He was President of IWWG (International Waste Working Group) from 2004 until 2009, and currently is a member, of the Managing Board of the same Association. In 2017 he was recipient of the prestigious "A Life for Waste" Award. He has given a series of talks and presentations in conferences on Waste Management and landfilling throughout the world. He is author of more than 150 scientific papers and 5 international books on waste management, published by Academic Press, Elsevier, EF and Spon.

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ANDREAS BARTL, TU Wien (AT)
Since 2002 Andreas Bartl is teaching and researching at Vienna University of Technology (TU Wien) at the institute of Chemical Engineering. Before joining the University he worked in the industry at Hirtenberger AG in Lower Austria for four years. He was head of the R&D department for pyrotechnics as well as responsible for the production in the primer plant. His most important project was the development of non-toxic ignition mixtures for small ammunition and automotive applications. Andreas holds a PhD degree in Technical Science from Vienna University of Technology. Andreas holds lectures in mechanical engineering, fiber technology and recycling and is responsible for several laboratory tutorials and seminars in the field of mechanical process engineering. He has supervised several diploma and doctoral theses mainly in cooperation with industrial partners. The topics are located in the field of recycling. The main expertise of Andreas Bartl is located in recycling and the morphological characterization of particles by optical image analysis.

Jianhua Yan, Zhejiang University (CN)
Professor Jianhua Yan is the vice president of Zhejiang University, director of National Engineering Laboratory for Waste Incineration Technology and Equipment, and chair professor of the Cheung Kong Scholars Award Program. His major research interests include clean combustion, pyrolysis and gasification, pollutant control, combustion acquisition, environmental protection in the energy conversion process and waste derived energy, etc. He has published 305 scientific papers and eight books. He owns 57 Chinese invention patents. He got one State Technology Invention Award (second prize), three State Science and Technology Progress Awards (second prize) and one State Innovation Team Award. Professor Yan served as co-chair of the Association of Chinese Graduate School (ACGS) from 2012 to 2016. He is a member of the Discipline Appraisal Group under the State Council. He is vice chairman of the National Alliance of Innovative Waste to Energy.

CLOSING LECTURE

Raffaello Cossu, Symposium Chairman Venice 2020
The curtains come down