Green development challenges within the environmental management framework

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Abstract

Green development of energy, water and environment systems is essential as these three systems represent the basic life needs of humankind. Therefore, environmental problems arising from each of these three systems need to be carefully addressed to preserve the energy, water and environment resources for future generations. This paper discusses some of the latest developments in three main areas of sustainability themes, namely energy, water and environment, that emerged from the 14th Sustainable Development of Energy, Water and Environment Systems (SDEWES) Conference held in 2019. As such, it acts as an editorial paper for the virtual special issue of the Journal of Environmental Management, dedicated to the SDEWES 2019 conference.

Keywords: Water and wastewater treatment; Environmental management and assessment; Energy systems

1. Introduction

After three successful years of cooperation between the Journal of Environmental Management (JEMA) and the Sustainable Development of Energy, Water and Environment

Systems (SDEWES) conference series that resulted in three JEMA Virtual Special Issues (VSI), in 2016 (Mikulčić et al., 2017), in 2017 (Mikulčić et al., 2019a), and in 2018 (Mikulčić et al., 2020) the cooperation between JEMA and SDEWES conference series has also been continued in 2019. This article follows the form of the previous introduction papers.

In 2019, the SDEWES Conferences was held 1–6 October 2019 in the city of Dubrovnik, Croatia and it brought together around 570 scientists, researchers, and experts in the field of sustainable development from 55 countries. There were 511 oral presentations, and 100 poster presentations during this conference, there was a record of 17 special sessions, one special and one clustering event. Also, there were 4 invited lectures and 2 panels with some of the most distinguished experts in the field. The papers in this VSI are based on archival articles presented at these three SDEWES 2019 Conferences. From all the archival submissions, 40 were invited to contribute to this VSI. After a rigorous JEMA review process, 21 papers were accepted for publication, and form this VSI. These 21 papers can be classified into three main research fields: Water and wastewater treatment (5 papers); Environmental management and assessment (9 papers) and Energy systems (7 papers). This paper shortly evaluates the named three groups of papers, and gives the JEMA readers a sense of continuity, by reviewing some previous publications in the same research area.

2. Background

Water as a vital resource for human life and its wellbeing has over the year been the research topic of several studies published in different journal's Special Issues dedicated to SDEWES conference series. Supply of drinking water, water storage and the freshwater distribution networks have been studied to a large extent all over the world and especially for arid regions: Australia (Talent, 2019), United Arab Emirates (Khan et al., 2019) and in the subsequent study by Al Quabeh et al. (2020), Lebanon (Bou-Fakhreddine et al., 2018), Ghana (Kumasi, 2018). Topics related to water resource management, groundwater remediation and preservation of existing groundwater wells have also been extensively studied. Sahin et al. (2018) studied water scarcity and the distribution network for efficient water management. The mapping of the value chain processes for the water and wastewater utility companies was done by Chofreh et al. (2019). Groundwater remediation by adsorption of ammonium was investigated by Vocciante et al. (2018). Total site centralized water integration method for reusing water among industries at an industrial site was analyzed by Ahmad Fadzil et al. (2020).

Water Footprint methodology was the research topic in the study by Wang et al. (2018), and in the subsequent study by Jia et al. (2019).

Wastewater treatment has also been the topic of several studies. Pitás et al. (2020) analyzed the wastewater treatment for the iron and steel production process. Ngene and Tota-Maharaj (2020) investigated the treatment of water produced at a crude oil production site. Yukseler et al. (2017) analyzed the treatment of wastewater from the textile industry. The simplest and most economical way of municipal wastewater treatment, wastewater stabilization ponds, were investigated by Kumar and Kumar (2020). Piol et al. (2019) studied the phosphate desorption process. Pietrelli et al. (2019) investigated the removal of As and Mn from drinking water. The removal of volatile organic compounds (VOCs) and hydrogen sulphide (H_2S) from wastewater treatment plant exhaust air was studied by Kasperczyk et al. (2019). Technical solutions for sewage sludge processing and sustainable sewage treatment were studied by Grobelak et al. (2019) and in a later study by Bressani-Ribeiro et al. (2019).

The *Environmental management and assessment* research topic have been studied in several papers. Various sectors, technologies and applications have throughout the years been environmentally assessed: olive oil production was investigated by Guarino et al. (2019); Lozano-Moreno and Maréchal (2019) studied sugar-ethanol production. Biogas production was evaluated by Marques et al. (2018), offshore processing of natural gas with capturing and storing of CO_2 was performed by Roefs et al. (2019) and in two subsequent studies by Teixeira et al. (2019) and by Gonzaga et al. (2020); carbon sequestration in a brown coal open-cast mine was studied by Placek-Lapaj et al. (2019); industrial ecology in industrial parks was analyzed by Promentilla et al. (2016); impact of electric vehicles was investigated by Ajanović and Haas (2019); traffic impact of transport planning strategy was analyzed by Kuang et al. (2019); energy use and water provision in school buildings were studied by Gamarra et al. (2018); tyre manufacturing process was investigated Shanbag and Manjare (2020); solar energy system was analyzed by Kim et al. (2019); wastewater and sludge management was analyzed by Heimersson et al. (2019); sea level rise induced coastal erosion and the implications of adaptation measures were analyzed by Sahin et al. (2019).

The environmental performance of solid waste management systems has also been the topic of several studies. Anić-Vučinić et al. (2020) investigated the metal content in waste printed circuit boards and their electronic components. Bala et al. (2019) investigated the pre-treatment and the consequent anaerobic digestion of the organic fraction of municipal solid waste. Klemeš et al. (2020) analyzed the minimization of the present and future plastic waste use related to COVID-19. The application of ceramic waste in brick blocks was studied by Fiala

et al. (2020). The anaerobic digestion technology as a route for bioenergy recovery in the agro-food industry sector has been studied by Duarte et al. (2020). Cotton industry waste materials have been investigated by Tenev et al. (2019). Kucbel et al. (2019) investigated the properties of compost from household food waste produced in automatic composters. Cleaner production measures in monosodium glutamate production have been analyzed by Yang et al. (2020). The use of waste materials as a potential feedstock for the production of alternative chemicals and fuels has been investigated by Stančin et al. (2019), and in later studies by Wang et al. (2019), and Stančin et al. (2020a).

Techno-economic and socio-economic assessment of different technologies and applications is crucial for sound decision making. The techno-economic, social and environmental assessment of a biomass-based district heating system was performed by Bozhikaliev et al. (2019). Brigagão et al. (2019) made a techno-economic analysis of thermochemical pathways for different corncob-to-energy options. Tschulkow et al. (2020) performed an integrated techno-economic assessment of a biorefinery process. Techno-economic analysis of integrated processes for the treatment and valorization of neutral coal mine effluents was done in the study by Micari et al. (2020). The techno-economic evaluation of waste heat recovery in a crude oil refinery was analyzed by Varga and Csaba (2018).

Different physical and chemical processes and their environmental impact were studied using the Computational Fluid Dynamics (CFD) modelling approach, such as particle separation inside a vortex cyclone (Mikulčić et al., 2014), radiative heat transfer (Jurić et al., 2020); the heat transfer performance of supercritical carbon dioxide in a printed circuit heat exchanger (Li et al., 2019); biomass co-firing under oxy-MILD mode conditions (Wang et al., 2020); the co-combustion process inside a rotary kiln (Mikulčić et al., 2019b) nitrogen oxides formation in a jet engine combustion chamber (Cerinski et al., 2020); nitrogen oxides formation reduction in a low volatile coal-fired boiler (Liu et al., 2018); the reduction of nitrogen oxides emissions from transport by using the selective non-catalytic nitrogen oxides reduction process by Baleta et al. (2017); numerical modelling of sulfur dioxide absorption for spray scrubbing (Bešenić et al., 2020).

Air pollution was investigated in several studies. Švédová et al. (2019) investigated the water-soluble ions in dust particles in the City of Ostrava. In a subsequent study, Strbova et al. (2019) investigated the particulate matter air pollution for the town of Napajedla, Czech Republic. Koval et al. (2018) investigated dust particles in an urban environment.

Energy systems is the research topic that has been most researched within papers published in different SDEWES Special Issues. The energy transition topic (Urbaniec et al.

2017) has been studied by several research groups investigating various issues. Following are some of the papers that examined the energy transition research topic: the implementation of renewable sources for the pig farming sector was analysed by Valiño et al. (2019); high-efficiency cogeneration systems for the food industry were investigated by Vellini et al. (2020); the increase of energy efficiency for campsites in a protected area was analyzed by Del Moretto et al. (2018); energy transition in Germany was studied by Schlör et al. (2018); the impacts climate change and of severe droughts on future energy systems was investigated by Jääskeläinen et al. (2018); introduction of heat pumps with heat storage in small-scale district heating systems was analyzed by Østergaard et al. (2019); the energy performance of a solar water heating system was investigated by Maraj et al. (2019); the power generation from a salinity gradient was studied by Altaee et al. (2019); the small-scale biomass power technologies for agricultural communities in developing countries were investigated by Aberilla et al. (2019).

Demand response and energy storage technologies have also been the research topic of several studies. Some of these technologies include heat energy storages (Taler et al., 2019),), thermal energy storages (Pospíšil et al., 2019), hydrogen storages (Marino et al., 2019), electrical battery storages (Roselli et al., 2017), lead-flow-batteries (Lanfranconi and Lilienhof, 2019), transcritical carbon dioxide charge-discharge energy storages (Fernandez et al., 2019), chemical storages (Mikulčić et al., 2019b); compressed air energy storages (Hämmerle et al., 2017), etc.

Plastic waste and biomass thermo-chemical conversion processes have been extensively studied. Biomass and its utilization technologies have been extensively studied worldwide. Juchelková et al. (2015), using the pyrolysis process studied the syngas production from perennial grasses. Raclavská et al. (2018) analyzed the impact of different temperatures on the pyrolysis of tetrapak. Růžičková et al. (2019) assessed the number of organic compounds in char and soot from the biomass combustion process in small boilers. Ancona et al. (2019) studied the biomass fluidized-bed gasification process. Mikulandrić et al. (2020) investigated biomass gasification efficiency through process control. Thermal analysis of the apricot kernel shell was investigated by Manić et al. (2020). Torrefied biomass fuels as a renewable alternative to coal in co-firing for power generation was analyzed by Sher et al. (2020). The effect of feedstock composition on the distribution of the products from pyrolysis of different herbaceous plants was investigated by Hlavsová et al. (2016). Pyrolysis-gasification of waste plastic for syngas production was studied by Al-asadi et al. (2020). Mikulčić et al. (2019d) analyzed the thermal decomposition of polyurethane plastic waste under different atmospheric conditions.

These are just some of the papers related to the SDEWES Conference series that have contributed to the knowledge increase in the research area of energy, water, and environmentally sustainable development.

3. This Virtual Special Issue papers

The *Water and wastewater treatment* theme consists of five papers in this VSI. The surface water flows have been studied by Mean et al. (2020). The study on a practical example in a Cambodian irrigation canal demonstrates the applicability of the developed level-set method. The water consumption of the Brazilian Economy and its driving forces have been investigated by Naspolini et al. (2020). The study showed agriculture and power generation are two main sectors related to water consumption. Drinking water containing excess fluoride, and the feasibility of zirconium impregnated hybrid anion exchange resin treating of such water has been analyzed by Singh et al. (2020). The study results showed that the proposed method could effectively remove fluoride from groundwater. Simperler et al. (2020) investigated the prioritization of stormwater management sites in urban areas. The study showed that the developed model could be effectively used for decision making in the implementation of nature-based solutions in urban areas. The wastewater treatment plant and the water-energy nexus has been studied by Simon-Várhelyi et al. (2020). The study showed that by improving the scheduling of the periodic influent load, a reduction in the energy costs of a wastewater treatment plant could be achieved.

There are nine papers in this VSI that are part of the *Environmental management and assessment* theme. Švédová et al. (2020) studied the chemical composition of street dust in a highly industrialized city for ten years. The study showed that metal concentrations in the years 2008 and 2018 had a comparable level of Fe, lower level of Pb and that the significant enrichment was found for Cu, Cr and Zn. Fijalkowski and Kwarciak-Kozlowska (2020) studied the sewage sludge phytoremediation rate using guaiacol peroxidase activity. The study demonstrated that guaiacol peroxidase activity results showed that the water-based soil extracts solidified with agar give more accurate results concerning the tests on raw soil. Dróżdż et al. (2020) investigated the current state and future perspectives of poultry manure management system in Poland. The study showed that the main challenge in poultry manure processing is to assure sufficient closing of carbon, nitrogen and phosphorous loops and safe application to soil. Tomić and Schneider (2020) studied the socio-economic effect of changes in the waste management system structure. The study results for different scenarios showed that the energy

recovery of waste generates higher income then material recovery. At the same time, overall lower system costs, and lower sensitivity of the system cost, is observed in the material recovery based scenarios. Mossali et al. (2020) analyzed the circular economy of lithium-ion batteries. The study showed that value-chain actors' integration is the key to future lithium-ion batteries recycling. Van Oijstaeijen et al. (2020) assessed the applicability of green infrastructure tools in urban planning. The study showed that different available toolkits for urban planning do not succeed in comprehensively setting urban green infrastructure. Long et al. (2020) based on three-dimensional ecological footprint and human development index assessed the sustainability of four island regions in China. The study showed that the proposed method could provide references for comprehensive planning and sustainable development assessment of island regions. Burić et al. (2020) performed an environmental footprint assessment of sea bream cage aquaculture concerning spatial stocking design. The study showed that an optimized spatial stocking design of fish cages could significantly reduce the environmental footprint while simultaneously allowing for an increase in annual fish production and optimal utilization of the farming site. Sebestyén et al. (2020) using the text mining algorithms analyzed the voluntary national reviews on Sustainable Development Goals. The study results showed that the proposed benchmark tool is capable of highlighting what kind of activities can make significant contributions to achieve sustainable development goals.

In the *Energy systems* theme, there are seven papers. The papers within this theme are analyzing the production and use of different alternative fuels and the corresponding utilization problems. Hájek et al. (2020) investigated the use of cosolvents in heterogeneously and homogeneously catalyzed methanolysis of oil. The study showed that by applying the proposed method, less energy is consumed and the biodiesel production can become more environmentally friendly. The thermo-catalytic co-pyrolysis of waste plastic and paper was assessed by Fekhar et al. (2020). The study showed that not only the reactor configurations but also the type of catalyst affected the product properties. Tóth et al. (2020) analyzed the production of high-quality diesel fuels from different waste sources. The study showed that there are favourable process conditions for the production of high-quality diesel fuels and that such fuels can lower pollutant emission. Combustibility of high-carbon slags from an entrained flow gasifier was investigated by Dai et al. (2020). Ste study showed that the combustion property of the high-carbon slags is worse than that of anthracite. Zhou et al. (2020) investigated the physical and chemical interactions between additives and coal ash on the deposition probe. The study showed that the molten deposit obtained by a drop-tube furnace at 1373 K was transformed into weakly-condensed deposit and strongly-sticky deposit respectively when

vermiculite and perlite were added separately. The formation of sulfur trioxide, an environmentally harmful and highly corrosive gas in coal-fired power plants has been studied by Dai et al. (2020). This study provided a deep understanding of the reaction pathway of sulfur trioxide catalytic formation by Fe_2O_3. Zhang et al. (2020) studied the hot corrosion behaviour of two representative materials used for superheaters in furnaces. The study showed that the high-humidity environment decreases the hot corrosion rate, while SO_2 concentration has the opposite influence.

4. Conclusions

This VSI introduction paper addresses a selection of research studies, from recent 14th Sustainable Development of Energy, Water and Environment Systems conference, on three topics named as Water and wastewater treatment; Environmental management and assessment; and Energy systems. Researchers from around the world have studied these three research topics. Some of the solutions for the problems reviewed in this article represent a knowledge gain and further increase in public awareness on the need for an environmentally responsible economic development. The Guest editors believe that the papers selected for this VSI will be of interest to Journal of Environmental Management readers.

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References

Aberilla, J.M., Gallego-Schmid, A., Azapagic, A., 2019. Environmental sustainability of small-scale biomass power technologies for agricultural communities in developing countries. Renew. Energy 141, 493-506.

Ahmad Fadzil, A. F., Wan Alwi, S. R., Abdul Manan, Z., Klemeš, J. J., 2020. Study on Impacts of Multiple Centralized Water Reuse Header from Consumer and Operator Perspectives, J. sustain. dev. energy water environ. syst., 8(4), 754-765.

Ajanovic, A., Haas, R., 2019. On the Environmental Benignity of Electric Vehicles, J. sustain. dev. energy water environ. syst., 7(3), pp 416-431

Altaee, A., Cipolina, A., 2019. Modelling and optimization of modular system for power generation from a salinity gradient. Renew. Energy 141, 139-147.

Al-asadi, M., Miskolczi, N., Eller, Z., 2020. Pyrolysis-gasification of wastes plastics for syngas production using metal modified zeolite catalysts under different ratio of nitrogen/oxygen. J. Clean. Prod. 271, 122186.

Al Quabeh, H., Saab, R., Ali, M. I. H., 2020. Chilled Water Storage Feasibility with District Cooling Chiller in Tropical Environment, J. sustain. dev. energy water environ. syst., 8(1), 132-144.

Ancona, V., Caracciolo, AB., Campanale, C., De Caprariis, B., Grenni, P., Uricchio, V.F., Borello, D., 2019. Gasification treatment of poplar biomass produced in a contaminated area restored using plant assisted bioremediation. J. Environ. Manag. 239, 137-141.

Anić-Vučinić, A., Bedeković, G., Šarc, R., Premur, V., 2020. Determining Metal Content in Waste Printed Circuit Boards and their Electronic Components, J. sustain. dev. energy water environ. syst., 8(3), 590-602.

Bala, R., Gupta, G.K., Dasgupta, B.V., Mondal, M.K., 2019. Pretreatment optimization and kinetics of batch anaerobic digestion of liquidized OFMSW treated with NaOH: Models verification with experimental data. J. Environ. Manag. 237, 313-321.

Baleta, J., Martinjak, M., Vujanović, M., Pachler, K., Wang, J., Duić, N. 2017. Numerical analysis of ammonia homogenization for selective catalytic reduction application. J. Environ. Manag. 203, 1047-1061.

Bešenić, T., Baleta, J., Pachler, K., Vujanović, M., 2020. Numerical modelling of sulfur dioxide absorption for spray scrubbing. Energy Convers. Manag. 217, 112762.

Bou-Fakhreddine, B., Mougharbel, I., Faye, A., Pollet, Y., 2019. Estimating daily evaporation from poorly-monitored lakes using limited meteorological data: A case study within Qaraoun dam – Lebanon. J. Environ. Manag. 241, 502-513.

Bozhikaliev, V., Sazdovski, I., Adler, J., Markovska, N., 2019. Techno-economic, Social and Environmental Assessment of Biomass Based District Heating in a Bioenergy Village, J. sustain. dev. energy water environ. syst., 7(4), 601-614.

Bressani-Ribeiro, T., Filho, C.R.M., de Melo, V.R., Bianchetti, F.J., de Lemos Chernicharo, C.A., 2019. Planning for achieving low carbon and integrated resources recovery from sewage treatment plants in Minas Gerais, Brazil. J. Environ. Manag. 242, 465-473.

Brigagão, G.V., Araújo, O.Q.F., de Medeiros, J.L., Mikulčić, H., Duić, N., 2019. A techno-economic analysis of thermochemical pathways for corncob-to-energy: Fast pyrolysis to bio-oil, gasification to methanol and combustion to electricity. Fuel Proces. Techn. 193, 102-113.

Burić, M., Bavčević, L., Grgurić, S., Vresnik, F., Križan, J., Antonić, O., 2020. Modelling the environmental footprint of sea bream cage aquaculture in relation to spatial stocking design. J. Environ. Manag. 270, 110811.

Cerinski, D., Vujanović, M., Petranović, Z., Baleta, J., Samec, N., Hriberšek, M., 2020. Numerical analysis of fuel injection configuration on nitrogen oxides formation in a jet engine combustion chamber. Energy Convers. Manag. 220, 112862.

Chofreh, A.G., Goni, F.A., Zeinalnezhad, M., Navidar, S., Shayestehzadeh, H., Klemeš, J.J., 2019. Value chain mapping of the water and sewage treatment to contribute to sustainability. J. Environ. Manag. 239, 38-47.

Dai, G., Zheng, S., Wang, X., Bai, Y., Dong, Y., Du, J., Sun, X., Tan, H., 2020. Combustibility analysis of high-carbon fine slags from an entrained flow gasifier. J. Environ. Manag. 265, 111009.

Dai, G., Wang, X., You, H., Wang, Y., Shan, Z., Tan, H., 2020. Catalytic function of ferric oxide and effect of water on the formation of sulfur trioxide. J. Environ. Manag. 264, 110499.

Del Moretto, D., Annunziata Branca, T., Colla, V., 2018. Energy efficiency and reduction of CO_2 emissions from campsites management in a protected area. J. Environ. Manag. 222, 368-377.

Dróżdż, D., Wystalska, K., Malińska, K., Grosser, A., Grobelak, A., Kacprzak, M., 2020. Management of poultry manure in Poland – Current state and future perspectives. J. Environ. Manag. 264, 110327.

Fekhar, B., Zsinka, V., Miskolczi, N., 2020. Thermo-catalytic co-pyrolysis of waste plastic and paper in batch and tubular reactors for in-situ product improvement. J. Environ. Manag. 269, 110741.

Fernandez, R., Chacartegui, R., Becerra, A., Calderon, B., Carvalho, M., 2019. Transcritical Carbon Dioxide Charge-Discharge Energy Storage with Integration of Solar Energy, J. sustain. dev. energy water environ. syst., 7(3), 444-465.

Fiala, L., Konrád, P., Fořt, J., Keppert, M., Černý, R., 2020. Application of ceramic waste in brick blocks with enhanced acoustic properties. J. Clean. Prod. 261, 121185.

Fijalkowski, K., Kwarciak-Kozlowska, A., 2020. Phytotoxicity assay to assess sewage sludge phytoremediation rate using guaiacol peroxidase activity (GPX): A comparison of four growth substrates. J. Environ. Manag. 263, 110413.

Gamarra, A.R., Istrate, I.R., Herrera, I., Lago, C., Lizana, J., Lechón, Y., 2018. Energy and water consumption and carbon footprint of school buildings in hot climate conditions. Results from life cycle assessment. J. Clean. Prod. 195, 1326-1337.

Gonzaga, C. S. B, Araújo, O. de Q. F., de Medeiros, J. L., 2020. A Monte Carlo Methodology for Environmental Assessment Applied to Offshore Processing of Natural Gas with High Carbon Dioxide Content, J. sustain. dev. energy water environ. syst., 8(1), 35-55.

Grobelak, A., Grosser, A., Kacprzak, M., Kamizela, T., 2019. Sewage sludge processing and management in small and medium-sized municipal wastewater treatment plant-new technical solution. J. Environ. Manag. 234, 90-96.

Guarino, F., Falcone, G., Stillitano, T., De Luca, A.I., Gulisano, G., Mistretta, M., Strano, A., 2019. Life cycle assessment of olive oil: A case study in southern Italy. J. Environ. Manag. 238, 396-407.

Hájek, M., Vávra, A., Mach, P., Straková, A., 2020. The use of cosolvents in heterogeneously and homogeneously catalyzed methanolysis of oil. J. Environ. Manag. 262, 110295.

Hämmerle, M., Haider, M., Willinger, R., Schwaiger, K., Eisl, R., Schenzel, K., 2017. Saline Cavern Adiabatic Compressed Air Energy Storage Using Sand as Heat Storage Material, J. sustain. dev. energy water environ. syst., 5(1), 32-45.

Heimersson, S., Svanström, M., Ekvall, T., 2019. Opportunities of consequential and attributional modelling in life cycle assessment of wastewater and sludge management. J. Clean. Prod. 222, 242-251.

Hlavsová, A., Corsaro, A., Raclavská, H., Vallová, S., Juchelková, D., 2016. The effect of feedstock composition and taxonomy on the products distribution from pyrolysis of nine herbaceous plants. Fuel Proces. Techn. 144, 27-36.

Jääskeläinen, J., Veijalainen, N., Syri, S., Marttunen, M., Zakeri, B., 2018. Energy security impacts of a severe drought on the future Finnish energy system. J. Environ. Manag. 217, 542-554.

Jia, X., Varbanov, P. S., Klemeš, J. J., Wan Alwi, S. R., 2019. Water Availability Footprint Addressing Water Quality, J. sustain. dev. energy water environ. syst., 7(1), 72-86.

Juchelkova, D., Corsaro, A., Hlavsova, A., Raclavska, H., 2015. Effect of composting on the production of syngas during pyrolysis of perennial grasses. Fuel 154, 380-390.

Jurić, F., Petranović, Z., Vujanović, M., Duić, N., 2020. Numerical assessment of radiative heat transfer impact on pollutant formation processes in a compression ignition engine. J. Clean. Prod. 275, 123087.

Kasperczyk, D., Urbaniec, K., Barbusinski, K., Rene, E.R., Colmenares-Quintero, R.F., 2019. Application of a compact trickle-bed bioreactor for the removal of odor and volatile organic compounds emitted from a wastewater treatment plant. J. Environ. Manag. 236, 413-419.

Khan, M. A., Ashar, N. N., Ganesh, A. G., Rais, N., Faheem, S. M., Khan, S. T., 2019. Bacterial Community Structure in Anaerobic Digesters of a Full Scale Municipal Wastewater Treatment Plant – Case Study of Dubai, United Arab Emirates, J. sustain. dev. energy water environ. syst., 7(3), 385-398.

Kim, B., Azzaro-Pantel, C., Pietrzak-David, M., Maussion, P., 2019. Life cycle assessment for a solar energy system based on reuse components for developing countries. J. Clean. Prod. 208, 1459-1468.

Klemeš, J.J., Fan, Y.V., Tan, R.R., Jiang, P., 2020. Minimizing the present and future plastic waste, energy and environmental footprints related to COVID-19. Renew. Sustain. Energy Reviews 127,109883.

Koval, S., Krahenbuhl, G., Warren, K., O'Brien, G., 2018. Optical microscopy as a new approach for characterizing dust particulates in urban environment. J. Environ. Manag. 223, 196-202.

Kuang, Y., Yen, B.T.H., Suprun, E., Sahin, O., 2019. A soft traffic management approach for achieving environmentally sustainable and economically viable outcomes: An Australian case study. J. Environ. Manag. 237, 379-386.

Kucbel, M., Raclavská, H., Růžičková, J., Švédová, B., Sassmanová, V., Drozdová, J., Raclavský, K., Juchelková, D., 2019. Properties of composts from household food waste produced in automatic composters. J. Environ. Manag. 236, 657-666.

Kumar, R., Kumar, P., 2020. Wastewater Stabilisation Ponds: Removal of Emerging Contaminants, J. sustain. dev. energy water environ. syst., 8(2), 344-359.

Kumasi, T.C., 2018. Financing Sustainable Water Service Delivery of Small Town Water Systems in Ghana: The Gaps and Needs, J. sustain. dev. energy water environ. syst., 6(3), 427-445.

Lanfranconi, M., Lilienhof, H.-J., 2019. All-Lead-Flow-Batteries as Promising Candidates for Energy Storage Solutions, J. sustain. dev. energy water environ. syst., 7(2), 343-354.

Li, X., Deng, T., Ma, T., Ke, H., Wang, Q., 2019. A new evaluation method for overall heat transfer performance of supercritical carbon dioxide in a printed circuit heat exchanger. Energy Convers. Manag. 193, 99-105.

Liu, X., Tan, H., Wang, Y., Yang, F., Mikulčić, H., Vujanović, M., Duić, N., 2018. Low NOx combustion and SCR flow field optimization in a low volatile coal fired boiler. J. Environ. Manag. 205, 30-35.

Long, X., Yu, H., Sun, M., Wang, X.-C., Klemeš, J.J., Xie, W., Wang, C., Li, W., Wang, Y., 2020. Sustainability evaluation based on the Three-dimensional Ecological Footprint and Human Development Index: A case study on the four island regions in China. J. Environ. Manag. 265, 110509.

Lozano-Moreno, J.A., Maréchal, F., 2019. Biomass logistics and environmental impact modelling for sugar-ethanol production. J. Clean. Prod. 210, 317-324.

Manić, N.G., Janković, B.B., Dodevski, V.M., Stojiljković, D.D., Jovanović, V.V., 2020. Multicomponent Modelling Kinetics and Simultaneous Thermal Analysis of Apricot Kernel Shell Pyrolysis, J. sustain. dev. energy water environ. syst., 8(4), 766-787.

Maraj, A., Londo, A., Gebremedhin, A., Firat, C., 2019. Energy performance analysis of a forced circulation solar water heating system equipped with a heat pipe evacuated tube collector under the Mediterranean climate conditions. 140, 874-883.

Marino, C., Nucara, A., Panzera, M.F., Pietrafesa, M., Varano, V., 2019. Energetic and economic analysis of a stand alone photovoltaic system with hydrogen storage. Renew. Energy 142, 316-329.

Marques, A. d. L., Pinto, F. P., Araújo, O. Q. d. F., Cammarota, M. C., 2018. Assessment of Methods to Pretreat Microalgal Biomass for Enhanced Biogas Production, J. sustain. dev. energy water environ. syst., 6(2), 394-404.

Mean, S., Unami, K., Fujihara, M., 2020. Level-set methods applied to the kinematic wave equation governing surface water flows. J. Environ. Manag. 269, 110784.

Micari, M., Cipollina, A., Tamburini, A., Moser, M., Bertsch, V., Micale, G., 2020. Techno-economic analysis of integrated processes for the treatment and valorization of neutral coal mine effluents. J. Clean. Prod. 270, 122472.

Mikulandrić, R., Böhning, D., Lončar, D., 2020. Modelling of Temperature and Syngas Composition in a Fixed Bed Biomass Gasifier using Nonlinear Autoregressive Networks, J. sustain. dev. energy water environ. syst., 8(1), 145-161.

Mikulčić, H., Vujanović, M., Ashhab, M.S., Duić, N., 2014. Large eddy simulation of a two-phase reacting swirl flow inside a cement cyclone. Energy 75, 89-96.

Mikulčić, H., Duić, N., Dewil, R., 2017. Environmental management as a pillar for sustainable development. J. Environ. Manag. 203, 867-871.

Mikulčić, H., Duić, N., Schlör, H., Dewil, R., 2019a. Troubleshooting the problems arising from sustainable development. J. Environ. Manag. 231, 52-57.

Mikulčić, H., Cerinski, D., Baleta, J., Wang, X. 2019b. Improving pulverized coal and biomass co-combustion in a cement rotary kiln by computational fluid dynamics. Chem. Eng. Techn. 42(12), 2539-2545.

Mikulčić, H., Ridjan Skov, I., Dominković, D.F., Wan Alwi, S.R., Manan, Z.A., Tan, R., Duić, N., Hidayah Mohamad, S.N., Wang, X. 2019c. Flexible Carbon Capture and Utilization technologies in future energy systems and the utilization pathways of captured CO_2. Renew. Sustain. Energy Reviews 114, 109338.

Mikulčić, H., Jin, Q., Stančin, H., Wang, X., Li, S., Tan, H., Duić, N., 2019d. Thermogravimetric Analysis Investigation of Polyurethane Plastic Thermal Properties Under Different Atmospheric Conditions, J. sustain. dev. energy water environ. syst., 7(2), 355-367.

Mikulčić, H., Wang, X., Duić, N., Dewil, R., 2020. Environmental problems arising from the sustainable development of energy, water and environment system. J. Environ. Manag. 259, 109666.

Mo, S., Pan, T., Wu, F., Zeng, M., Huang, D., Zhang, L., Jia, L., Chen, Y., Cheng, Z., 2019. Facile one-step microwave-assisted modification of kaolinite and performance evaluation of pickering emulsion stabilization for oil recovery application. J. Environ. Manag. 238, 257-262.

Mossali, E., Picone, N., Gentilini, L., Rodrìguez, O., Pérez, J.M., Colledani, M., 2020. Lithium-ion batteries towards circular economy: A literature review of opportunities and issues of recycling treatments. J. Environ. Manag. 264, 110500.

Naspolini, G.F., Ciasca, B.S., La Rovere, E.L., Pereira Jr., A.O., 2020. Brazilian Environmental-Economic Accounting for Water: A structural decomposition analysis. J. Environ. Manag. 265, 110508.

Ngene, S., Tota-Maharaj, K., 2020. The Influence of Production Chemicals on the Quality of Oilfield Produced Water, J. sustain. dev. energy water environ. syst., 1080319.

Østergaard, P.A., Jantzen, J., Marczinkowski, H.M., Kristensen, M., 2019. Business and socio-economic assessment of introducing heat pumps with heat storage in small-scale district heating systems. Renew. Energy 139, 904-914.

Pietrelli, L., Ippolito, N.M., Ferro, S., Dovi, V.G., Vocciante, M., 2019. Removal of Mn and As from drinking water by red mud and pyrolusite. J. Environ. Manag. 237, 526-533.

Piol, M.N., Paricoto, M., Saralegui, A.B., Basack, S., Vullo, D., Boeykens, S.P., 2019. Dolomite used in phosphate water treatment: Desorption processes, recovery, reuse and final disposition. J. Environ. Manag. 237, 359-364.

Pitás, V., Somogyi, V., Kárpáti, Á., Thury, P., Fráter, T., 2020. Reduction of chemical oxygen demand in a conventional activated sludge system treating coke oven wastewater. J. Clean. Prod. 273, 122482.

Placek-Lapaj, A., Grobelak, A., Fijalkowksi, K., Singh, B.R., Almås, Å.R., Kacprzak, M., 2019. Post – Mining soil as carbon storehouse under polish conditions. J. Environ. Manag. 238, 307-314.

Pospíšil, J., Charvát, P., Arsenyeva, O., Klimeš, L., Špiláček, M., Klemeš, J.J., 2019. Energy demand of liquefaction and regasification of natural gas and the potential of LNG for operative thermal energy storage. Renew. Sustain. Energy Reviews 99, 1-15.

Promentilla, M.A.B., Bacudio, L.R., Benjamin, M.F.D., Chiu, A.S.F., Yu, K.D.S., Tan, R.R., Aviso, K.B., 2016. Problematique approach to analyze barriers in implementing industrial ecology in philippine industrial parks. Chem. Eng. Trans. 52, 811-816.

Raclavská, H., Růžičková, J., Škrobánková, H., Koval, S., Kucbel, M., Raclavský, K., Švédová; B., Pavlík, P., Juchelková, D., 2018. Possibilities of the utilization of char from the pyrolysis of tetrapak. J. Environ. Manag. 219, 231-238.

Roefs, P., Moretti, M., Welkenhuysen, K., Piessens, K., Compernolle, T., 2019. CO_2-enhanced oil recovery and CO_2 capture and storage: An environmental economic trade-off analysis. J. Environ. Manag. 238, 307-314.

Roselli, C., Tariello, F., Sasso, M., 2019. Integration of a Photovoltaic System with an Electric Heat Pump and Electrical Energy Storage Serving an Office Building, J. sustain. dev. energy water environ. syst., 7(2), 213-228.

Růžičková, J., Kucbel, M., Raclavská, H., Švédová, B., Raclavský, K., Juchelková, D., 2019. Comparison of organic compounds in char and soot from the combustion of biomass in boilers of various emission classes. J. Environ. Manag. 236, 769-783.

Sahin, O., Bertone, E., Beal, C., Stewart, RA., 2018. Evaluating a novel tiered scarcity adjusted water budget and pricing structure using a holistic systems modelling approach. J. Environ. Manag. 215, 79-90.

Sahin, O., Stewart, R.A., Faivre, G., Ware, D., Tomlison, R., Mackey, B., 2019. Spatial Bayesian Network for predicting sea level rise induced coastal erosion in a small Pacific Island. J. Environ. Manag. 238, 341-351.

Schlör, H., Venghaus, S., Märker, C., Hake, J-F., 2018. Managing the resilience space of the German energy system - A vector analysis. J. Environ. Manag. 218, 527-539.

Sebestyén, V., Domokos, E., Abonyi, J., 2020. Focal points for sustainable development strategies—Text mining-based comparative analysis of voluntary national reviews. J. Environ. Manag. 263, 110414.

Shanbag, A., Manjare, S., 2020. Life Cycle Assessment of Tyre Manufacturing Process, J. sustain. dev. energy water environ. syst., 8(1), 22-34.

Sher, F., Yaqoob, A., Saeed, F., Zhang, S., Jahan, Z., Klemeš, J.J., 2020. Torrefied biomass fuels as a renewable alternative to coal in co-firing for power generation. Energy. 118444.

Simon-Várhelyi, M., Cristea, V.M., Luca, A.V., 2020. Reducing energy costs of the wastewater treatment plant by improved scheduling of the periodic influent load. J. Environ. Manag. 262, 110294.

Simperler, L., Himmelbauer, P., Ertl, T., Stoeglehner, G., 2020. Prioritization of stormwater management sites in urban areas. J. Environ. Manag. 265, 110507.

Singh, S., German, M., Chaudhari, S., Sengupta, A.K., 2020. Fluoride removal from groundwater using Zirconium Impregnated Anion Exchange Resin. J. Environ. Manag. 263, 110415.

Strbova, K., Ruzickova, J., Raclavska, H., 2019. Application of multivariate statistical analysis using organic compounds: Source identification at a local scale (Napajedla, Czechia). J. Environ. Manag. 238, 434-441.

Stančin, H., Růžičková, J., Mikulčić, H., Raclavská, H., Kucbel, M., Wang, X., Duić, N., 2019. Experimental analysis of waste polyurethane from household appliances and its utilization possibilities. J. Environ. Manag. 243, 105-115.

Stančin, H., Mikulčić, H., Wang, X., Duić, N., 2020. A review on alternative fuels in future energy system. Renew. Sustain. Energy Reviews 128,109927.

Švédová, B., Kucbel, M., Raclavská, H., Růžičková, J., Raclavský, K., Sassmanová. V., 2019. Water-soluble ions in dust particles depending on meteorological conditions in urban environment. J. Environ. Manag. 237, 322-331.

Švédová, B., Matýsek, D., Raclavská, H., Kucbel, M., Kantor, P., Šafář, M., Raclavský, K., 2020. Variation of the chemical composition of street dust in a highly industrialized city in the interval of ten years. J. Environ. Manag. 267, 110506.

Talent, M., 2019. Smarter Cities: Cleaning Electricity, Gas and Water Metered Consumption Data for Social and Urban Research, J. sustain. dev. energy water environ. syst., 7(3), 466-481.

Taler, D., Dzierwa, P., Trojan, M., Sacharczuk, J., Kaczmarski, K., Taler, J., 2019. Mathematical modeling of heat storage unit for air heating of the building. Renew. Energy 141, 988-1004.

Teixeira, A.M., de Oliveira Arinelli, L., de Medeiros, J.L., de Queiroz F. Araújo, O., 2019. Economic leverage affords post-combustion capture of 43% of carbon emissions: Supersonic separators for methanol hydrate inhibitor recovery from raw natural gas and CO_2 drying. J. Environ. Manag. 236, 534-550.

Tenev, M. D., Farías, A., Torre, C., Fontana, G., Caracciolo, N., Boeykens, S. P., 2019. Cotton Industry waste as adsorbent for Methylene Blue, J. sustain. dev. energy water environ. syst., 7(4), 667-677.

Tomić, T., Schneider, D.R., 2020. Circular economy in waste management – Socio-economic effect of changes in waste management system structure. J. Environ. Manag. 267, 110564.

Tóth, O., Holló, A., Hancsók, J., 2020. Alternative component containing diesel fuel from different waste sources. J. Environ. Manag. 265, 110562.

Tschulkow, M., Compernolle, T., Van den Bosch, S., Van Aelst, J., Storms, I., Van Dael, M., Van den Bossche, G., Sels, B., Van Passel, S., 2020. Integrated techno-economic assessment of a biorefinery process: The high-end valorization of the lignocellulosic fraction in wood streams. J. Clean. Prod. 266, 122022.

Urbaniec K., Mikulčić H., Duić N., 2016. SDEWES 2014 - Sustainable Development of Energy, Water and Environment Systems. J. Clean. Prod. 130, 1-11.

Valiño, L., Sarasa, C., Duarte, R., 2019. Economy-wide effects of a sustainable pathway in the pig sector: A case study in Aragon (Spain). J. Environ. Manag. 239, 84-89.

Van Oijstaeijen, W., Van Passel, S., Cools, J., 2020. Urban green infrastructure: A review on valuation toolkits from an urban planning perspective. J. Environ. Manag. 267, 110603.

Varga, Z., Csaba, T., 2018. Techno-economic evaluation of waste heat recovery by organic Rankine cycle using pure light hydrocarbons and their mixtures as working fluid in a crude oil refinery. Energy Convers. Manag. 174, 793-801.

Vellini, M., Gambini, M., Stilo, T., 2020. High-efficiency cogeneration systems for the food industry. J. Clean. Prod. 260, 121133.

Vocciante, M., De Folly D'Auris, A., Finocchi, A., Tagliabue, M., Bellettato, M., Ferrucci, A., Reverberi, AP., Ferro, S., 2018. Adsorption of ammonium on clinoptilolite in presence of

competing cations: Investigation on groundwater remediation. J. Clean. Prod. 198, 480-487.

Wang X., Klemeš J.J., Walmsley T.G., Wang Y., Yu H., 2018. Recent developments of water footprint methodology. Chem. Eng. Trans. 70, 511-516

Wang, X., Ma, D., Jin, Q., Deng, S., Stančin, H., Tan, H., Mikulčić, H., 2019. Synergistic effects of biomass and polyurethane co-pyrolysis on the yield, reactivity, and heating value of biochar at high temperatures. Fuel Proces. Techn. 194, 106127.

Wang, X., Zhang, J., Xu, X., Mikulčić, H., Li, Y., Zhou, Y., Tan, H., 2020. Numerical study of biomass Co-firing under Oxy-MILD mode. Renew. Energy 146, 2566-2576.

Yang, D., Jia, X., Dang, M., Han, F., Shi, F., Tanikawa, H., Klemeš, J.J., 2020. Life cycle assessment of cleaner production measures in monosodium glutamate production: A case study in China. J. Clean. Prod. 270, 122126.

Yukseler, H., Uzal, N., Sahinkaya, E., Kitis, M., Dilek, F.B., Yetis, U. 2017. Analysis of the best available techniques for wastewaters from a denim manufacturing textile mill. J. Environ. Manag. 203, 1118-1125.

Zhang, J., ur Rahman, Z., Wang, X., Wang, Z., Li, P., Wang, Y., Bate, D., Zhao, K., Tan, H.., 2020. Hot corrosion behaviors of TP347H and HR3C stainless steel with KCl deposit in oxy-biomass combustion. J. Environ. Manag. 263, 110411.

Zhou, S., Wang, M., Xiong, X., Tan, H., Lv, Z., Wang, X., Yang, F., 2020. Effect of thermal expansion additives on alleviating the ash deposition of high-sodium coal. J. Environ. Manag. 269, 110799.