

**16TH CONFERENCE ON SUSTAINABLE
DEVELOPMENT OF ENERGY, WATER
AND ENVIRONMENT SYSTEMS**

**October 10-17,
2021,
Dubrovnik,
Croatia**



BOOK OF ABSTRACTS

Edited by:

Marko Ban, Neven Duić, Daniel Rolph Schneider, Valeria Ancona, Davide Astiaso Garcia, Anna Barra Caracciolo, Domenico Borello, Annamaria Buonomano, Francesco Calise, Andrea Cipollina, Jose-Luis Cortina, Uroš Cvelbar, Diana D'Agostino, Pietro De Palma, Ganesh Duraisamy, Yee Van Fan, Paola Grenni, Daniele Groppi, Abul Kalam Hossain, Ioannis Ieropoulos, Soteris Kalogirou, Jiri Jaromír Klemeš, Rebeka Kovačič Lukman, Christos N. Markides, Mariusz Markowski, Giorgio Micale, Hrvoje Mikulčić, Benedetto Nastasi, Adolfo Palombo, Andrea Pietrelli, Tomislav Pukšec, Jian Song, Alessandro Tamburini, Marian Trafczynski, Krzysztof Urbaniec, Laura Vanoli, Petar Sabev Varbanov, Maria Vicedomini, Milan Vujanović and Aleksander Zidanšek



INTERNATIONAL CENTRE FOR SUSTAINABLE DEVELOPMENT OF ENERGY, WATER AND ENVIRONMENT SYSTEMS

16th CONFERENCE ON SUSTAINABLE DEVELOPMENT OF ENERGY, WATER AND ENVIRONMENT SYSTEMS

BOOK OF ABSTRACTS

**October 10 – 15, 2021, Dubrovnik, Croatia
(hybrid event)**

Organizers

University of Zagreb, Zagreb, Croatia
Instituto Superior Técnico, Lisbon, Portugal

In cooperation with

Aalborg University, Aalborg, Denmark
American International College, Saad Al-Abdullah, Kuwait
University of Belgrade, Belgrade, Serbia
Brno University of Technology, Brno, Czech Republic
Universidad de Buenos Aires, Buenos Aires, Argentina
Cyprus University of Technology, Limassol, Cyprus
Delft University of Technology, Delft, The Netherlands
University of Dubrovnik, Dubrovnik, Croatia
Griffith University, Queensland, Australia
Hamburg University of Applied Sciences, Hamburg, Germany
Jozef Stefan International Postgraduate School, Ljubljana, Slovenia
TH Köln – Technology, Arts, Sciences, Cologne, Germany
Macedonian Academy of Sciences and Arts (MASA-RCESD), Skopje, North Macedonia
University of Naples Federico II, Naples, Italy
University of Palermo, Palermo, Italy
American University of Ras Al Khaimah, Ras Al-Khaimah, United Arab Emirates
Federal University of Rio de Janeiro, Rio de Janeiro, Brazil
Industrial University of Santander, Bucaramanga, Colombia
University of Sarajevo, Sarajevo, Bosnia and Herzegovina
The Scientific and Technological Research Council of Turkey (TÜBITAK), Ankara, Turkey
"Vinča" Institute of Nuclear Sciences, Belgrade, Serbia
Warsaw University of Technology, Warsaw, Poland
Xi'an Jiaotong University, Xi'an, Shaanxi, China

Executive organizers

International Centre for Sustainable Development of Energy, Water and Environment Systems,
Zagreb, Croatia

Partners

The Combustion Institute – Adria Section, Zagreb, Croatia
Slovenian Association for the Club of Rome, Ljubljana
Club of Rome - European Research Centre, Konstanz
Mediterranean Network for Engineering Schools and Technical Universities – RMEI, Marseille,
France
The World Academy of Art and Science

International Scientific Committee

Prof. Maria da Graça Carvalho, Instituto Superior Técnico, Lisbon, Portugal, Chair
Prof. Neven Duic, University of Zagreb, Zagreb, Croatia, Co-chair
Prof. Jiří Jaromír Klemeš, Brno University of Technology - VUT Brno, Brno, Czech Republic, Co-Chair for the Central and Eastern Europe
Prof. Henrik Lund, Aalborg University, Aalborg, Denmark, Co-Chair for Northern Europe
Prof. Ingo Stadler, TH Köln, Cologne, Germany, Co-Chair for Western Europe
Prof. Poul Alberg Østergaard, Aalborg University, Aalborg, Denmark
Prof. Susana Boeykens, Universidad de Buenos Aires, Buenos Aires, Argentina
Prof. Raf Dewil, KU Leuven, Leuven, Belgium
Prof. Zvonimir Guzović, University of Zagreb, Zagreb, Croatia
Dr. Şiir Kilkış, The Scientific and Technological Research Council of Turkey (TÜBİTAK), Ankara, Turkey
Prof. Soteris Kalogirou, Cyprus University of Technology, Limassol, Cyprus
Prof. Tarik Kupusovic, University of Sarajevo, Sarajevo, Bosnia and Herzegovina
Prof. Natasa Markovska, Macedonian Academy of Sciences and Arts, Skopje, North Macedonia
Prof. Brian Vad Mathiesen, Aalborg University, Aalborg, Denmark
Prof. Mousa Mohsen, American International College, Kuwait
Prof. Simeon Oka, Institute Vinca, Novi Beograd, Belgrade, Serbia
Prof. Adolfo Palombo, University of Naples Federico II, Naples, Italy
Prof. Antonio Piacentino, University of Palermo, Palermo, Italy
Prof. Nikola Rajakovic, University of Belgrade, Belgrade, Serbia
Prof. Nikola Ruzinski, University of Zagreb, Zagreb, Croatia
Prof. Eduardo Serra, Universidade Federal do Rio de Janeiro – UFRJ, Rio de Janeiro, Brazil
Prof. Daniel Rolph Schneider, University of Zagreb, Zagreb, Croatia
Prof. Rodney Stewart, Griffith University, Gold Coast City, Australia
Prof. Ivo Šlaus, Rudjer Boskovic Institute, Zagreb, Croatia
Prof. Krzysztof Urbaniec, Warsaw University of Technology, Plock, Poland
Dr. Petar Sabev Varbanov, Brno University of Technology - VUT Brno, Brno, Czech Republic
Prof. Qiuwang Wang, Xi'an Jiaotong University, Xi'an, Shaanxi, China
Prof. Jinyue Yan, Royal Institute of Technology, Stockholm, Sweden
Prof. Aleksander Zidanšek, Jozef Stefan International Postgraduate School, Ljubljana, Slovenia

Honorary members

Prof. Kemal Hanjalic, Delft University of Technology, Delft, Netherlands
Prof. Vyacheslav Kafarov, Industrial University of Santander, Bucaramanga, Colombia
Prof. Walter Leal Filho, Hamburg University of Applied Sciences, Hamburg, Germany
Prof. Vladimir Lipovac, University of Dubrovnik, Dubrovnik, Croatia, honorary member
Prof. Jordan Pop-Jordanov, Macedonian Academy of Sciences and Arts, Skopje, Macedonia
Dr. Subhas K. Sikdar, United States Environmental Protection Agency, Cincinnati, United States
Prof. Xiliang Zhang, Tsinghua University, Beijing, China

Local Organizing Committee

Prof. Neven Duić, University of Zagreb, CHAIR
Dr. Goran Krajačić, University of Zagreb, CO-CHAIR
Prof. Zvonimir Guzović, University of Zagreb,
Conference secretary
Dr. Tomislav Pukšec, University of Zagreb
Dr. Marko Ban, SDEWES Centre
Ms. Ana-Marija Ljubanović, SDEWES Centre
Ms. Andreja Biskup Lazanin, SDEWES Centre
Dr. Tibor Besenik, SDEWES Centre

Mr. Luka Herc, University of Zagreb
Mr. Filip Jurić, University of Zagreb
Ms. Irma Kremer, University of Zagreb
Ms. Ana Lovrak, University of Zagreb
Mr. Antun Pfeifer, University of Zagreb
Mr. Hrvoje Stančić, University of Zagreb
Mr. Goran Stunjek, University of Zagreb

Publisher Faculty of Mechanical Engineering and Naval Architecture, Zagreb

ISSN – 1847-7178 (digital proceedings)

Editors

Marko Ban
Neven Duić
Daniel Rolph Schneider
Valeria Ancona
Davide Astiaso Garcia
Anna Barra Caracciolo
Domenico Borello
Annamaria Buonomano
Francesco Calise
Andrea Cipollina
Jose-Luis Cortina
Uroš Cvelbar
Diana D'Agostino
Pietro De Palma

Ganesh Duraisamy
Yee Van Fan
Paola Gremi
Daniele Groppi
Abul Kalam Hossain
Ioannis Ieropoulos
Soteris Kalogirou
Jiří Jaromír Klemeš
Rebeka Kovačič Lukman
Christos N. Markides
Mariusz Markowski
Giorgio Micale
Hrvoje Mikulčić
Benedetto Nastasi

Adolfo Palombo
Andrea Pietrelli
Tomislav Pukšec
Jian Song
Alessandro Tamburini
Marian Trafczynski
Krzysztof Urbaniec
Laura Vanoli
Petar Sabev Varbanov
Maria Vicedomini
Milan Vučanović
Aleksander Zidanšek

Technical Editors Aleksandra Mudrovčić, Marko Ban

Scientific Advisory Board

I. Šlaus, *Croatia* - Chairman

J. Adiansyah, Indonesia; A. Ajanovic, Austria; S. Ajib, Germany; S. Alabrudzinski, Poland; A.H. Alami, United Arab Emirates; A. Alami Merrouni, Morocco; D.M. S. Albuquerque, Portugal; R. Aldaco, Spain; M. Alfe, Italy; M. Allam, Italy; A. Alouache, Algeria; M. Alsheyab, Qatar; A. Altaee, Australia; A. Altmimi, Iraq; S.R. Alwi, Malaysia; P. Ammendola, Italy; M. Amosa, Nigeria; A. Anastasovski, North Macedonia; S. Aneli, Italy; A. Anić Vučinić, Croatia; S. Anweiler, Poland; E. Apaydin Varol, Turkey; P. Arocena, Spain; E. Assoumou, France; D. Astiaso Garcia, Italy; S. Atabay, United Arab Emirates; A. Avami, Iran; S. Avdullahi, Kosovo; J. Avsec, Slovenia; M.I. Ayala Chauvin, Ecuador; V. Bakić, Serbia; T. Baklacioglu, Turkey; A. Baldinelli, Italy; I. Balen, Croatia; J. Baleta, Croatia; B.D. Baloni, India; M. Ban, Croatia; S.S. Baral, India; G. Barone, Italy; I. Barut, Turkey; I. Batas Bjelic, Serbia; N. Baycan, Turkey; M. Beccali, Italy; J.A. Becerra Villanueva, Spain; E. Bellos, Greece; V. Bermudez Benito, Qatar; M. Berni, Brazil; T. Bešenić, Croatia; D. Beysens, France; A. Bezama, Germany; A. Bhagyanathan, India; R. Bhandari, Germany; M. Bietresato, Italy; L. Bilir, Turkey; J. Bogdanović-Jovanović, Serbia; S. Boldyryev, Russian Federation; A. Bonanno, Italy; L. Bondareva, Russian Federation; J. Bonet-Ruiz, Spain; M. Bonomolo, Italy; S.P. Borg, Malta; D. Bottino-Leone, Italy; P. Brachi, Italy; T.A. Branca, Italy; S. Caldera, Australia; C. Caligiuri, Italy; P. Caputo, Italy; N. Caracciolo, Argentina; R. Carli, Italy; M. Carvalho, Brazil; B. Castellani, Italy; P. Catrini, Italy; J. Cerezo, Mexico; G. Cerri, Italy; B. Cestnik, Slovenia; R. Chacartegui, Spain; F. Chang, Taiwan; M. Charde, United Arab Emirates; P. Charvat, Czech Republic; D. Chemisana, Spain; B.L.F. Chin, Malaysia; D. Chinese, Italy; G. Cinti, Italy; M. Cipek, Croatia; A. Cipollina, Italy; T. Clees, Germany; A. Cormos, Romania; C. Cormos, Romania; M. Correia De Oliveira, Portugal; J. Cortes Oggero, Chile; N. Cukovic Ignjatovic, Serbia; U. Cvelbar, Slovenia; D. Cvetinović, Serbia; R. Černý, Czech Republic; M. Čalasan, Montenegro; D. D'agostino, Italy; G. Danon, Serbia; G. Davis, United States; C. De Blasio, Finland; P. De Jong, Brazil; A. De Pascale, Italy; M. Dębowksi, Poland; A. Dedinic, North Macedonia; N. Degiuli, Croatia; U. Desideri, Italy; M. Despotovic, Serbia; S. Di Fraia, Italy; A. Di Maria, Belgium; M.C. Díaz-Ramírez, Spain; F.B. Dilek, Turkey; C. Dinca, Romania; J. Domac, Croatia; D.F. Dominković, Denmark; D. Dović, Croatia; D. Drazic, Serbia; P. Droege, Germany; E. Dzaferovic, Bosnia and Herzegovina; M. Dzikuć, Poland; I. Džijan, Croatia; D. Đaković, Serbia; A. Egusquiza, Spain; R. El-Emam, Canada; A. Elshkaki, China; V. Eveloy, United Arab Emirates; B. Fabiano, Italy; F. Feijoo, Croatia; S. Ferrari, Italy; M. Ferraro, Italy; V.J. Ferreira, Spain; L. Fiala, Czech Republic; R. Figaj, Poland; K. Fijalkowski, Poland; O. Filho, Brazil; V. Filipan, Croatia; S. Filipović, Serbia; M. Filipowicz, Poland; R.V. Filkoski, North Macedonia; A. Flamos, Greece; A. Foley, United Kingdom; K.F.S. Fong, China; D. Foo, Malaysia; C. Forzano, Italy; V. Franzitta, Italy; F. Freire, Portugal; G. Frigo, Germany; R. Fuster, Chile; A. Gagliano, Italy; A. Galatioto, Italy; A. Galinis, Lithuania; I. Garcia Kerdan, United Kingdom; M.T. García-Álvarez, Spain; N. Gaurina-Medimurec, Croatia; M. Genovese, Italy; M. Georgiadis, Greece; A. Gholamzadeh Chofreh, Czech Republic; A. Gianfreda, Italy; D. Giannakopoulos, Greece; A. Gimelli, Italy; A. Gölle, Hungary; A. Gomes, Portugal; F. Gonella, Italy; A. González-Espinosa, Spain; D. Gordic, Serbia; D. Goricanec, Slovenia; W. Goryl, Poland; A. Gougam, United Arab Emirates; L. Greco, Italy; A. Grobelak, Poland; A. Grosser, Poland; F. Guarino, Italy; X. Guo, China; L. Gustavsson, Sweden; P. Gvero, Bosnia and Herzegovina; D.L. Ha, France; R.

Haas, Austria; **A. Haddad**, Brazil; **M. Hájek**, Czech Republic; **S. Halilčević**, Bosnia and Herzegovina; **M.I. Hassan Ali**, United Arab Emirates; **M. Hendel**, France; **P. Hendrick**, Belgium; **E. Henning**, Brazil; **C. Henriques**, Portugal; **C.A. Herme**, Argentina; **M. Herrando**, Spain; **I. Herrera**, Spain; **N. Holjevac**, Croatia; **H. Hondo**, Japan; **M. Honic**, Austria; **P.Y. Hoo**, Singapore; **A.K. Hossain**, United Kingdom; **W. Huang**, Taiwan; **N. Hvala**, Slovenia; **O. Hwai Chyuan**, Malaysia; **G. Iglesias**, Ireland; **V. Ivanovic**, Poland; **T. Izumi**, Japan; **D. Jakus**, Croatia; **A. Janjic**, Serbia; **B. Jiang**, China; **R. Jovanović**, Serbia; **V. Jovanović**, Serbia; **A. Jovovic**, Serbia; **V. Józsa**, Hungary; **D. Juchelkova**, Czech Republic; **S. Kabashi**, Kosovo; **M. Kacprzak**, Poland; **S. Kambara**, Japan; **I. Karabegović**, Bosnia and Herzegovina; **A. Kazagic**, Bosnia and Herzegovina; **A.R. Keeley**, Japan; **M. Keppert**, Czech Republic; **H. Keskin Citiroglu**, Turkey; **G. Khavin**, Ukraine; **A. Khosravi**, Finland; **D. Khripko**, United Kingdom; **B. Kilkis**, Turkey; **K. Kim**, Korea, Republic of; **Y. Kim**, Korea, Republic of; **D. Klimenta**, Serbia; **L. Klimes**, Czech Republic; **J. Knápek**, Czech Republic; **M. Knez**, Slovenia; **C. Ko**, Taiwan; **D. Koncalovic**, Serbia; **K. Kontoleon**, Greece; **A. Korpa**, Albania; **S. Koščak Kolin**, Croatia; **R. Kovačič Lukman**, Slovenia; **G. Krajačić**, Croatia; **A. Krkoleva**, North Macedonia; **G. Krolczyk**, Poland; **P. Krstevski**, North Macedonia; **L. Kulay**, Brazil; **M. Kušljugić**, Bosnia and Herzegovina; **K.T. Lee**, Malaysia; **A. Lefkir**, Algeria; **V. Lekavičius**, Lithuania; **L. Lešnik**, Slovenia; **Y. Li**, China; **C. Lin**, Taiwan; **T.C. Ling**, Malaysia; **L. Lingai**, France; **F. Liu**, United Kingdom; **G. Liu**, China; **L. Liu**, Australia; **X. Liu**, Denmark; **S. Lohani**, Nepal; **D. Lončar**, Croatia; **N.S. Lopez**, Philippines; **J. Louis**, Finland; **M. Lu**, Taiwan; **T. Ma**, China; **T. Majozi**, South Africa; **A. Makarova**, Russian Federation; **I. Malico**, Portugal; **L. Malka**, Albania; **M.L. Maloncy**, Netherlands; **P. Mancarella**, Australia; **N. Manic**, Serbia; **M. Manno**, Italy; **A. Maraj**, Albania; **K. Marathe**, India; **C.N. Markides**, United Kingdom; **E. Marrasso**, Italy; **L. Martinelli**, Italy; **B. Martinkauppi**, Finland; **I. Mauleón**, Spain; **P. Maussion**, France; **G. Mavromatidis**, Switzerland; **A. Mazzei**, United States; **A. Mazzi**, Italy; **R. Medronho**, Brazil; **T. Mehmood**, China; **D. Menegon**, Italy; **H. Meschede**, Germany; **S. Midžić-Kurtagić**, Bosnia and Herzegovina; **J.J. Milón Guzmán**, Peru; **M. Mistretta**, Italy; **I. Mladenoska**, North Macedonia; **M. Moldovan**, Romania; **B. Möller**, Germany; **J. Mondol**, United Kingdom; **L. Montorsi**, Italy; **J. Moravcová**, Czech Republic; **M. Mori**, Slovenia; **M. Muccillo**, Italy; **K. Mulder**, Netherlands; **M. Münster**, Denmark; **S. Nair**, Australia; **B. Nakomčić-Smaragdakis**, Serbia; **F. Nardeccchia**, Italy; **B. Nastasi**, Italy; **M. Neagoe**, Romania; **A.M. Negm**, Egypt; **D. Nicholas**, United States; **A. Nikolić**, Bosnia and Herzegovina; **M. Nikolova**, Bulgaria; **S. Nižetić**, Croatia; **Y. Noorollahi**, Iran; **M. Noro**, Italy; **B. Norton**, Ireland; **R. Norvaišienė**, Lithuania; **N. Novelli**, United States; **M. Obrecht**, Slovenia; **C.M. Odulio**, Philippines; **K.Y. Oh**, Korea, Republic of; **T. Okadera**, Japan; **G. Oluleye**, United Kingdom; **S. Padula**, Italy; **C. Pak**, Korea, Republic of; **H. Pandžić**, Croatia; **A. Pantaleo**, Italy; **K. Panuwatwanich**, Thailand; **E. Paris**, Italy; **Y. Park**, Korea, Republic of; **G. Pasternak**, Poland; **N. Patorniti**, Australia; **D. Pavkovic**, Croatia; **J. Pedraza Garciga**, Cuba; **Y. Peralta-Ruiz**, Colombia; **A. Pereira**, Brazil; **P. Pereira Da Silva**, Portugal; **T. Petkovska Mircevska**, North Macedonia; **V. Petkovski**, North Macedonia; **F. Petrakopoulou**, Spain; **Z. Petranović**, Austria; **A. Pfeifer**, Croatia; **F. Pietrapertosa**, Italy; **C. Pirola**, Italy; **C. Piselli**, Italy; **A. Piwowar**, Poland; **E. Plaza**, Sweden; **A.E. Plesu Popescu**, Spain; **J.M. Ponce-Ortega**, Mexico; **N. Popov**, Canada; **S. Posch**, Austria; **S. Postoronca**, Moldova; **H. Pramanik**, India; **D.. A. Predin**, Slovenia; **D. Pretolani**, Italy; **L. Proskuryakova**, Russian Federation; **M. Protic**, Serbia; **T. Pukšec**, Croatia; **M. Pusnik**, Slovenia; **S. Quoilin**, Belgium; **F. Raganati**, Italy; **A.M. Ragossnig**, Austria; **B. Rajh**, Slovenia; **J. Ramos**, Portugal; **P. Raskovic**, Serbia; **L. Razon**, Philippines; **A.C. Reis**, Brazil; **L. Režný**, Czech Republic; **C. Ribeiro**, Brazil; **F. Rinaldi**, Italy; **A. Ríos**, Ecuador; **J. Rodríguez Martín**, Spain; **A. Rodzkin**, Belarus; **G. Romano**, Italy; **C. Roselli**, Italy; **V. Roy**, France; **J.E. Ruelas Ruiz**, Mexico; **A. Runchal**, United States; **E. Rusu**, Romania; **L. Rusu**, Romania; **T. Ryley**, Australia; **O. Sahin**, Australia; **M.I.A. Sajjad**, Pakistan; **I. Sakata**, Japan; **M. Salvia**, Italy; **N. Samec**, Slovenia; **M. San-Román**, Spain; **C. Saras**, Spain; **M. Sarmento**, Portugal; **I. Savic**, Serbia; **A. Savvides**, Cyprus; **E. Scatto**, Italy; **J. Schmandt**, United States; **T. Schneiders**, Germany; **M. Schulze**, Germany; **V. Sebestyén**, Hungary; **R. Segurado**, Portugal;

M. **Sellitto**, Brazil; A. **Suurde**, Estonia; P. **Silva Ortiz**, Brazil; N. **Simões**, Portugal; S. **Singh**, India; M. **Siroix**, France; I.R. **Skov**, Denmark; R. **Skvorčinskienė**, Lithuania; J. **Smallwood**, South Africa; M. **Smol**, Poland; L. **Sokka**, Finland; V. **Soldo**, Croatia; R. **Solimene**, Italy; V. **Somogyi**, Hungary; M.- L. **Soran**, Romania; A. **Sorce**, Italy; P. **Sorknæs**, Denmark; K. **Sornek**, Poland; J. **Sousa**, Portugal; H. **Sözer**, Turkey; C. **Spataru**, United Kingdom; M. **Srbinovska**, North Macedonia; S. **Stanković**, Serbia; P. **Stefanović**, Serbia; Ž. **Stevanović**, Serbia; D. **Stojiljkovic**, Serbia; M. **Stojiljković**, Serbia; V. **Strezov**, Australia; S.A. **Sulaiman**, Malaysia; L. **Sun**, Japan; B. **Sundén**, Sweden; K. **Suwannahong**, Thailand; P. **Swiatek**, Germany; C. **Sy**, Philippines; P. **Škobalj**, Serbia; B. **Škrbić**, Serbia; R. **Šomplák**, Czech Republic; N. **Šuman**, Slovenia; V. **Šušteršič**, Serbia; T. **Tabata**, Japan; L.C. **Tagliabue**, Italy; J. **Taler**, Poland; A. **Tamosiunas**, Lithuania; M. **Tańczuk**, Poland; V. **Tasić**, Serbia; M.D. **Tenev**, Argentina; A. **Terelak-Tymczyna**, Poland; J. **Terrados Cepeda**, Spain; A. **Terziev**, Bulgaria; E. **Tesfamariam**, South Africa; C. **Testa**, Italy; U.Y.A. **Tettey**, Sweden; J. **Thakur**, Sweden; G. **Thomassen**, Belgium; G.M. **Tina**, Italy; T. **Tomić**, Croatia; Z. **Tomsic**, Croatia; M. **Trafczyński**, Poland; M. **Trajanović**, Serbia; K.C. **Tran - Gulbrandsen**, Norway; G. **Trbic**, Bosnia and Herzegovina; C. **Tregambi**, Italy; L. **Tronchin**, Italy; V. **Tunguz**, Bosnia and Herzegovina; J. **Uche**, Spain; W. **Uchman**, Poland; G. **Unakitan**, Turkey; K. **Unami**, Japan; A. **Vakhitov**, Uzbekistan; S. **Van Passel**, Belgium; D. **Van Vuuren**, Netherlands; L. **Vanoli**, Italy; D. **Varevac**, Croatia; Z. **Varga**, Hungary; G. **Vasic**, Serbia; C. **Vassiliades**, Cyprus; S. **Vasta**, Italy; J. **Vaughan**, Australia; E. **Vazquez**, Brazil; S. **Venghaus**, Germany; V.K. **Venkiteswaran**, Malaysia; N. **Verba**, United Kingdom; M. **Vicidomini**, Italy; I. **Visa**, Romania; R. **Volpe**, Italy; B. **Vucijak**, Bosnia and Herzegovina; G. **Vučković**, Serbia; R. **Vujadinovic**, Montenegro; A. **Vujanovic**, Slovenia; M. **Vujanović**, Croatia; V. **Vukasinovic**, Serbia; V. **Vukovic**, North Macedonia; T. **Walmsley**, New Zealand; E. **Wang**, United States; F. **Wang**, China; J. **Wang**, Czech Republic; Y. **Wang**, China; M. **Webb**, Australia; S. **Werle**, Poland; D. **Wittmann**, Brazil; K. **Wołosz**, Poland; S. **Wongcharee**, Thailand; C. **Wulf**, Germany; K. **Xhaxhiu**, Albania; D. **Xia**, China; U. **Yetis**, Turkey; C. **Yin**, Denmark; F. **You**, United States; X. **Zhang**, China; X. **Zhang**, China; D. **Zivkovic**, Serbia; P. **Zivkovic**, Serbia; P. **Zunino**, Italy; G.D. **Zupančić**, Croatia; K. **Zwarycz-Makles**, Poland; T. **Žakula**, Croatia; A. **Žnidarčič**, Slovenia

BOOK OF ABSTRACTS

Contents

Plenary lectures	47
Enabling Pathways Towards Sustainable Urban System Scenarios for Effective Climate Mitigation	47
Flexibility and Resilience from Multi-Energy Systems	48
Status of Renewable Energy Systems in the World	49
The ESSence of Geography in Energy Sciences	50
The Impact of Sector Coupling on Future Energy Systems.....	51
The Ipcc Sixth Assessment Report: a New Milestone for Our Understanding of Human-Caused Climate Change	52
Untying the Knot: Explorations to Meet Climate and Sustainability Goals	53
Special session: Bio-Electrochemical Systems as Sustainable Technologies for Implementing Innovative Remediation and Energy Harvesting Technologies	54
Development of Bio-Digital Interface Powered by Microbial Fuel Cells	57
Microbial Activity and Energy Production of Terrestrial MFCs in Presence of Compost and Persistent Organic Pollutants	58
Power and Electrofiltration Characteristics of Scalable and Low-Cost Microbial Fuel Cells for Resource Recovery from Urine.....	59
Stacked Air-Cathode MFCs for Small Sensors Power Supplying	60
Composite, Recycled Polypropylene-Coated Ceramic Membranes for Microbial Fuel Cells ...	61
Biodegradation and Biosorption Potential of Organophosphorus Pesticides in the Presence of Hydrochar and Biochar.....	62
Special session: Clean energy technologies and systems for sustainability	63
Exergy Analysis of Seawater Desalination Through Reverse Osmosis Driven by a Otec Plant	65
Complex Fluid Flows in Mini and Microchannels with Micro and Nano Enhanced Surfaces for Advanced Heat Recovery Systems.....	66
High-Temperature Solar Energy System with Thermally-Actuated Passive Solar Tracking....	67
Theoretical and Experimental Characterization of a Scroll Expander Operating in an Orc-Based Power Unit and Technological Improvement	68
Study on Hybrid Heat and Power Co-Generation System.....	69
Numerical Investigation on Thermochemical Behaviour Improvement of Corrugated Heat Storage Unit with Porous Metal Support	70
Dynamic-Mode-Decomposition of the Wake of a Nrel-5MW Wind Turbine.....	71
Developing of an Offline Monitoring Method for the Electric Energy Demand of a Healthcare Facility in Italy.....	72
Design and Assessment of a Large-Scale Integrated Power-to-Gas Plant for Renewable Sng Production in Remote Areas.....	73

Modelling and Experimental Investigations of Solar Thermal and Air Source Heat Pump System for Domestic Water Heating	74
Study on the Uniformity of Phase Distribution in Two-Phase Flow Heat Exchangers with Small Channels	75
A Transient Simulation-Based Approach for Hydrogen Production Assessment from Concentrating Solar Thermal Collectors	76
Special session: Developing energy-efficient and environment-friendly process equipment, process control and maintenance solutions for sustainable process manufacturing.....	77
The Dynamic Model of a Rectification Heat Exchanger Using the Concept of Heat-Integrated Distillation Column (Hidic)	79
Energy Analysis of the Operation of an Industrial Nozzle with Variable Outlet Conditions During Compressible and Transient Airflow	80
Impact of Uncertainty in Methods for Determining the Thermal Resistance of Fouling on the Scheduling of Heat Exchangers Cleaning	81
Experimental Investigation of an Impact of a Finned Pipe Inclination on the Cooling System Efficiency in Boiling Investigation Stand with Minichannel.....	82
Application, Optimization and Upscaling of Compact Trickle Bed Bioreactors for Removal of VOCs and H ₂ S in Biological Wastewater Treatment Plants	83
Gene Activity Control to Identify Biological Pathways of N ₂ O Production by Activated Sludge in Bioreactor Under Limited Do Conditions and Nitrite Presence	84
Non-Random Method of Cleaning Schedule Optimization for Heat Exchangers in a Hen	85
Impact of Temperature Approach on the Behavior of the Rectification Heat and Mass Exchanger Under Fouling Constraints.....	86
Game Theory Based Method for Payoff Sharing in District Energy System with Industry Under Uncertainty.....	87
Special session: From particle physics to sustainable world: Celebrating the achievements of Ivo Šlaus	88
Circular Economy Indicators for Ports: a Case Study of Slovenia	90
Terahertz Technology Towards Future Sustainable Buildings	91
Vessel In-Water Cleaning and Wastewater Treatment	92
Happiness as a Tool for Sustainable Development.....	93
Transforming Our World	94
Leadership for a New Paradigm: Planetary Moment and Momentum.....	95
On-Grid Photovoltaic System in Banja Pejës the Recreational Toursitic Enterprise – Comparative Analysis of Software Calculated Values and On-Site Measured Ones	96
How Covid-19 Could Help Climate Change Mitigation, Energy Transition and Sustainable Development?.....	97
Expert System for Systematic Monitoring of Sustainability-Related Competences in Higher Education.....	98
The ESSence of Plasma for Future Energy Storage Materials	99

Do the Technological Monopolies Endanger Democracy?	100
Special session: Future energy systems technologies and models fostering Green Deal targets across buildings, electricity and mobility sectors.....	101
Big Data Observation Analysis of Marine Service to Public End-Users Needs	103
Single-Tank Storage Versus Multi-Tank Cascade System in Hydrogen Refueling Stations for Fuel Cell Buses	104
Heat Storage in Buildings to Foster Green Deal Targets. A Top-Down Energy Modelling of Heating Electrification Pathways	105
Imbalanced Federated Learning Model for Blade Icing Detection of Wind Turbines	106
A Novel Deep Neural Network for Non-Intrusive Load Monitoring	107
Design and Implementation of a New Wind Speed and Power Forecasting Model Based on Hybrid Neural Network and Wpd Pre-Processing.....	108
Hybrid Method for the Aquaculture Energy Consumption Short Term Forecasting: Case Study of Norwegian Fish Farms.....	109
Data-Driven Building Energy Modelling – an Analysis of the Potential for Generalization ..	110
Technical, Economic and Environmental Issues Related to Electrolysers Capacity Targets According to the Italian Hydrogen Strategy: a Critical Analysis.....	111
Zedistrict in a Portual Area of the Mediterraneum.....	112
Comparing Optimal Hydrogen Solutions in a Renewable Energy Community in Islands	113
Convolutional Long Short-Term Memory Neural Model for Short-Term Wind Speed Forecasting: a Case Study of North Aegean Islands	114
Analyzing Solutions for Energy Independency of Small Islands - the Case Study of the Favignana Island	115
Techno-Economic Analysis of Renewable Energy System Flexibility: a Case Study for Sicily Island	116
A Review on Reversible Solid Oxide Cells Applications to the Building Sector	117
Special session: Harnessing the resource potential of our seas in a sustainable manner.....	118
Analysis of Offshore Wind Power Generation in the Brazilian Electricity System	120
Assessment of the Wind Power Dynamics in the North Sea Under Climate Change Conditions	121
The Near Future Expected Wave Power in the Coastal Environment of the Iberian Peninsula	122
Review of the Potentials for Implementation of Floating Solar Panels on Lakes and Water Reservoirs	123
Potentials for Implementation of Seawater Heat Pumps in Mediterranean	124
Boron Recovery from Desalination Seawater Brines by Selective Ion-Exchange Resins	125
Analysis of Sea Waves Energy Resources in Baltic Sea and Technical Possibilities of Their Usage for Energy Generation in Poland.....	126
Analysis of Thermal Efficiency of a Corrugated Double-Tube Heat Exchanger with Nanofluids	127

Machine Learning Based Long-Term Forecasting of Metocean Data for the Design of Marine Renewable Energy Systems	128
Blue Energy Potential Assessment and Their Impact on the Electricity System of the Republic of Croatia	129
Predictability and Quality of the Tidal Energy Resource Adds Value for Renewable Energy Grids and Off-Grid Power Solutions	130
Assessment of the Potential of Forward Osmosis as Pretreatment of the Multi-Effect Distillation Process	131
Blue Energy Spearheading the Energy Transition: the Case of Crete.....	132
Special session: Integration of Smart Cities and Smart Industry for Circular Economy: Energy, Water and Waste to Secondary raw material for Sustainable Future	133
Techno-Economic Assessment of Flexible Hydrogen and Power Production Based on Biogas Catalytic Reforming with Carbon Dioxide Capture Feature.....	138
Highly Efficient Diclofenac Decontamination from Water Using Green and Eco-Friendly Three-Dimensional Graphene in Packed Column Configuration	139
Stress Analysis of Printed Circuit Heat Exchanger for Advanced Nuclear Reactor Power Generation System.....	140
Optimization of Hydrogen Liquefaction Process Using Multi-Component Refrigerant	141
Environmental Impact Assessment of Post-Combustion CO ₂ Capture Applied in Cement Production Plants.....	142
Solid Waste Integration Towards Efficient Use of Resources: Tomsk Region	143
Optimising Response Time and Cost in Energy Systems for Smart Grid Operations.....	144
Life Cycle Impact Assessment (LCIA) of Selected ZIF-8 Synthesis Methods.....	145
Numerical Study of Flow Boiling Heat Transfer Characteristics of R32 in Horizontal Straight Tube	146
Multiphysics Coupling Simulation on Temperature Rise and Mechanical Characteristics of Direct Current Biased Transformer.....	147
Numerical Study and Optimal Design of Flow and Heat Transfer for Trench Cable	148
Advanced Approach to Cooperative Waste Treatment Cost Reduction Game.....	149
A Deep Learning Framework to Predict the Consumption of Petroleum Products	150
Anomaly Detection for Short Time-Series Data in Waste Management	151
Retrofit of Integrated Waste Gas-to-Energy Units by Conceptual Design Method	152
A Hybrid Evolutionary Algorithm for Heat Exchanger Network Retrofit for Processes with Multiple Operating Cases.....	153
Cooling Effectiveness of Li-Ion Battery Module with Multiple Phase Change Materials for Hybrid Electric Vehicle	154
Designing Solar Utility Systems	155
Cooperative Game Theory Approach for Plants' Fair Profit Allocation in Water Eco-Industrial Park.....	156

A Circular Economy Driving Change in the Management of Plastic Waste in Hospitals During the Covid-19 Pandemic	157
Multi-Level Stratification of Territories for Waste Composition Analysis	158
Improving Household Waste Segregation and Recycling in Circular Economy Transition by Analysing Resident Engagement in Social Media.....	159
Applications of Game Theory in Engineering Problems: a Summary of Methods and Their Assessment	160
Multi-Period Optimization of an Organic Rankine Cycle: Utilization of Waste Heat from the Aluminium Industry and Solar Thermal.....	161
Structural Optimization of Printed Circuit Heat Exchanger Used for Hydrogen Cooler by Exergoeconomic Method	162
Investigations on the Uniformity of Flow Distribution of Supercritical LNG in a Printed Circuit Heat Exchanger	163
Influence of Separately Collected Waste on Mixed Municipal Waste Quantity	164
Can Photofixation of Nitrogen Compete with Traditional Nitrogen Fertilizers Production?.	165
Waste Management Forecasting for EU Member States Considering Demographic Development	166
Mass Integration with Headers of Intermediate Purity and Multiple Fresh Resources	167
Industrial and Urban Symbiosis: Closing the Circle.....	168
Regional Transmissions of Embodied Energy-Carbon-Water System: Case Study of Coastal Area China	169
Numerical Investigation of Two-Phase Thermosyphon Heat Pipe with Different Orientations	170
Experimental Investigation of Thermal-Hydraulic Performance of Supercritical CO ₂ in Asymmetric Airfoil Printed Circuit Heat Exchanger	171
Machine Learning Driven Waste-to-Energy Valorisation for Low-Carbon Dimethyl Ether Production	172
Thermal Performance of Flat-Plate Heat Pipes with Various Working Fluids Under Different Inclination Angles	173
Numerical Investigation on Melting Process of Phase Change Materials with Metal Foam and Fins in a Rectangular Container with Varying Inclination Angles.....	174
Experimental Study on Heat Transfer of Granular Flow in Moving Bed: Application of Heat Resistance Theory	175
Assessing Process Effectiveness and Specific Environmental Impact of Heat, Power & Chemicals (Hpc) Option as Future Perspective in Biogas	176
Sensitivity Analysis of Biogas Supply Network Considering Parameter Uncertainties	177
Optimization and Effect of Particles Distribution in Grille-Sphere Composite Packed Bed with Steam Methane Reforming	178
A Practical Approach for Synthesis of Biodiesel via Non-Edible Seeds Oils Using Trimetallic Based Montmorillonite Nano-Catalyst.....	179
CO ₂ Precooling-Assisted Refrigeration Cycle for Energy-Efficient and Cost-Effective Biomethane Liquefaction Process	180

Secondary Separation of Fine Particles Emitted by Biomass Boilers: Controlled Particles Growth and Particles Impaction.....	181
SPIL-HX: a Software Suite for Heat Recovery Networks and Equipment Design	182
Special session: Plant Assisted Bioremediation of Contaminated Areas: A Sustainable Technology for Recovering Soil Pollution and Energy Conversion in a Framework of Circularity	183
Microcosm Experiment for Assessing Sunflower Capability to Grow on a PCB-Contaminated Soil	185
Fluidized Bed Gasification of Biomass from Plant-Assisted Bioremediation: Assessment of the Effect of Different Catalytic Bed Materials on Heavy Metals Emissions	186
Organic Amendments of Contaminated Soil for Improving Phyto-Assisted Bioremediation	187
Chemical Valorization of Poplar Biomasses Grown on a Contaminated Area: Effect of One-Step Pre-Treatment with Performic Acid to Enhance Enzymatic Digestibility	188
Special session: Renewable energies, innovative HVAC systems and envelope technologies for the energy efficiency of buildings.....	189
Effect of Climate Changes on the Energy Performance of Nzebs in Mediterranean Climate: Discussion About the Renewable Integration.....	192
Large-Scale Hydrogen Production Using a Grid-Connected Renewable-Based Water Electrolysis System in Different World Climates.....	193
Climate Change and the Building Sector: an Integrated Building Energy Simulation Early – Design Tool.....	194
Experimental Study of a Solar System Based on Hybrid PVT Collectors for the Provision of Heating, Cooling and Electricity in Non-Residential Buildings.....	195
Adaptive Transparent Insulation Materials for Window Application: Thermal and Optical Evaluation.....	196
Creating User-Building Interaction Profiles for Low-Carbon Heating in Residential Buildings in Europe	197
Demonstration of the Value of Network Topology Optimization for Advanced District Thermal Energy Systems	198
Influence of Input Data in Urban Building Energy Simulations: Lesson Learnt from an Italian Case Study	199
Development of Mgso ₄ -Mesoporous Silica-Based Salt Composites for Thermal Chemical Energy Storage: the Role of Porous Structure on Water Adsorption.....	200
Analysis of a New Index for the Thermal Performance of Opaque Building Components in Summer	201
Impact of Zoning HVAC Control Systems in Users Comfort and Energy Efficiency in Residential Buildings.....	202
Novel Pseudo 3D Design of Solar Thermal Facades with Triangle and Trapeze Solar Thermal Collectors for Increased Architectural Acceptance	203
HVAC Polyvalent Technologies to Balance Contemporary Loads in Buildings	204
Techno-Economic Comparison of Hydrogen- and Electricity-Driven Technologies for the Decarbonisation of Domestic Heating	205

A Study on the Synergy Between a PV-Based Renewable Energy Community and a Low Temperature District Heating System with Distributed Heat Pumps	206
The Transient Hygrothermal Modelling to Assess the Thermal Transmittance Variation of Opaque Walls in the Mediterranean Climate.....	207
Optimal Household PV Arrays Under Current and Voltage Limitations	208
Optimal Design and Operation of Distributed Generation and Biomass District Heating....	209
Design and Characterization of an Opv-Etfe Multi-Layer Semi-Transparent Glazing	210
Optical and Thermal Performance of a Mirror-Array Concentrating Solar Collector.....	211
Nzeb Smart Management: Some Evaluations Based on the Energy Performance Monitoring of a Case-Study	212
Energy and Economic Performance of Solar-Assisted Cooling Systems for Southern Italy: a Critical Comparison Based on a Case Study	213
Analysis of the Opportunity of Demand Response (Dr) Strategies in Shopping Centres	214
The Role of Solar Cooling for Nearly Zero Energy Multifamily Buildings: Performance Analysis Across Different Climates	215
Building Integration of Active Solar Energy Systems in the Urban Fabric: Façade Renovation Using Building Integration of Active Solar Systems and Effects on Thermal Comfort in Public Spaces	216
Effectiveness and Constraints of Using PV/Thermal Collectors for Heat-Driven Chillers....	217
Optimized Design and Integration of Energy Storage in Solar-Assisted Ground-Source Heat Pump Systems	218
Heuristic Model-Based Predictive Control Strategies for an Institutional Net-Zero Energy Building	219
Improvements of Simplified Hourly Models for the Energy Assessment of Buildings: the Application of En Iso 52016 in Italy	220
Design and Control Analysis for Building Integrated Photovoltaics-Heat Pump Combinations in a House.....	221
Building Integrated Photovoltaic Thermal/thermoelectric (Pvt/tec) Air System: Modelling and Simulation	222
Building Integrated Concentrating Photovoltaic/thermal Glazing (Copvtg) Systems: Experimental Campaign and Dynamic Simulation Tool Validation.....	223
Analysis of the Energy Consumption of the Italian Railway Building Stock	224
Exploring the Impact of Variable Physical Parameters of Human Body on the Assessment of Energy Demands in Smart Buildings Toward a Novel Dynamic Thermal Comfort Approach	225
Covid-19 and Indoor Air Quality: Dynamic Simulation Approach to Enhance Ventilation System in Railway Sector	226
Thermal and Electrical Modelling of a Double-Skin Façades Integrating Bifacial Photovoltaics: Energy and Economic Performance Assessment.....	227
Application of Artificial Neural Network for Energy Management of a Smart Community..	228
Simulation and Control for Energy Management: an Energy Management Strategy Applied to a Multi-Zone Building Coupled with Solar Based and Energy Storage Technologies.....	229

A Cost-Optimal Analysis of Adaptation Measures in Educational Buildings of Warm Mediterranean Region	230
Towards Energy-Positive Buildings Through a Quality-Matched Energy Flow Strategy	231
Special session: Renewable Fuels and New Technologies in Sustainable Combustion.....	232
Review of Regenerative Cooling Technology for Scramjet Engines: Phenomena and Challenges	233
Effects of Swirlers on Outlet Temperature and Co Emission of a Gas Turbine Combustor ..	234
Waste Cooking Oil Biodiesel Combustion in a Novel Low Emission Swirl Burner.....	235
Slagging Mechanism of Multiple Biomass Co-Combustion in a Full-Scale Circulating Fluidized Bed Boiler	236
Transition of Coal Regions by Cultivation of Short Rotation Copies and Dedicated Energy Crops for Biomass Co-Firing – a Case Study.....	237
Enrichment of Residual Carbon from Coal Gasification Fine Slag by Spiral Separator	238
Study on the Effect of Flow Blockage Due to Rod Deformation in Quench Experiment	239
Severe Accident Analysis of the Dual-Functional Lithium-Lead Test Blanket Module (Dfll-Tbm) Using the Isaa-Dfll Code	240
Research on the Effects of Local Throttling on Two-Phase Flow Instabilities in Open-Channel System.....	241
Numerical Modelling of Flue Gas Desulfurisation by Absorption in Spray and Wall Film ...	242
A Transient Model of a Hybrid System Based on Biomass Gasification and PV for Combined Cooling, Heat and Power for Electric Mobility Services.....	243
Automatized Procedure for Calculation of Laminar Flame Speed and Autoignition Data Bases in Coherent Flame Models.....	244
The Impact of Inlet Boundary Conditions on Freeboard CFD Results in a Small-Scale Wood Pellet Boiler	245
Decomposition of Organic Contaminants from Solar Pyrolysis Tar in Oxidation Processes	246
Spatially Selective EGR - a Novel Approach for Heat Release Control in Continuous Combustion	247
Innovative Virtual Design and Experimental Characterisation of a Small Scale Sewage Sludge Incineration System	248
Mass Transfer Modelling in Spray Droplets Absorption for Wet Flue Gas Desulfurization Application	249
Scaling up Extractive Deacidification of Waste Cooking Oil.....	250
Experimental Study on NO Heterogeneous Reduction by Char	251
Hydrogen-Enriched Natural Gas in the Decarbonization Perspective	252
Comparison of Reduced Chemical Kinetics Models of Ammonia Combustion in the Experimental Burner	253
Special session: The transition toward a decarbonized energy system: the role of energy efficiency and renewable energy sources.....	254

What are the Achievements of the European Union Member States Towards Energy-Sustainable Agriculture: a Contribution to the Structural Efficiency Approach	258
PV-Powered Electric Vehicle Charging Stations.....	259
Dynamic Strategies of the Integration of Power and Transport Sectors for Energy Systems in Transition	260
Techno-Economic Analysis of a Green Hydrogen Valley for an Industrial District in Sardinia	261
Energy Performance of Window Components Fitted with Photchromic Glass Compared with Traditional Systems Fitted with Traditional or Low-E Coated Glass	262
An Innovative Concept of Trombe Wall for Yearly Use in Residential Buildings	263
Experimental and Simulation-Based Tests on the Calibration of a Grey-Box Model Using Pso	264
A Solar-Assisted Low-Temperature District Heating Network Coupled with a Ground-Source Heat Pump.....	265
Time-Evolution of Electricity Generation System: Criticalities and Opportunities.....	266
Thermo-Economic Assessment of Flexible Nuclear Power Plants in the UK's Future Low-Carbon Electricity System: Role of Thermal Energy Storage.....	267
Evaluating Social Awareness of Energy Communities Through Semantic Network Analysis of Online News	268
Multi-Model Assessment of Heat Decarbonisation Options in the UK Using Renewable Hydrogen	269
Experimental Exergy Analysis of a Ground Source Heat Pump with Combi-Thermal Storage	270
A Gis-Based Approach to Identify Potential Heat Sources for Heat Pumps and Chillers Supplying District Heating and Cooling.....	271
Application of Wave-to-Wire Modelling to Optimise Oscillating Water Column Wave Energy Converters for Small Installations in the Mediterranean Sea	272
A Step Towards Decarbonized District Heating Systems: Assessment of the Importance of Individual Metering on the System Level	273
Fixed and Tracking PV System for Net Zero Energy Buildings: Comparison Between Annual and Monthly Energy Balance.....	274
Assessing the Feasibility of an Integrated Clc-Methanation System Using Solar Dried and Torrefied Biomasses as a Feedstock	275
Plastic Waste to Methanol: a Chemical Recycling Pathway	276
Non-Linear Model Predictive Control for the Space Heating System of Buildings in Norway	277
Dynamic Simulation Modelling of Reversible Solid Oxide Fuel Cells for Energy Storage Purpose	278
Dynamic Simulation of a CO ₂ Heat Pump System for Residential Space Heating: Case Study for the "Superbonus" Strategy	279
Smart Energy District Based on the Integration of Photovoltaic, Electric Vehicles and Combined Heat and Power Generation: Optimal Design	280

Optimal Design of a 5Th Generation District Heating and Cooling Network Based on Sea Water Heat Pumps	281
Anaerobic Digester Feed by Renewable for Biomethane Production	282
Harmonized Multi-Scale Energy Planning in Metropolitan Areas: the Economic and Environmental Impact of Conurbation Systems in the Regional Energy Plan	283
Development Opportunities for Energy Communities in Urban Regeneration Plans	284
Data Driven Optimal Design of a Cogeneration Plant: the Case Study of a Hospital Building	285
Design of Heating, Cooling and Power Networks Deriving from the Insertion of Micro-Cogeneration Units in Densely Populated Areas: an Italian Case Study	286
Special session: Valorisation of Brines for the Recovery of Energy and Raw Materials	287
Development of Innovative Technology for the Treatment and Recovery of Textile Industry Brine Waste Stream	290
Sustainable Recovery of Lithium from Saline Streams by Flow Capacitive Deionization	291
Techno-Economic Analysis of a Novel Hybrid System for the Valorisation of SWRO Brines in a Minor Sicilian Island	292
Chemical, Modelling and Experimental Efforts on Selective Ca and Mg Separation from Ro Seawater Desalination Brines	293
Valorization of Surface-Waters Ro Brine via Assisted-Reverse Electrodialysis for Minerals Recovery: Performance Analysis and Scale-up Perspectives	294
Redesigning the Coal Mine Wastewater Treatment to Enable Transition to Circular Economy Practices: the Zero Brine and Dębieńsko Case Studies	296
Evaluation of Saltwork Ponds Operation Through Brine Characterization and Geochemical Modelling Using PHREEQC Code Integrating the Pitzer Correction	297
Seabrine™ - the Industrial Waste Brine Solution Brine Purification Demo Plant with HPO Process for Valorization of TOCReduction of Industrial Waste Brines	298
Valorization of Seawater Desalination Brines Through the Integration of Eutectic Freeze Crystallization and Electrodialysis with Bipolar Membranes Innovative Technologies.....	299
Special session: Waste derived Biomix fuels for high efficiency and low emission application.....	300
Effect of Quality of Used Oil on the Properties of Biodiesel, Engine Performance and Engine Out Emissions	301
Energy and Sustainability Based Investigation of an Off-Road Diesel Engine Fuelled with Cassia Fistula Biodiesel.....	302
Biomix Fuel Production from Waste Resources and Their Utilization in a VCR-Crdi Compression Ignition Engine.....	303
Biodiesel Fuel Property Enrichment and NOx Emission Mitigation Techniques	304
Aviation Biofuels: Progress and Challenges.....	305
Model for Energy Consumption and Costs of Bioethanol Production from Waste Paper	306
Addition of the Natural Compound Squalene Reduces Oxidation in Unsaturated Oils	307

Investigation on Yield, Fuel Properties, Ageing and Low-Temperature Flow of Various Fish Oil Esters	308
Advanced sustainable energy conversion systems	309
Thermodynamically Consistent Reduced Dimensionality Multi-Species Electrochemical Model for Solid Oxide Fuel Cell Performance Modelling, Control and Digital Twin	309
Green Hydrogen Production Potential in West Africa – Case of Niger	311
Photocatalytic Activities of Visible Light Photocatalysts for Hydrogen Production by Liquid Phase Plasma Irradiation.....	312
CFD Simulation of Ball Milling Reactor for Novel Ammonia Synthesis Under Ambient Conditions	313
Tofu Derived Electrocatalyst for Oxygen Reduction Reaction in Anion Exchange Membrane Fuel Cell	314
Synthesis of Atomically Dispersed Mn-Nc Hollow Sphere as Enhanced Electrocatalysts in Fuel Cell	315
Challenges of Heat Pipes Application for Sustainable Development of Energy Systems	316
Alternative fuels	317
Prediction of the Product Yield from the Co-Pyrolysis of Biomass and Waste Plastics and the Influence of the Synergistic Effect.....	317
Synthesis of Co and Fe Doped Hollow Carbon Spheres from Mof/polypyrrole Core-Shell Particles and Their Application for Oxygen Reduction Reaction.....	318
Design and Optimization of a Multi-Mode Hydrogen Delivery Infrastructure for Clean Mobility	319
Advanced Methods of Green Hydrogen Production and its Transportation.....	320
A Decentralized Production of Sustainable Synthetic Kerosene: Impacts of Operation Strategies on the Energy Supply	321
Sustainable Synthetic Kerosene: Evaluation of a Power-to-Liquid Process via Fischer-Tropsch Reaction on the Basis of an Open-Source Python Model	322
Incentive Structures for Power-to-X Pathways in EU and Member States	323
Biofuels and biorefineries 1.....	324
Lipids Extraction from Sewage Sludge Using Green Biosolvent for a Sustainable Production of Biodiesel	324
Evaluation of Biogas Potential of Sewage Sludge Co-Digestion with Different by-Products from Vegetable Oils Industry.....	325
Valorization of Organic Waste to Aromatics via Catalytic Pyrolysis with Methane	326
Continuous Flow Upgrading of Biomass Pyrolysis Oils to Gasoline- and Diesel-Range Hydrocarbons over Bimetallic Rureox/c Catalyst	327
Condensed Hydrodeoxygenation of Biomass Pyrolysis Oil to Aviation Fuels Using Ni-Based Bimetallic Catalysts	328
Production of Oligosaccharides from Macroalgae: Process Development for an Innovative Marine Biorefinery.....	329
Biofuels and biorefineries 2.....	330

Effective Fractionation Processes for the Upgrading of Microalgae Biomass in the Biorefinery Framework	330
Wet Torrefaction of Digestate from Sewage Sludge in Terms of Energy Application.....	331
Towards a Sustainable Development Framework: Valorization of Banana Waste Under a Biorefinery Approach.....	332
Evaluation of Steam Demand, Water Use and Integration Opportunities in Brazilian Sugarcane Biorefineries	333
Kinetic Study of Biomass Oxycombustion and Pyrolysis	334
Biofuels and biorefineries 3.....	335
Application of Response Surface Methodology to Describe the Effect of Cooking Process on Selected Properties of Palm-Based Frying Oils Used as Biodiesel Feedstock	335
Effect of Cooking Conditions on Selected Properties of Biodiesel Produced from Palm-Based Waste Cooking Oils	336
A Feasibility Study on the Development of a Biogas Production System for a Sustainable Business Park in the Hoek Van Holland Area - the Netherlands.....	337
Life Cycle Assessment of a Passenger Car Fed with Blends of Petrol and Renewable Fuels and Comparison with a Battery Electric Vehicle.....	338
Valorisation of Biomass Wastes Through Intermediate Pyrolysis	339
Ignition and Combustion Characteristics of Biomass Derived Fast Pyrolysis Bio-Oil in a Combustion Research Unit.....	340
Biofuels and biorefineries 4.....	341
Integral Analysis of Liquid-Hot-Water Pretreatment of Wheat Straw: Evaluation of the Production of Sugars, Degradation Products and Lignin.....	341
Optimization of the Colloidal Lignin Particle Production Process: Temperature and Lignin Concentration Influence in the Solvent Shifting Precipitation	342
The Influence of Transition Metals in Mg-Al Mixed Oxides on Synthesis of Ethanol to Valuable Products: Reaction Pathways	343
Transformation of Spent Coffee Grounds Under Near-Critical Conditions of Binary Water-Organic Solvent Systems Towards Value-Added Bioproducts.....	344
Upgrading of Raw Biogas Using Non-Porous Membranes	345
Cleaner Fuel Production via Co-Processing of Vacuum Gas Oil with Rapeseed Oil Using a Novel Niw/acid-Modified Phonolite Catalyst.....	346
Buildings 1.....	347
An Integrated Deep Learning Based Approach for Real-Time Monitoring of Occupancy and Windows Within Buildings for Demand-Driven HVAC Operations.....	347
Analysis of HVAC System Operational Fault Impacts on Energy Demand and Thermal Comfort Under Current and Future Climate Scenarios	348
Enhancing Window Solar Heat Gains in Winter by Nir-Selective Nanofilms.....	349
Machine Learning-Based Individualized Comfort Modeling for Smart Buildings	350
Energy-Saving Potentials by Dynamic Spectrally Selective Window Structures	351

An Overview of Clothing Insulation Measurement for Use in PMv-Based HVAC Control and Vision-Based Approach for Clothing Insulation Prediction	352
Integration of Numerical and Experimental Approach in Life Cycle Assessment of Stand-Alone Microgrid System	353
Buildings 2.....	354
The Impact of Using the Application of a Cnn-Based Approach for Equipment Usage Detection on Building Energy.....	354
Investigation of the Integration of Wind Buffers on the Wind and Thermal Comfort Performance of Lateral and Peripheral Skygardens	355
Economic Optimised Energy Retrofits of a Building When Using Different Retrofitting Materials Under Different Energy Scenarios	356
Development of an Integrated Passive Heat Recovery Technology and Ventilation System for Reducing the Building Energy Demand.....	357
Evaluating a High Rise Building in Humid Subtropical Climates in Shanghai for Passive House Classification	358
Investigation of the Transient Thermal Performance of a Pavement Solar Collector (Psc) for Urban Overheating Mitigation	359
Improving the Building Envelope Performance Through Tensile Material in the Iranian Climates	360
Buildings 3.....	361
Ventilation and Thermal Performance of a Novel Windcatcher System with Passive Dehumidification	361
Evaluation of the Impact of the Spatial Deployment of Vegetative Barriers on the Building's Thermal and Energy Performance	362
Thermal Performance Under Future Climate Scenarios for an Enerphit Building in Athens	363
Investigation of the Aero-Thermal Comfort Performance of a Passive Cooling and Heat Recovery Windcatcher Using a Modified Thermophysiological Model.....	364
Design Strategies to Increase the Cascading of Wood Materials in Buildings: Lessons from Architectural Practice.....	365
Occupant Lifestyle: Impact on Energy Use of High-Rise Dwellings in Southeast China.....	366
The Sustainable Heating of Amsterdam's Historic Buildings	367
Buildings 4.....	368
E-Safe: Energy and Seismic Affordable Renovation Solutions for the Decarbonisation and Seismic Safety of the EU Building Stock	368
Evaluation of the Ventilation and Cooling Performance of a Windcatcher with Helical Coil Heat Transfer Device (Hchtd) for Hot Climates	370
Investigating High Resolution Profiles of Building Energy Demand and Renewable Production for Increasing Flexibility	371
Possibilities for Deep Renovation in Multi Apartment Building Under Different Climate and Economic Conditions	372
Computational Approach to Predict Thermal Comfort Levels in Passivhaus Based on Natural Ventilation	373

Material Classification and Reuse Framework Based on the Reverse Dismantling of Buildings in Urban Mining: a Study in Tcclab	374
Soft Digital Twin for IEQ Enabling the Covid Risk Mitigation in Educational Spaces	375
Buildings 5.....	376
Integration of Environmental Impact Assessment into Parametric Performance-Based Structural Design for Flexible Industrial Buildings.....	376
Net-Zero Buildings What are They and What Should They Be?	377
Sustainable Use of Material Resources in AEC Industry - a Review.....	378
Framework for a Digital Urban Mining Platform for the Building Stock of Vienna	379
Investigation of the Influence of the Integration of Vegetation and Evaporative Cooling on the Aero-Thermal Comfort Performance of Buildings with Courtyards in Hot Climates.....	380
An Evaluation on the Effect of Thermal Mass to Modulate Overheating in Different Climates in China and the Role of Night Ventilation	381
Energy Renovation of an Existing Building in Limassol, Cyprus, with Double Skin Façade and Building Integration of Active Solar Energy Systems: Energy Performance and Life Cycle Cost Analysis.....	382
Buildings 6.....	383
Influence of Silica Sand on the Structure and Properties of the Gypsum-Based Mortar Under Temperature Load.....	383
Evaluation of the Effect of Climate Change on the Energy and Comfort Resilience of Urban Buildings.....	384
Assessment of Daylight Performance for Typical In-Patient Rooms in Healthcare Facilities and the Impact on Energy Efficiency	385
Optimization Method of a Model Predictive Control System for Thermal Activated Buildings	386
A Review on Domestic Heat Water Supply via Cascading Heat Pumps	387
Measurement of a Refrigeration System and Integration of a Digital Twin for Operational Optimization.....	388
Cogeneration, trigeneration, polygeneration	389
A Dynamic Multi-Objective Optimization Framework for Simultaneous Process Design and Control of a Cogeneration System Considering Uncertainties.....	389
A Multi-Objective Optimization Approach to Design an Integrated Renewable Energy System Including Exergorisk and Reliability Characteristics for Sustainable Operation.....	390
Pilot Process Demonstration of a Feasible, Plastic Pyrolysis We-to-En System Through Biomass Decentralized Heating Business Model.....	391
Numerical and Experimental Analysis of the Operation of the Micro-Cogeneration System with a Wood-Fired Stove and Prototypical Thermoelectric Generator.....	392
Predictive Dynamic Model of a Smart Cogeneration Plant Fueled with Fast Pyrolysis Bio Oil	393
Theoretical Analysis for the Use of High-Temperature Geothermal Reservoirs with Coaxial Deep Borehole Heat Exchangers as a Heat Source for Cogeneration of Electricity and Heat	394

Decarbonisation, Energy and water efficiency in industry and mining 1 ... 395

Socioeconomic Impacts of Cleaner Production Practices in Chemical Industry.....	395
Carbon Permit Sharing in Industrial Symbiosis: a Game Theory-Based Optimisation Model	396
Life Cycle Analysis of a Cobalt-Free Li-Ion Battery Cell to Support the Renewable Energy Transition	397
Seawater Flue Gas Desulphurization Process for Coastal Industrial Areas	398
Optimization of Membrane-Based Post-Combustion Carbon Capture Using a Network Flow Model	399
Gypsum Based Composites with Improved Water Resistance.....	400
Debottlenecking of an Existing Gas Pyrolysis Plant for Energy-Saving and Emission Reduction	401

Decarbonisation, Energy and water efficiency in industry and mining 2 ... 402

A Review on Occupancy Prediction Through Machine Learning for Enhancing Energy Efficiency, Air Quality and Thermal Comfort in the Built Environment.....	402
Industrial Ceramic Waste as Low Cost and Eco-Friendly Pozzolana Active Filler in Gypsum-Based Binders.....	403
Just Suspended Speed Simulation in Torus Reactor Using Multiple Nonlinear Regression Model	404
Optimisation of Multiperiod Heat Exchanger Networks Including Thermal Energy Storages	405
Hybrid Solvents Based on Des and Amines for CO ₂ Capture	406
Techno-Economic Assessment of the Simultaneous Electrocatalytic Synthesis of CO ₂ and Water to Valuable Base Chemicals Such as Ethylene	407

Decarbonisation, Energy and water efficiency in industry and mining 3 ... 408

Opportunities and Barriers of Plasma Catalysis for Carbon Capture and Utilization: a Techno-Economic Assessment.....	408
A Proposal of Process Integration for the Decarbonization of the Steel Industry.....	409
Conceptual Design of the Steel Industry in 2050 Considering Collaboration with Local Communities	410
Techno-Economic and Environmental Analysis of Carbon, Capture and Utilization of Fermentation CO ₂ from Ethanol Distilleries.....	411
Model Predictive Control Using Mechanistic Data-Driven Model for Optimal Operation in Agro-Food Industry.....	412
A Preliminary Study of Calcite Saturation States with Varying pH and Salinity	413

Decarbonization of industrial production emissions: special focus on steel industry 414

Sponge Iron with the New Black: Production and Use of Bio-Coal in a Direct Reduced Iron (Dri) Plant.....	414
Coupling Energyplan and LCA to Perform a Scenario Analysis on the Decarbonization of Chinese Steel Industry	415

Production and Characterization of Biocarbon from Woody Biomass Under Different Pyrolysis Conditions	416
Study on Densification of Biocarbon for Metal Production Application	417
Integration of Power-to-Hydrogen with Direct Iron Ore Reduction for Low-Carbon Steelmaking	418
District heating and/or cooling in smart energy systems	419
Evaluation of a Solar-Driven Heat Pump for Power-to-Heat Applications: from Building to District Level in a Distributed Energy System	419
Heating and Cooling Networks: a Comprehensive Review of Modelling Approaches to Map Future Directions	420
Mutual-Benefit of District Heating Market and Network Operation for Prosumers Integration	421
Optimisation of Urban Waste Heat Source Integration into Existing District Heating Systems	422
An Innovative Approach to Model Positive Energy Districts in Italy	423
A Sectorial and Process-Based GIS Methodology for Mapping Denmark's Industrial Excess Heat Potential for 3DH and 4DH Systems.....	424
Energy markets	425
Electricity Consumption and Market Prices in Serbia – Impact of the Pandemic of Covid-19	425
Evaluation of the Participation of Residential and Commercial Consumers in Energy Communities, a Case Study in València, Spain	426
Selection of Appropriate Variables to Analyze Renewable Energy Strategic Investments in Power Markets Considering Diversification Issues and the Effects of Weather and Competition Uncertainty.....	427
Short-Term Load Forecasting Using Time Series Clustering.....	428
Heading Towards Sustainable and Democratic Electricity Systems.....	429
Assessing Flexibility Options in the Electricity Markets Clearing	430
The Nonlinear Relationship Between Household Composition and Residential Electricity Consumption	431
Energy policy 1	432
Improving Thermal Comfort in Poor-Energy Dwellings Through Test Cells for Climate Change Mitigation in the Mediterranean Area	432
Hope and Reality of Renewable Energies in Rural Areas.....	433
Competition in the Heat Market: District Heating System as the Infrastructure for Competition Among Producers.....	434
Estimating the Marginal Cost of Renewable Energy Certificates in South Korea.....	435
Prospective Scenarios for Madagascar's Electrification by 2050: Discussing Energy Policy Framework	436
A Long-Run Perspective on World Energy Demand: Risk and Sustainability Implications .	437

A Common and Coherent Transformation? Comparison of Policy Approaches for the German Bioeconomy	438
Energy policy 2	439
A Just and Clean Energy Transition: Resilience and Competitiveness of the European Regions	439
Decarbonising Italian Gas Network: Possible Scenarios for Green Hydrogen for 2030-2050	440
Extending the Capabilities of Energy Signature Modelling – Lessons Learned from a Case Study	441
Comprehensive Analysis of the Energy Legislative Framework of Kyrgyzstan: Investigation to Develop a Roadmap of Kyrgyz Renewable Energy Sector.....	442
Diving Towards a Complete Decarbonisation of the Spanish Energy System from a Top-Down Viewpoint and Data Analysis.....	443
Energy Justice Conceptual Framework for Technology Assessment.....	444
Energy system analysis 1.....	445
An Interdisciplinary Approach of a Local Peer-to-Peer Energy Trading Model for a More Sustainable Power Grid.....	445
Agriculture in the Context of Economy Decarbonisation Modelling	446
Modelling Transport Sector in Energy Planning Model: a Part of Multi-Sectoral Approach for Modelling the Decarbonization of Lithuania	447
Technical, Economic and Ecological Effects of Lowering Temperatures in the Moscow District Heating System	448
Hydrogen for the Decarbonization of Maritime Sector: Feasibility Analysis of On-Board Power-Train System Based on Pemfc Technology	449
Simulation of a Prototypal Micro-Orc for Residential Application When Driven by Solar Source	450
Modeling Hydropower to Assess its Contribution to Flexibility Services in the Bolivian Power System.....	451
Energy system analysis 2.....	452
Electric and Thermal Energy Communities Comparison Assessment: a Case Study in a Mediterranean District	452
Planning Positive Energy Districts in Meditarrean Cities, Methodology and Approach to València, Spain	453
A Deep Learning Prediction Module for the Iot System Energysaver for Monitoring and Estimating Power Consumption.....	454
Participation of a PV Power Plant to the Italian Ancillary Service Market via a Hydrogen-Based Power-to-Power System: Economic Impact of Secondary Frequency Reserve Provision	455
Sector Coupling and Flexibility Solutions in the Italian National Energy Systems with 100% RES Supply to Power and Mobility	456
Transient Thermal Modeling of Aluminum Cells for Renewable Energy Integration	457
Data Centers Cooling: On-Site Integration for Smart Energy System.....	458

Energy system analysis 3.....	459
Assessment of Waste Heat Recovery in Uae's Steel Industry	459
Modeling and Optimization of Sector-Coupled Energy Systems Using Milp.....	460
The Role of Wastewater Treatment Plants in Sector-Coupling and Reduction of CO ₂ Emissions by Flexible Operation – a Case Study.....	461
The Potential Role of Microwave Heating on the Decarbonisation of the Pigment Industry - a Numerical Study.....	462
The Future Role of Bioenergy in the German Heat Sector Under Consideration of Consumer Choice in Energy System Optimization Modeling	463
Data-Driven Energy Planning in Practice: a Study Based on German and Chinese Cities....	464
Planning of the High Share of Renewable Sources Within the Republic of Serbia Energy System: from 21,7To 40 % - Can We Reach 100%?	465
Energy system analysis 4.....	466
Techno-Economic Feasibility of a Small Renewable Energy Community: a Case Study of Office Buildings in South of Italy	466
Modelling Tool for Energy Consumption of Freezing Chambers in Seafood Sector.....	467
Parametrising the Energy Transition for LNG Export-Dependent System; Qatar	468
Techno-Economic Analysis of Green Hydrogen Production in Poland.....	469
The Role of Biomass Energy in a 100% Renewable Energy System for Akita Prefecture, Japan	470
Open-Source Backbone Model for Studying the Development of the Baltic Energy System .	471
Energy system analysis 5.....	472
Closing the Gap Towards 100% Renewable Energy System in the Case of Scarce Renewable Source Availability	472
First Approach for a Techno-Economic Analysis of Storage Components Used for Improving Energy Management Strategies in Microgrids.....	473
Modelling of 100% Renewable Energy Systems in Integrated Assessment Models by Multi-Timeframe Regression Analysis	474
Model for the Assessment of Decarbonisation in the Industry Sector	475
Modeling of the Chemical-Looping Combustion of Syngas in Packed Bed Reactors.....	476
Performance Analysis of Four Data-Driven Prognostic Models for Lithium-Ion Batteries Capacity Prediction Based on Data Multiplicity	477
Energy system analysis 6.....	478
An Mip Model with Endogenous Capacity Investment for Energy Transition Pathways - Interrelation Between Power-to-X, Demand Response and Market Coupling	478
Optimization of the Possible Pathways for Gradual Energy System Decarbonisation	479
Smart Energy and Smart Abatement for Chile's Energy Transition	480
Time Series Sectoral Mapping of Energy Transition Paths and Greenhouse Gas Emissions.	481
Techno-Economic Analysis of Coupling Thermochemical Energy Storage with Power-to-Heat for Increased Utilisation of Solar PV in Residential Space Heating Systems.....	482

Optimal Heat Storage in District Energy Plants with Heat Pumps and Electrolysers	483
Environmental policy and management 1.....	484
Evaluation of Properties and Composition of the Mixed Municipal Waste	484
Climate Emergency Declarations and Climate Ambition of Local Plans: a Comparative Assessment for Italian Cities	485
Characterization of Biofilms Made from Pigmented Native Potato Starch Solanum Tuberosum Subspecies Andigena and its Biodegradability Capacity as an Alternative to the Use of Artificial Polymers	486
Oil Tank Farm Emission Trends of Russian Refineries	487
The Optimum Energy and Wood Procurement Scenario for its Dynamic Management in Carbon Neutral Forest Industry	488
The Impact Assessment of NO ₂ Emission from District Heating Plant on Local Air Quality, the Case of Zemun, Belgrade	489
Environmental policy and management 2.....	490
Assessing Interlinkages Between Climate Protection and Resource Conservation on Global Level – Trends and Insights from System Dynamics Modeling	490
Raising Public Awareness of Pollution in Skopje as a Basis for Conducting Social Marketing Activities	492
Performance Analysis of a Hybrid Electro-Mechanical Air Purifier for Particulate Matter Control in Large Rooms	493
How Do Climate Change Mitigation Policies in the Waste Sector Affect the Sustainable Development Goals? A Case Study of North Macedonia.....	494
Ecological Risk Assessment for Pesticide Pollution at Sultan Marshes Wetland, Turkey	495
The Possibilities of Application of Artificial Intelligence in Environmental Monitoring Systems	496
Environmental policy and management 3.....	497
Assessment of Water Quality Deterioration at Laborec River Basin	497
Life Cycle Assessment of Four Residential Buildings in Slovakia and Comparative Analysis	498
Biochar's Effect on the Ecosystem Services Provided by Sandy-Textured and Contaminated Sandy Soils: a Systematic Review Protocol	499
Streamflow Components and Climate Change: Lessons Learnt After Modelling Experiences in Mediterranean Catchments	500
Green economy and better governance 1	501
Technological Change, Consumption Patterns and Income Distribution: Strategies for a Low-Carbon EU Transition	501
The Influence of Regulation, Taxes and Charges on the Energy Supply of Buildings	502
Effect of Recycled Content and Other Policies on Plastic Packaging Industry – an Analytical Economics Approach	503
Second-Life EV Batteries for Stationary Energy Storage Applications in Local Energy Communities	504

Interdisciplinary Research on the Solar Energy Implementation in the Context of the Circular Economy	505
Contribution to Strategic Project Management for Dams Towards Sustainability	506
The Importance and Potential of Photovoltaics in the Context of Low-Carbon Development in Poland	507
Green economy and better governance 2	508
Green Measures in Urban Areas.....	508
The Evolution of the Post-Consumer Plastic Packaging Waste System in Flanders.....	509
Sustainability Framework for Assessment of Mergers and Acquisitions in Energy Sector.....	510
Shadow Pricing of Energy-Related Carbon Emission in Agriculture: an Adaptive Approach	511
A Decision Support System to Analyze the Forest Circular Bioeconomy	512
Modeling of Integrated Organic Waste Management System Based on the Principles of Sustainable Circular Economy.....	513
Hybrid and electric vehicles	514
Efficiency Comparison of Different Powertrain Structures Intended for a Hybrid Skidder... <td>514</td>	514
Comparison of Two Battery Charging Control System Designs Without and with Soc Estimator	515
Potential Use of Novel Efficient Direct Driven Electro-Hydraulic System for Skidders.....	516
Design of a Starting and Torque Boosting System for an Internal Combustion Engine Using a 48V Starter Motor/generator Within a Po Mild Hybrid Vehicle Configuration	517
Prospects for the Electrification of Road Transport: Battery Electric Vehicles vs. Fuel Cell Vehicles.....	518
Solar-Powered Small Autonomous Boat for Environmental Measurements	519
A User Perspective on Current Drivers and Barriers for Electric Vehicle Usage in Austria ..	520
Energy Consumption Analysis Modelling of a Mid-Size BEV	521
Modelling for pollution avoidance and energy efficiency 1	522
Influence of Waste-to-Energy Plant Integration on Local Immission Load.....	522
Experimental and Mechanism Study on the NOx Formation and Control During the Self-Sustaining Incineration Process of N-Containing VOCs (Dimethylformamide).....	523
Experimental Study on Emission Characteristics of a Pre-Combustion Low NOx Burner in an Industrial Boiler	524
Numerical Assessment of NOx Formation and Control in Pressurized Oxy-Ammonia Combustion	525
Study on Preheating Decarburization Process and Combustion Characteristics of Fine Slag in Coal Gasification	526
Modeling Char Evolution for Bituminous Coal During Pyrolysis at High Pressure	527
Modelling for pollution avoidance and energy efficiency 2	528
Quantifying the Transmission of Outdoor Pollutants into the Indoor Environment and Vice-Versa – Methodologies, Challenges and Future Direction.....	528

Investigation of the Impact of Outdoor Pollutants on the Indoor Air Quality of Naturally Ventilated Buildings in Urban Canyons.....	529
Estimation of Mercury Emissions and Releases in Air, Water, Soil and Waste Using UNEP Toolkit in Albania.....	530
An Impact of 3D Printing Conditions on Emissions of Ultrafine Particles	531
Prediction of Hg Distribution During the Process of Lignite Combustion in Fluidized Boiler and Flue Gas Cleanup with Use of Regression Models and Neural Networks	532
Modelling for pollution avoidance and energy efficiency 3.....	533
Granulometric and Adsorption Studies of Four Albanian Natural Clays Toward Pesticides	533
Effect of Length, Location and Angle of Inserting Internal Spiral Fins on the Micro Combustor Performance for Thermophotovoltaic Systems	534
Experimental and Numerical Study of Ammonia/Methane/Air Laboratory Burner	535
Optimal Control of Reflux Ratio in Batch Distillation of Non-Ideal Binary Mixtures	536
A Comparison of Calibration and Uncertainty Analysis Algorithms for Altinapa Reservoir Watershed Hydrologic Model.....	537
A New Non-Iterative Calculation Method for Cross-Flow Tube Heat Exchangers with Complicated Flow Arrangements	538
Nano and micro technologies and science for sustainable development of energy, water, and environment systems.....	539
Effect of Plasma Actuation on Film Cooling Performance	539
Condensation Pressure Drop Characteristics of Propane in Helically Coiled Tube-In-Tube Heat Exchanger	540
Heat Transfer Effectiveness Characteristics Maps for Additively Manufactured Triply Periodic Minimal Surfaces Compact Heat Exchangers.....	541
Detection of Microplastics Pollution in Dubai Coastal Water Using Senitel-2 Imagery and Regression Analysis	542
Modification of Commercial Ro and Nf Membranes with Zwitterionic L-DOPA and TiO ₂ ..	543
Effects of Leonardite Humic Acid as an Eco-Efficient Superplasticizer on Setting and Hydration of Portland Cement	544
The Use of Nanofertilizers to Increase Precision in Rice Production	545
Regional planning and cooperation.....	546
Local Adaptation Plans in Mediterranean Europe: How Cities and Regions are Responding to the Climate Crisis?	546
Participatory Process Protocol Towards Energy Transition Planning on Touristic Islands...547	547
Urban Energy Transition Indicator Selection. A Multicriteria Decision-Making Tool for City Stakeholders	548
Supporting Local Authorities to Plan Energy Efficiency in Public Buildings – the Case of Teruel Province: from Local Needs to Regional Planning	549
Energy System Modeling Analysis for Regional Planning and Policy Making – a Case Study of Groningen Province in the North of the Netherlands	550

Renewable electricity generation systems 1	551
Low Pressure Calcination of Limestone to Boost Thermochemical Energy Storage Based on the Calcium Looping Process.....	551
Energy Performance Evaluation for a Floating Photovoltaic System Located on the Reservoir of a Hydro Power Plant Under the Mediterranean Climate Conditions	552
Efficiency Increase of Photovoltaic Systems by Means of Evaporative Cooling.....	553
Exergy Analysis of Solar-Geothermal Based Power Plant Integrated with Boiling and Reverse Osmosis Water Purification	554
Multiple Impacts of Low-Carbon Technologies and Their Role in the Decision-Making for Small Investors	555
Distributed Generation and Solar Photovoltaic Energy: the Case of Brazil	556
Investigation of Cost Saving Potential for Biopower Generation by Fuel Switching in Northern Thailand.....	557
Water-Energy NEXUS in African Power Pools – the Dispa-Set Africa Model.....	558
Renewable electricity generation systems 2	559
Case Study of the Distributed Generation Photovoltaic System Installation Connected to Electrical Grid in a Rest Home: Technical Economic Analysis of Cost and Benefit.....	559
Assessment of Industry 4.0 Readiness for Hydropower Generation Industry in Laos.....	560
A New Numerical Tool for the Techno-Economic Analysis of Small Hydropower Plants.....	561
Effect of Working Fluid on Characteristics of Organic Rankine Cycle with Medium Temperature Geothermal Water.....	562
Effect of Tube Size on Alternative Material Heat Exchangers for Geothermal Applications by Numerical Model.....	563
Electrical Interconnection of a Solar Roof-Tile System: System Topology and Microconverter	564
Long-Term Pathways for Carbon-Neutrality from Chile: Variability in Absorption CO ₂	565
Influence of the Thermal Storage Type on the Concentrated Solar Power Plant with Electric Heater	566
Renewable energy resources 1	567
A Novel Control Strategy for Wind- and Sea-Induced Vibratory Loads Alleviation on Floating Offshore Wind Turbines	567
A Non-Gaussian Multivariate Statistical Monitoring of Spatio-Temporal Wind Speed Frequency Towards Renewable Energy Quality Improvement in South Korea.....	568
Life Cycle Assessment of Fixed and Single-Axis Tracking System for Photovoltaic Power Plants: a Case Study for Multi-Crystalline Silicon (Multi-Si) Photovoltaic Modules in Northeast Brazil	569
Analysis of Residential Rooftop PV Diffusion in India Through a Bass Model Approach.....	570
Economic, Environmental and Social Analysis of the Biomass Exploitation and Application to a Spanish Region	571
Deconvolution Techniques for the Kinetic Modeling of the Brewer's Spent Grain Pyrolysis ..	572
Renewable energy resources 2	573

Wind Energy Opportunities in Central Asia	573
Biomass Devolatilization Process Parametric Analysis by Varying the Ratio of the Components H ₂ O/CO ₂ , Co/CO ₂ and (CH ₄ ,C ₂ H ₄)/CO ₂	574
Performance Analysis of Gravitational Water Vortex Turbine Using Openfoam	575
Power Generation from Landfill Methane: Weather-Related Volatility Analysis to Include it in the Colombian Power Portfolio	576
Reversible Solid Oxide Cell Coupled with Auxiliary and Desalination Systems: the Applied Case of an Offshore Wind Turbine	577
Analysis of Operational Characteristics of Bio-Oxy Cfbc with Indirect S-CO ₂ Turbine	578
Renewable energy resources 3	579
Wave Power Forecasting Using an Effective Decomposition-Based Bi-Directional Deep Learning Model: a Case Study of Mediterranean Sea, Favignana Island	579
Preliminary Analysis of Energy Yield of Wind Farms in the Context of Seasonal Changes ..	580
Energy Analysis and Advantages of Using Solar Thin-Film PV Panels in Kosovo Climate Circumstances	581
Assessing the Energy-Saving Potential of Ground Source Multiple-Chillers in Simple and Hybrid Configurations	582
Incorporating Concentrating Solar Power (CSP) Technologies in a Bottom-up Planning Model: Freshwater Consumption and Greenhouse Gas Emissions Under a Life Cycle Perspective .	583
A SWOT Analysis of Renewable Energy in Kyrgyzstan: Assessment and Outlook for Fostering the Kyrgyz Renewable Sector.....	584
Renewable energy resources 4	585
Exploratory Study About Wind-Solar Hybrid Power Plants in Brazil	585
A GIS Based Integrated Participatory Approach for Wind-Farm Siting	586
Harnessing the Economic Potential of Ocean Thermal Energy Conversion in Upscaling Scenarios: Methodological Progress Illustrated for Indonesia	587
Sulfur-Free Supported Carbide Catalysts for the Hydrotreatment of Gasoil and Co-Processing with Rapeseed Oil.....	588
Evaluating Heat Energy Potential of a Flooded Underground Mine– a Case Study.....	589
Renewable energy resources 5	590
Sediment Heat Energy Production Expected to Use the Climate Change Effect to its Advantage	590
Overview of the Exploration and Exploitation Activities of the Geothermal Brine Reservoirs in the Republic of Croatia	591
Environmental and Economic Sustainability of Energy from Forest Residues in Turkey	592
Efficiency of Solar Energy Use for Domestic Hot-Water Systems in the Northern Regions .	593
Small Hydropower Plants for Sustainable Development	594
Ignition Behavior of Hydrotreated Pyrolysis Oil in a Combustion Research Unit.....	595
Renewable energy resources 6	596

One-Dimensional Numerical Prediction of Syngas Components in a Bubbling Fluidized Bed Gasifier.....	596
CFD-Based Air Feed System Development for a Bubbling Fluidized Bed Gasifier.....	597
Waste Gas Utilization by Combining Operation with Syngas Conversion to Biomethane Technology	598
Analysis of Greenhouse Gas Emissions Reduction from Biogas Production Based on Agricultural Residues and Industrial by-Products	599
Numerical Simulation of Biochar Combustion in a Simulated Ironmaking Electric ARC Furnace	600
Electro-Mechanical Properties of High Dense Yttrium-Doped Barium Zirconate Electrolyte Materials for Fuel Cells	601
Renewable energy resources 7	602
Multiphase CFD Simulation and Experimental Validation of Spent Coffee Grounds Pyrolysis in a Bubbling Fluidized Bed Reactor	602
The Stability of Mixed Oxide as a Catalyst for Transesterification of Vegetable Oil	603
Fatty Acid Distribution of Chlorella Sorokiniana Grown with Crude Glycerol and Anaerobic Digestate as an Alternative Source of Bio-Oil for Biodiesel Production	604
Complex Aspects of Energy Crops and Policy Implications	605
Canabis Sativa as Multi Purpose Energy Crop.....	606
Offshore Wind Speed Classification Using Merra-2 and Machine Learning Models of the Mediterranean Sea	607
Renewable energy resources 8	608
Technical and Environmental Issues on the Development of Offshore Wind Farms: the Mediterranean Sea Case Study	608
Analysis of the Power Production from a Wind Turbine Installed in Urban Area of Prishtina	609
Using B15 in Vehicles on Real On-Road Circumstances - a Case Study	610
Experimental Study of Flame Variations of Biogas Enriched with Hydrogen	611
Spatio-Temporal Solar-Wind Complementarity Studies in the Provinces of Kalinga and Apaya, Philippines Using Canonical Correlation Analysis	612
Deep Borehole Heat Exchangers and Geoenergetics - Review Based on Polish Experiences and Research	613
Renewable heat systems	614
CFD Simulation of a Thermal and Fluidynamic Behavior of a Chimney Solar Dryer.....	614
Abatement of Particulate Emissions from a Pellets Biomass Combustion.....	615
Improvement of Existing Ground Source Heat Pump System by Incorporating a Compressor Frequency Converter	616
Levelized Costs and Economic Impact of Geothermal District Heating: a Decision-Path Analysis.....	617
Going Deeper in Shallow Geoexchange Heat Pump Systems – Is it Worth It?	618

Directions of Geothermal Development in Poland on the Example of the Current Activity of Geotermia Uniejów Ltd. and the Commune Authorities.....	619
Research, innovation and development 1.....	620
Heat and Mass Transfer Assessment for the Controlled Instantaneous Decompression Process Applied to Fruits and Vegetables: Modelling and Mathematical Validation.....	620
Sectoral and Geographical Diffusion Patterns of Technology for a Low-Carbon World Economy: an Input-Output Approach	621
Biochar from Plant-Assisted Bioremediation: Potential Applications for Sorptive Removal of Phenolic Pollutants from Water	622
Technological Learning in the End-of-Life Phase of Crystalline Silicon Solar Panels	623
A Retrofitting Design of Automated Borehole Drilling System Using Legacy Draw-Works Mechanical Brake Hardware	624
Valorisation of Technology Transfer Projects in Universidad De Buenos Aires	625
Research, innovation and development 2.....	626
Experimental Investigation on Heat Exchanger Channel Preparation of Superalloy Inconel718 by Electrochemical etching	626
Modeling a Novel Building-Integrated PVT-Air-Collector System Coupled to a Heat Pump Using Open Source Libraries	627
Use of 3D Printing and Scanning in the Development of a Prototype Polymer Solar Collector	628
Volumetric Optical Measurements of Solid Fuel Combustion in Oxy-Fuel Atmospheres.....	629
Analysis of Exhaust Emissions from a Skidder Diesel Engine During Various Engine Loads	630
Counteracting Against Range Anxiety: a Portfolio of Measures for Increased Driving Range of Electric Vehicles	631
Research and Innovation Trends in Energy Technologies: the Role of Programme Managers at the European Innovation Council and the Challenges in Green Hydrogen Generation	632
Smart energy systems 1	633
Peer-to-Peer Energy Trading System Higashifuji Case – Electricity Trading Between Electric Vehicles, Households, and Office Through Blockchain Platform	633
Advancing a Novel Customer-Centric Retail Energy Trading Framework: a Critical Assessment of Existing Modelling Techniques	634
Thermal-Hydraulic Evaluation of Different Configurations of Printed Circuit Heat Exchanger in S-CO ₂ Brayton Cycle.....	635
Coupling H ₂ Fuel Cells and Heat Pumps for Tertiary-Sector Decarbonization from a Whole-System Perspective.....	636
Imperialist Competitive Algorithm Applied to the Optimal Integration of Photovoltaic Distributed Generation Units into a Microgrid	637
Demand Side Management in Intra-Day Markets.....	638
Smart energy systems 2	639
A Study on Anomaly Detection of Energy-Related Data in Large-Scale Facilities.....	639

Microgrid Powered by Renewable Sources Improving Resilience in an Urban Settlement: a Case Study in Italy.....	640
Virtual Net-Billing with Proportional Fair Sharing: a Computationally Efficient Method for Real-Time Energy Sharing in Communities	641
Application of Ann for Management of Energy Storage Systems with High Share of Renewable Energy Sources.....	642
X-Flex Project for More Flexible Electricity Markets	643
Decarbonization and Employment in Europe	644
Smart energy systems 3	645
Flexibility Options in 100% Renewable Energy World Regions	645
Current Progress on the Advanced Energy Planning on the Smart Islands	646
Digital Transformation and Efficiency Improvement of Gas Meter Readings on the Example of a Pilot Project	647
Smart Energy Denmark - Strategies for a Fully Decarbonized Society	648
Smart Energy Europe – Developing a Renewable Energy Scenario for a Decarbonized Europe	649
Industry Electrification and Flexible Energy Demand in 100% Renewable Energy Scenarios	650
Smart transport systems and policy.....	651
Integration of Electrical Systems on a Hybrid Skidder Based on Parallelized Low-Cost Direct Current Power Converter Array.....	651
The Economic Value of Hybrid Battery Swap/Storage Stations	652
Life Cycle Assessment of Urban Public Transportation from Conventional to Electrical Buses: a Case of Study in Brazil.....	653
Quantification of Savings for the European Transport Sector Through Energy Efficient Urban Planning.....	654
Macro-Factors Driving Low Carbon Mobility Choices Across Europe	655
Energy Efficient Decarbonisation Strategy for the Danish Transport Sector by 2045	656
Social acceptance/ Education in sustainable development	657
University Extension Projects to Train Engineering Students in Sustainability and Social Impact.....	657
Insights into the Integration of Environmental Sustainability in Slovenian Bachelor, Master, and Doctoral Programs	658
Perception of Being a Low Carbon Nation Through Technology and Nature-Based Solutions	659
Unequal Regional Benefits and Vulnerabilities in Cost-Optimal and Near-Optimal Scenarios of the European Electricity Sector in 2035	660
A Comprehensive Study on the Aesthetics of Electricity Consumption Graphs on Appliance Level and Their Triggering Potential on Human Emotions	661
An Experimental Investigation on the Comprehension of Electricity Consumption, Generation and Grid Supply Visualization	662

Energy Sufficiency for Rural Communities: the Case of the Bolivian Lowlands.....	663
Storage 1	664
Investigation of the Effect of Envelope on Building Thermal Storage Performance Under Mpc Control Strategy	664
Thermo-Economic Analysis of Changing the PCM Layer Thickness for CSP Plants' Combined Sensible-Latent Heat Storage Tank.....	665
Optimization of Packed Bed Latent Heat Storages Filled with PCM-Capsules Based on Superellipsoids	666
Integration of Thermochemical Energy Storage System Based on Ca(OH) ₂ /CaO Reaction	667
Electric Vehicles Batteries for Circular Economy: Second Life as Stationary Storage.....	668
Storage 2	669
Analysis of Wind to Hydrogen Production and Carbon Capture Utilisation and Storage Systems for Novel Production of Chemical Energy Carriers	669
Experimental Study on the Impact of Passive and Active Enhancement Techniques in the Storage and Use of Solar Thermal Energy	670
A Performing System to Store Waste Heat: Composites of Mofs and CaCl ₂	671
Application of Permanent Neodymium Magnets in Green Hydrogen Production	672
Modelling and Performance Assessment of an Integrated Liquid Organic Hydrogen Carrier-Thermal Energy Storage (LOHC-Tes) Process for Hydrogenation Heat Recovery.....	673
Sustainability comparisons and measurements 1	674
Review of Social Assessment Methodologies for the Case of Renewable Energy Technologies	674
Comparative Sustainability Assessment of Alternative Technologies and Fuels for Individual Motorized Mobility.....	675
A New Reliability-Centered Maintenance Programming for Sustainable Distribution Networks Based on New Indexed Components Ranking	676
Comparative Analysis of Energy Efficiency in Lithuanian Farms.....	677
Development of a Tool to Estimate Carbon Emissions in Districts and Dwellings. Open Access Planner for Citizens and Policymakers	678
LCA Assessment of Zinc Recovery from Spent Pickling Acids.....	679
Domestic Value Added as an Indicator for Sustainability Assessment – a Case Study on Alternative Drivetrains in the Passenger Car Sector	680
Traceability for Attaining Sustainability Towards Circularity of Electric Batteries	681
Sustainability comparisons and measurements 2	682
Lessons Learned from Labyrinth Type of Air Preconditioning in Exergy-Aware Greenhouses	682
Deep Geothermal Energy Extraction: a Review on Environmental Hotspots with Focus on Geo-Technical Site Conditions	683
Analyzing the Embeddedness of Climate Change in Sustainable Development Goals	684

Sustainability Assessment of the Cantabrian Fishery: Combined Life Cycle Assessment and Data Envelopment Analysis (LCA+DEA) Approach Including Socio-Economic Indicators	685
Structural Changes in the EU Agricultural System: the Sustainability Prism and Energy-Induced Effects.....	686
Environmental Life Cycle Assessment of Nano-Cellulose and Biogas Production from Elephant Manure	687
The Possibilities of Gpf Surface Modification in the Aspect of Micro-Contaminants Removal	688
Sustainability comparisons and measurements 3	689
Nutritional Footprint Comparative in Cantabria: Fisheries Production Vs Horeca and Household Consumption	689
Enrivonmental Sustainability of Potato Chips Production Under a Life Cycle Perspective: the Case Study of a Cantabrian Industry.....	690
Improving Measures of Local Sustainability Performance Enhancing Adaptive Capacity in Hungary.....	691
European Legislation and Thermochemical Recovery of Plastic Waste – Energy Recovery from the Sustainable Economy Development Point of View.....	692
Demonstrating Environmental Benefits of Introducing Lupine as Alternate Crop in Autochthonous Winter Wheat – Oilseed Rape Rotation Systems	693
Digital Solutions for the Sustainability Assessment of the Agri-Food Value Chain.....	694
Strategies for Wine Environmental Impact Reduction Based in a Multiyear Analysis.....	695
Sustainable resilience of systems	696
Towards a More Sustainable Tourism Under a Life Cycle Thinking Approach: the Case Study of the Camino Lebaniego in Cantabria.....	696
Influence of Surrounding Buildings on Roof Mounted Renewable Energy Installations Using Fluid-Structure Interaction Modelling for Typhoon Resilience.....	697
Exergy Based Optimisation of a Poultry Processing Wastewater Treatment Plant	698
The Interaction of Environmental Systems and Human Development in a Time of Wild Cards. A Big-Data Enhanced Foresight Study.....	699
The Potential of a Guiding Image for River Restoration Efforts: a Literature Review	700
Effects of Barriers Removal on River Ecological Status: the Tagus River Basin as a Case Study	701
Thermal power plants/District heating and/or cooling.....	702
Assessing the Techno-Economic and Environmental Sustainability of Sludges Waste Management in the Italian Contest	702
Analysis of Steam Turbine Operation in Cogeneration with Extremely Low Steam Flow.....	703
Decarbonization Potential of Integrating Industrial Excess Heat in a District Heating Network: the Portuguese Case	704
CO ₂ Capture from Ambient Air and Methanation: a Modelling Study of the Integrated Process	705

Optimal Investment Analysis for Heat Pumps and Nuclear Heat in Decarbonised Helsinki Metropolitan District Heating System	706
Systematic Mapping of Heat Sources in an Urban Area.....	707
Transport management.....	708
Retrofitting Fuel Stations with Charging Infrastructure to Accelerate the Electrification of Transport.....	708
Energy Economic and Environmental Challenges for Urban Mobility: the Case of Vienna..	709
Electrification of Maritime Transport Through Integration of Battery-Powered Electric Ships and Renewable Energy Systems	710
Environmental Efficiency of High Capacity Transportation in Roundwood Trucking in Finland	711
Energy Demand of Light Rail Transport Using Driving Cycle and Powertrain Analysis.....	712
Urbanism.....	713
The Interconnectedness of City Sustainability and Climate Change Mitigation	713
The Future Health-Related Challenges in Urban Environments Caused by Climate Change	714
Mapping Heatwave Vulnerability - Case of Budapest, Hungary.....	715
Heating and Cooling Demand Assessment with European Legislation, Degree Days Approach and Gis-Based Tools. Climate Change Impact on Demand and Retrofitting Benefits in Mediterranean Case Study.....	716
Role of People-Participation in Sustainable Development at Local-Level in Indian Context	717
Waste and wastewater treatment and reuse 1	719
Water Reuse and Water Utilities: an Economic Framework	719
Experimental Investigation on Thermal Decomposition of Waste Materials Under Different Conditions for Oxy-Waste Incineration Technology Development	720
Data-Driven Modelling Based on Artificial Neural Networks for Predicting Energy and Effluent Quality Indices of the Wastewater Treatment Plant.....	721
Experimental Study of the Ultrasonic Effectiveness Combined with Other Advanced Oxidation Processes in Water and Wastewater Treatment	722
Applications of Waste Materials in the Production of Concrete: a Review	723
Medium-Chain Fatty Acids Production from Organic Municipal Solid Waste in the Pilot-Scale Reactor: Effect of Leachate Recirculation and Dilution	724
An Examination of Covid-19 Impacts on the Australian Construction and Demolition Waste Management and Resource Recovery Industry	725
Waste and wastewater treatment and reuse 2	726
Thermodynamic Analysis of the Process of Decomposition of Hazardous Waste in Thermal Plasma with the Use of Different Working Media	726
Feasibility Study of an Anaerobic Digestion Plant in a Small Island.....	727
Perspective on the Use of Tire Waste in Multilayered Acoustic Boards for Civil Engineering Applications.....	728
Catalytic Pyrolysis Process for the Valorisation of Municipal Plastic Wastes	729

Quantifying the Nitrogen and Phosphorus Fertilizer Value of Latrine Dehydration and Pasteurization (Ladepa) Machine Processed Sludge	730
Degradation and Mineralization of Ibuprofen by UV/persulfate Oxidation Process in Batch and Continuous Plug Flow Reactors.....	731
Simulation of Technical and Economic Performance for Waste Processing Technologies for MSW in Region of Slovenia and Croatia	732
Waste and wastewater treatment and reuse 3	733
Simulation of Municipal Solid Waste Incineration in an Industrial Grate Boiler Coupled with an In-House Bed Model and Analysis for the Feedstock Flexibility	733
Recovery of Salts from Synthetic Erythritol Culture Broth via Electrodialysis	734
Thermoeconomic Analysis of a Municipal Solid Waste to Energy Plant: Case of Fier (Albania)	735
Valorization of Horticultural Waste and by-Products Through Composting Processes.....	736
Sustainable Materials for Resource Recovery from Wastewater in Agricultural Systems.....	737
Evaluation of Nutrient Recovery Potential of Biochar, Bentonite and Terracotta Materials and Their Performance in Microbial Electrochemical Systems	738
Activated Carbons from Lignocellulosic Agroforestry Wastes for the Biosorption of Hazardous Pollutants from Waste-Waters	739
Waste and wastewater treatment and reuse 4	740
Thermal Degradation and Kinetic Analysis of Multi-Layered Plastics	740
Application of Opoka-Rock in Effective Nitrogen and Phosphorus Management According to Circular Economy.....	741
Valorization of the Depleted Fermentation Substrate of Ganoderma Lucidum Production: Study Case to Treat Wastewater from Coffee Processing in Colombia.....	742
Water Reuse in a Poultry Processing Wastewater Treatment Plant	743
Stability Improvement of Laccase for Micropollutant Removal of Pharmaceutical Origins from Municipal Wastewater	744
Analysis of the Zinc Adsorption Properties and Toxicity of Solid Non-Conventional (Biomass) Adsorbents.....	745
Municipal Solid Wastes in Covid-19 Situation – Management and Environmental Studies	746
Waste and wastewater treatment and reuse 5	747
Composition Analysis, Characterization and Physico-Chemical Properties of Separately Collected Packaging Waste Residual Waste Streams	747
Plastic Waste Pyrolysis Plants Overview and Economic Viability Assessment of Implementation on a Small Scale.....	748
Challenges on Trace Metal Recovery from Saltwork Bitterns: Equilibrium, Kinetic and Morphological Properties for Sorbents Selection	749
Thermal Upgrading of Hydrochars from Anaerobic Digestion of Municipal Solid Waste Organic Fraction.....	750
The Impact of Environmental Attitudes and Group-Level Selection on Individual Recycling Behaviour in a Public Good Framework	751

Determination of Heavy Metal Concentration in the Aced Rouiba Tannery Effluents in Algeria and Theoretical Study of Chromium Reduction by Complexation with Dithiocarbamate	752
Evaluation of Up-Concentration Potential for Direct Membrane Filtration of Municipal Wastewater	753
Water desalination.....	754
Energy Analysis of a Seawater Desalination Plant Using Energy from Waste	754
Direct Contact Membrane Desalination Similarity Analysis.....	755
Investigating a Few-Layered Graphene Based Adsorbents for Hybrid Adsorption Cooling and Water Desalination	756
3D Multi-Phase Lattice Boltzmann Simulations in Hydrophobic Membranes for Membrane Distillation	757
Experimental Characterization of the Temperature Gradient Inside a Membrane Distillation Module.....	758
Water-energy nexus	759
Evaluation of Water and Energy Systems by Novel Operational Coefficients Considering the NEXUS Between Exergy and Water	759
Demonstration of Renewable Energy Sources and Demand Side Management Implementation on the Future Smart Island.....	760
Field Studies for Strategic Planning of Sewage Treatment in a Highly Urbanized City – Inclusion of Biosolids Control in Water-Energy Nexus.....	761
Linear Modelling of Water Potential and Supply for Decentralized Energy-Water-Food Systems - Case Study St. Rupert Mayer, Zimbabwe.....	762
Competing Water Uses Between Agriculture and Energy: Quantifying the Future Impacts of Climate Change for the Portuguese Power Sector	763
Updated Perspective on Using Batteries for Mitigating Hydropeaking.....	764
Swat Model Optimisation Incorporating Geological Catchment Heterogeneity Through Calibration Strategies: the Henares River Basin (Spain)	765
Hydrological Impacts of Climate Change in a Groundwater-Dependent Mediterranean Basin: the Salado River Basin (Spain)	766

SDEWES2021.0711

Possibilities for Deep Renovation in Multi Apartment Building Under Different Climate and Economic Conditions

D. Koncalovic¹, J. Nikolic¹, V. Vukasinovic¹, D. Gordic¹, D. Zivkovic*²

¹Faculty of Engineering, University of Kragujevac, Serbia; ²Institute for Information Technologies, University of Kragujevac, Serbia (*dubravka@uni.kg.ac.rs)

Abstract

Possibilities for deep renovation of apartment buildings to the passive house level under different circumstances were analysed. The variables included different local climatic conditions, degree of economy and market development of the country (energy prices, energy footprint, labour prices, etc.) as well as different levels of insulation of the building envelope and others, related variables.

To obtain an optimal solution for the deep renovation, an adequate methodology was developed. The proposed methodology is based on the interaction of energy simulation and mathematical optimization. In the developed model, the energy performances of the building were determined using the EnergyPlus package and the optimal solution was obtained according to several criteria using a mixed-integer non-linear programming model. The conclusions are drawn in line with the results of the optimization, from which various consequences may follow, including those related to the attitude of policymakers and subsidies or incentives related to the housing sector policies.