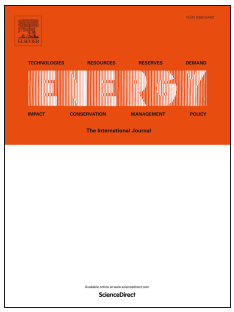
Accepted Manuscript



Renewable Energy and Energy Storage Systems

A.G. Olabi

PII: S0360-5442(17)31230-6

DOI: 10.1016/j.energy.2017.07.054

Reference: EGY 11242

To appear in: *Energy*

Received Date: 0360-5442 0360-5442

Revised Date: 0360-5442 0360-5442

Accepted Date: 0360-5442 0360-5442

Please cite this article as: Olabi AG, Renewable Energy and Energy Storage Systems, *Energy* (2017), doi: 10.1016/j.energy.2017.07.054.

Renewable Energy and Energy Storage Systems

A.G. Olabi

University of the West of Scotland, School of Engineering, High Street, Paisley, PA1 2BE, UK, Email: abdul.olabi@uws.ac.uk

Abstract:

With the increase of the production of power/energy from renewables it becomes much important to look at methods and techniques to store this energy. In principle, the renewable energy can be transformed into another form of storable energy and to be transformed back when needed.

The main Energy storage techniques can be classified as: 1) Magnetic systems: Superconducting Magnetic Energy Storage, 2) Electrochemical systems: Batteries, fuel cells, Super-capacitors, 3) Hydro Systems: Water pumps, 4) Pneumatic systems: Air compressors, 5) Mechanical systems: Flywheels, 6) Thermal systems: Molten Salt, Water or oil heaters.

When we are talking about energy storage systems, we should consider the criteria of selection for method and technique of storing this energy. Researchers and scientists have classified different criteria in selecting the energy storage techniques, the main points to be considered are: 1) the available energy resources, 2) energy requirement and application, 3) energy storage efficiency, 4) energy storage cost, 5) energy storage infrastructure, 6) other factors.

This editorial describes articles presented at the 8th International Conference on Sustainable Energy and Environmental Protection SEEP2015. Main topics include renewable energy and energy storage systems and various articles related to the conference scope.

Keywords: Renewable Energy, Energy Storage Systems, Wind, Solar, Heat Pipe, Environment.

1- Introduction:

The eighth international conference on sustainable energy and environmental protection is part of the series of SEEP Conferences which have been established in 2004 by Prof A.G.Olabi, during the last years seven special issues has been published [1-8], the conference editor has contributed in many publications related to renewable energy and environmental issues under different subtitles such as; Hydrogen and Fuel Cell [9-12], Biofuel [13-17], Solar Energy and Air Pollution and Environmental issues [18-22].
Many articles have been published in the previous SEEP conferences; articles were published to cover all renewable energy and environment themes. The main themes are; Hydrogen and Fuel Cell developments [23-28], Electric Vehicles [29-31], Wind and planning issues [32-35], PV and Solar Energy [36-44], Bio-Energy [45-58], Alternative Energy and Environmental Issues, Pipe Heat Exchanger and related Fuel Efficiency and Environmental Protection [59-119].

This special issue presents some selected and peer reviewed papers from the 8th International Conference on Sustainable Energy and Environmental Protection SEEP 2015 which was held at the University of West of Scotland in Paisley Campus between 11th and 14th August 2015. In SEEP2015, about 180 papers were presented, 60 papers were invited to submit an extended version to the Energy. After peer review, 21 papers were selected to be published as a special issue in this journal.
These articles can be described as:
Three-dimensional proton exchange membrane fuel cell model: Comparison of double channel and open pore cellular foam flow plates [120].
Investigation of the effects of thermal, oxidative and irradiation treatments on the behaviour of poly-ethylene glycol as a phase change material in thermal energy storage systems [121].
The ignition characteristics and combustion processes of the single coal slime particle under different hot-coflow conditions in N2/O2 atmosphere [122].
An investigation into the use of the heat pipe technology in thermal energy storage heat exchangers [123].
Energy savings and reduction of CO2 emission using Ca(OH)2 incorporated zeolite as an additive for warm and hot mix asphalt production [124].
Cost reduction for the lipid production from distillery and domestic mixed wastewater by Rhodosporidium toruloides via the reutilization of spent seed culture medium [125].

Performance and emission characteristics of an IC engine under SI, SICAI and CAI combustion modes [126].

Trends and prospects of energy efficiency development in Slovenian industry [127].

The performance of a heat pipe based solar PV/T roof collector and its potential contribution in district heating applications [128].

Optimal management of a theoretical coastal aquifer with combined pollution and salinization problems, using genetic algorithms [129].

Design and development of an hybrid light commercial vehicle [130].

A new pH phenomenon to predict polarity reversal in lead-acid cells [131].

Energetic potential of the co-digestion of sludge with bio-waste in existing wastewater treatment plant digesters: A case study of an Italian province [132].

Modeling of energy efficiency increase of urban areas through synergies with industries [133].

Early fault detection and diagnosis in bearings for more efficient operation of rotating machinery [134].

Design and optimization of baffled fluid distributor for realizing target flow distribution in a tubular solar receiver [135].

Co-hydrotreating of algae and used engine oil for the direct production of gasoline and diesel fuels or blending components [136].

Supplying bio-compressed natural gas to the transport industry in Ireland: Is the current regulatory framework facilitating or hindering development? [137].

Theoretical and empirical study of heat and mass transfer inside a basin type solar still [138].

A model calculation of the carbon footprint of agricultural products: The case of Slovenia [139].

Development of a global energy management system for non-energy intensive multi-site industrial organisations: a methodology [140].

2- Content Details:

The first paper [120], presents a study to develop a unique three-dimensional computational fluid dynamic electrochemical model for open pore cellular foam material as a flow plate, comparing it to a double channel flow plate and experimental results, researching its application as an alternative to conventional flow plate materials in proton exchange membrane fuel cells.

Using the same membrane electrode assembly and operating parameters, the model simulations, including hydrogen and oxygen distribution and water activity, are examined. IV-curves obtained from the model and experimentally, are analysed and the results are discussed. The model is validated by comparing simulated IV-curve results against experimental results, and model limitations are identified.
The results indicate that the open pore cellular foam material flow plate distributes both hydrogen and oxygen more evenly from inlet to outlet through the fuel cell, when compared to the double channel fuel cell, outperforming it in both simulated and experimental runs.

The second paper [121], PEG (poly-ethylene glyco1) with an average molecular weight of 2000 g/mol has been investigated as a phase change material for thermal energy storage applications. PEG sets were maintained at 80°C for 861 h in air, nitrogen, and vacuum environment; the samples maintained in vacuum were further treated with air for a period of several weeks. The experiments showed that the presence of oxygen led to the degradation of the polymer and to a slight decrease of its melting temperature, while the treatment with electron radiation reduced polymer's heat of fusion. FTIR (Fourier transform infrared spectroscopy) spectrum analysis showed bands assigned to carbonyl/carboxylate functional groups, indicating the degradation of PEG in the presence of air/oxygen.

The third paper [122], presented work on the ignition characteristics and combustion processes of single coal slime particle in a vertical heating tube furnace in N2/O2 oxidant atmosphere were investigated under different hot-coflow conditions, including variations in coflow temperature (Tc = 923, 1073, and 1173 K), gas flow rate (V = 0 - 30 L/min), and oxygen concentration (O2% = 5% - 100%). All investigated hot-coflow conditions exhibited three ignition behaviours, homogeneous ignition of volatiles, heterogeneous ignition of char, and heterogeneous ignition of coal. Additionally, three corresponding ignition regimes were observed in the oxygen concentration-coflow temperature plane. Critical conditions for the transitions of the three ignition mechanisms varied as flow was increased from 0 to 30 L/min. Various ignition mechanisms resulted in various combustion processes.

In paper [123], the issue of the low conductivity of PCMs has been addressed by using an embedded finned water-charged heat pipes into the PCM bulk. Both heat pipes and the PCM tank used in this investigation were made of 316 L stainless steel. The PCM used in this work was PLUSICE S89, which has a melting temperature of 89°C and crystallization point of

77°C. The evaporator section of the heat pipe was heated by condensing a steam flow. The heat that was absorbed in the evaporator section was then discharged to the PCMs by the heat pipe multi-legged finned condenser. Tests were conducted for both charging (melting) and discharging (crystallization) of PLUSICE S89. It was observed that the thermal resistance posed by PCM during the discharging stage was higher compared to that during the charging process.

Next paper [124], investigated the energy saving and CO2 emission reduction properties of Ca(OH)2 incorporated zeolite (CaZ), synthesized by a solegel method and used as an additive for ASCON (asphalt concrete) production at different temperatures (120, 140 and 180°C). The addition of up to 6 wt.% CaZ lowered the ASCON production temperature to 120°C, leading to a production cost saving of 0.882 million US$/y, and an energy saving of 24,831 GJ/y for 140,000 Tonne/y compared to conventional HMA (hot mix asphalt) production at 180°C. In addition, CO2 emission was reduced from 7500 ppm for HMA production to 500 ppm for WMA production at 120°C. The significantly lower energy consumption and CO2 emission resulting from addition of CaZ composite are associated with easy release of water vapor due to the dendrite nano structure of the synthesized CaZ, accompanied by easy volume expansion and asphalt viscosity reduction..

This study [125] explores the possibility to reuse the spent seed culture medium while saving resource and cost. The cells produced from the 2nd time reused medium without extra nutrient addition showed similar performances to the fresh medium in lipid production (biomass 7.42 ± 0.31 g/L, lipid yield 2.74 ± 0.42 g/L, and lipid content 36.90 ± 4.36%) and removal efficiencies for organics and nutrients (chemical oxygen demand, total nitrogen, and total phosphorus removal of 86.47 ± 1.40%, 50.73 ± 6.15%, and 74.36 ± 3.39%, respectively), in non-sterile distillery and domestic mixed wastewater after two-day cultivation. The 3rd time reused medium showed relatively low removal efficiencies for organics and nutrients as well as poor lipid production at the early culture stage, resulting in the reutilization of 3rd time spent medium not recommended even with 50% nutrient supplementation. Around 30% reduction in the material cost for the medium preparation could be achieved by the spent medium reutilization.

The objective of paper [126] is to determine the effects of spark ignition (SI), spark assist controlled auto ignition (SI-CAI) and pure CAI combustion modes on the performance and

emissions in a modified IC engine. For this purpose, the emissions, performance, and heat release analyses for these combustion modes were obtained at two different engine speeds (1500-2000 rpm) and various excess air ratio (EAR) in the range of 1.0-1.3 with 0.1 increments for both wide open throttle (WOT) and 50% opening throttle positions.

Reference [127], presents an overview of the energy efficiency development trends in Slovenian industry. To assess the development of energy efficiency, an energy efficiency index (ODEX) is applied, also highlighting some of the non-technical, structural changes. Furthermore, the future development prospects of energy-intensive industry in Slovenia are addressed in compliance with the national legislative framework and energy efficiency targets.

Paper [128], presents the findings of six experimental configurations of solar-thermal collectors are presented and analyzed. Five of the solar-thermal panel configurations were implemented with a cooling cycle. Two of the solar-thermal panels were equipped with monocrystalline silicon modules, the other two collectors were equipped with polycrystalline silicone modules, one of the collectors was based on heat pipe technology and was equipped with a cooling system, while the last collector did not include any cooling cycle. The duration of the experiments was four days during the September of 2014 and they were conducted under different solar radiation conditions. The second part of the paper presents the simulation results for five of the solar-thermal panels connected with a cooling water tank (volume of 500 L), a domestic hot water tank (volume 350 L) and a water heat pump, in terms of covering the hot water demands of a single family dwelling. The results showed that the hybrid solar collectors would be able to cover approximately 60% of the dwelling's hot water needs for days with low levels of solar radiation, while for days with high solar radiation they could cover the hot water requirements of the family by 100%.

Paper [129], discusses optimal management of a theoretical coastal aquifer, providing water for drinking and/or irrigation purposes, which is threatened by seawater intrusion from the coast and by nonconservative pollutant plumes from the inland. A new computational tool, able to address the combined pollution-salinization problem, is used. It optimizes the classic Pump-And-Treat and Hydraulic Control techniques without compromising aquifer's sustainability.

Paper [130] presents the powertrain control strategy and the development process of the first prototype. Finally, the work focuses on the main results which have been achieved by the first vehicle prototype during an experimental campaign carried out on a chassis dynamometer.

This paper [131] discusses new experimental work investigating the change in pH of the electrolyte of individual cells in Lead-Acid batteries during discharge with a view to predicting cell polarity reversal and thereby pre-empting potentially catastrophic failure in batteries. The discharge tests were carried out on batteries which were classified as ‘new’ and ‘aged’ as a means of indicating their state of health. A new pH phenomenon has been recorded for the first time in this paper as evidenced by experimental results including measurement of half-cell potentials. The trends observed during the discharge tests could be used as additional means of indicating impending cell reversal in series connected lead-acid cells.

Paper [132], studies the effect of co-digesting sludge with bio-waste was investigated using an experimental apparatus set for reproducing the operating conditions of a full-scale digester in an existing wastewater treatment plant of 90,000 PE (population equivalent). An increase in the organic loading rate from 1.46 kgVS/m3 day to 2.1 kgVS/m3 day obtained by introducing 40 kg of biowaste per m3 of sludge in the digester caused an increase in the specific methane generation from 90 NL/kgVS to 435 NL/kgVS. These results were used to assess the energetic potential of digesters in eight existing wastewater treatment plants operating in an Italian province with 28,000 PE to 90,000 PE. Results showed that these facilities were able to codigest globally about 2900 tonnes per year of bio-waste and to generate about 3400 MWh/year of electricity.

Due to the lack of research concerning the symbiosis of industry and cities, no figures are available which enables an economic comparison with other energy production technologies. An economic assessment was carried out [133] using four towns as examples. With the help of the annuity method, amortization times are determined. Additionally levelized costs for electricity and heat under different scenarios are calculated. They reach from 60 to 91 V/MWh for electricity and 25e38 V/MWh for heat. A sensitivity analysis takes into account possible price fluctuations.

Early fault detection and diagnosis plays an increasingly important role in various energy systems where it is critical to avoid deteriorating condition, degraded efficiency and unexpected failures. Rollingelement bearings are among the most common components of rotating machinery used for transformation of energy. Mechanical wear and defective bearings cause rotating machinery to decrease its efficiency, and thus increase energy consumption. A new technique for early fault detection and diagnosis in rolling-element bearings based on vibration signal analysis is presented. After normalization and the wavelet transform of vibration signals, the standard deviation as a measure of average energy and the logarithmic energy entropy as a measure of the degree of disorder are extracted in sub-bands of interest as representative features. Then the feature space dimension is optimally reduced to two using scatter matrices. In the reduced two-dimensional feature space the fault detection and diagnosis is performed by quadratic classifiers. Accuracy of the new technique was tested on four classes of the recorded vibrations signals, i.e. normal, with the fault of inner race, outer race and balls operation. An overall accuracy of 100% was achieved. The new technique will be further tested and implemented in a real production environment [134].

Paper [135], presents an original study on the design and optimization of baffled fluid distributor for the realization of optimal fluid flow distribution in a tubular solar receiver. The basic idea is to install a perforated baffle in the inlet fluid distributor and to optimize the configuration of orifices on the baffle so as to approach the target flow distribution among downstream parallel tubes. A pressurized-air solar receiver comprising of 45 parallel tubes is used for study, with copper or Inconel 600 used as the filling material.

In Ref [136], the microalgae and UEO blends were converted into three fractions (oil, gas and solid) when subjected to the co-hydrotreating processes. The most abundant product fraction was upgraded oil. Mass loss is predominantly ascribed to the light oil fraction loss during the solvent vaporization process. The solids primarily consisted of the catalyst, inorganic salts and char. The dispersing and clearing agents in the UEO are potential sources for the control of solid formation. The gaseous products consisted predominantly of unreacted H2 along with CO2 and CH4 formed during the cohydrotreating process. Large quantities of C2eC5 hydrocarbons were observed in the gaseous products produced at more severe temperatures. The addition of the noble metal catalysts promoted the in situ hydrogenation and cracking of oil intermediates, which led to oil with low viscosity and easy recovery. Catalysts also promoted the secondary reactions of the gaseous products to form heavier oil molecules. The

presence of hydrogen can improve the oil quality by promoting the in situ hydrocracking and hydrorefining of the oil.

Paper [137] critiques the current regulatory framework in Ireland, highlights areas of ambiguity and puts forward an aligned solution to allow bio-CNG market participants to utilise the network safely, in a regulatory sound and cost-effective manner.

In paper [138], two recent models for calculating the coefficient of evaporative heat transfer (he,w-gc) have been investigated by taking into account view factors of radiative heat exchange. In the first model (Model 1), the vapour concentration ratio (Cr=he,w-gc/hc,w-gc) depends on different thermodynamic variables inside the solar still. The other model of Cr (Model 2) is a third-order polynomial function of the operating temperature of the solar still (Ti). Results show that Cr has a critical value for Model 1 with no turning point for Model 2 in the considered temperature range. There exists an operating temperature Ti¼Tis at which the two models yield the same value of Cr. Estimates of the coefficient of he,w-gc obtained by using Model 1 are higher than those of Model 2 when Ti < Tis, with a reversed trend when Ti > Tis. Model 1 exhibits lower values of the root mean square error.

In paper [139], a model calculation of the carbon footprint in the agricultural sector was developed in order to calculate the carbon footprint of grains, fruit, and other agriculture products based on a calculation of total greenhouse gas emissions resulting from production, from the beginning of the production process to storage and delivery to the final consumer or the food industry.

Paper [140] presents the systematic development and implementation of a novel energy management methodology for multi-site organisations to reach optimal efficiency across their network. The methodology, a Global Energy Management System, is based on the following strategic pillars: (1) Site Characterisation; (2) Performance Evaluation; (3) Energy Strategy; and (4) Shared learnings and dissemination. These pillars are underpinned by essential foundations: (a) Global energy team and communication forum; (b) Knowledge base at site and global level; and (c) Corporate Energy Policy. The methodology incorporates both quantitative performance evaluation using novel key performance indicators and benchmarking, as well as qualitative characterisation using energy management maturity models.

Conclusions and remarks

In this special issue of the international conference of sustainable energy and environmental protection SEEP2015, all the above topics have been presented and discussed, which cover many important themes related to the conference scope. This conference series wish to contribute to the developments of achieving 100% renewable energy by 2050 and to sort out all issues related to Energy Storage Systems..

Acknowledgments

The guest editor would like to thank the reviewers who have made a valuable contribution by reviewing, commenting and advising the authors. Also, the guest editor would like to thank all authors for their excellent contribution of high standard articles. The guest editor would like to thank the Editor-in-Chief Prof. Henrik Lund for the valuable support to edit this special issue. Finally, the guest editor would like to thanks all administration staff in the journal for their excellent support, in particular to the Journal Senior Publisher Ms Fernanda Ogochi, the Journal Manager Mr Dhilip Kumar Perumal and the Publishing Content Coordinator Ms. Emily Wan.

References

1. A. Foley, A.G. Olabi, 2017, Renewable energy technology developments, trends and policy implications that can underpin the drive for global climate change, Renewable and Sustainable Energy Reviews, 68, 2, pp. 1112-1114.
2. A.G. Olabi, 2016, Hydrogen and Fuel Cell developments: An introduction to the special issue on “The 8th International Conference on Sustainable Energy and Environmental Protection (SEEP 2015), 11-14 August 2015, Paisley, Scotland, UK”, International Journal of Hydrogen Energy, 41, pp.16323-16329.
3. A.G.Olabi, 2016, Energy quadrilemma and the future of renewable energy, Energy, 108, pp 1-6.
4. A.G.Olabi, 2014, 100% Sustainable Energy, Guest Editor’s Introduction. Energy, 77, pp1-5.
5. A.G.Olabi, 2013, State of the art on renewable and sustainable energy, Guest Editor’s Introduction. Energy, 61, pp2-5.
6. A.G.Olabi, 2012, Sustainable Energy and Environmental Protection, Energy, 39, 1. pp2-5.
7. A.G.Olabi. 2011. Developments in sustainable energy and environmental protection. Simulation Modelling Practice And Theory, 19, 4.

8. A.G.Olabi. 2010. The 3rd international conference on sustainable energy and environmental protection SEEP 2009, Guest Editor's Introduction. Energy, 135, 12, pp4508-4509.
9. A.M. Oladoye, J.G. Carton, K. Benyounis, J. Stokes, A.G. Olabi, 2016, Optimisation of pack chromised stainless steel for proton exchange membrane fuel cells bipolar plates using response surface methodology, Surface & Coatings Technology, 304, pp. 384–392.
10. Tabbi Wilberforce, A. Alaswad, A. Palumbo, M. Dassisti, A.G. Olabi, 2016, Advances in stationary and portable fuel cell applications, International Journal of Hydrogen Energy, 41, pp. 16509-16522.
11. A. Alaswad, A. Baroutaji, H. Achour, J. Carton, Ahmed Al Makky, A.G. Olabi, 2016, Developments in fuel cell technologies in the transport sector, International Journal of Hydrogen Energy, 41, pp. 16499-16508.
12. J.G. Carton and A.G. Olabi, 2015, Representative model and flow characteristics of open pore cellular foam and potential use in proton exchange membrane fuel cells, International Journal of Hydrogen Energy, 40, 16, pp. 5726–5738.
13. Cristina Rodriguez, A. Alaswad, K.Y. Benyounis, A.G. Olabi, 2016, Pretreatment techniques used in biogas production from grass, Renewable and Sustainable Energy Reviews, 68, 2, 1193-1204.
14. M.E. Montingelli, K.Y. Benyounis, J. Stokes, A.G. Olabi, 2016, Pretreatment of macroalgal biomass for biogas production, Energy Conversion and Management, 108, pp. 202–209.
15. L.E.N. Ekpeni, K.Y. Benyounis, J. Stokes, A.G. Olabi, 2016, Improving and optimizing protein concentration yield from homogenized baker's yeast at different ratios of buffer solution, International Journal of Hydrogen Energy, 41, pp. 16414-16427.
16. Leonard .E. N. Ekpeni1, Fehintola .F. Nkem-Ekpeni, K.Y. Benyounis, A. K. M. Aboderheeba, J. Stokes, A. G. Olabi, 2014, Yeast: A Potential Biomass Substrate for the Production of Cleaner Energy (Biogas), Energy Procedia, 61, pp. 1718 – 1731.
17. Leonard .E. N. Ekpeni1, K.Y. Benyounis, Fehintola .F. Nkem-Ekpeni, J. Stokes, A. G. Olabi, 2014, Energy Diversity through Renewable Energy Source (RES) – A Case Study of Biomass, Energy Procedia, 61, pp. 1740 – 1747.
18. K. Wang, H. Wu, D. Wang, Y. Wang, Z. Tong, F. Lin, A.G. Olabi, 2015, Experimental study on a coiled tube solar receiver under variable solar radiation condition, Solar Energy, 122, pp. 1080-1090.
19. Jianqin Zhu, Kai Wang, Hongwei Wu, Dunjin Wang, Juan Du, A.G. Olabi, 2015, Experimental investigation on the energy and exergy performance of a coiled tube solar receiver, Applied Energy, 156, pp. 519-527.
20. H. Achour, A.G. Olabi, 2016, Driving cycle developments and their impacts on energy consumption of transportation, Journal of Cleaner Production, 112, 2, pp. 1778–1788.
21. V. Lawlor, A.G. Olabi, 2015, Review of scientific research regarding PPO, tallow and RVO as diesel engine fuel, Fuel, 145 , pp. 25-38.
22. H.Achour, J. Carton and A.G. Olabi. 2011. Estimating Vehicle Emission from Road Transport, case study: Dublin City. Applied Energy, 88, 5, pp1957-1964.
23. Doherty W, Reynolds A, Kennedy D, Computer simulation of a biomass gasification-solid oxide fuel cell power system using Aspen Plus, Energy, 135, 12, pp 4545-4555.

24. Carton JG, Olabi AG. Wind/hydrogen hybrid systems: opportunity for Ireland's wind resource to provide consistent sustainable energy supply. Energy 2010; 35(12): 4536-44.
25. Carton JG, Lawlor V, Olabi AG, Hochenauer C, Zauner G. Water droplet accumulation and motion in PEM (Proton Exchange Membrane) fuel cell minichannels. Energy 2012; 39(1): 63-73.
26. Rokni M. Thermodynamic analysis of SOFC (solid oxide fuel cell)-stirling hybrid plants using alternative fuels. Energy 2013; 61: 87-97.
27. Bunin GA, Wuillemin Z, François G, Nakajo A, Tsikonis L, Bonvin Dominique. Experimental real-time optimization of a solid oxide fuel cell stack via constraint adaptation. Energy 2012; 39: 54-62.
28. J.G. Carton, A.G. Olabi. 2010. Design of experiment study of the parameters that affect performance of three flow plate configurations of a proton exchange membrane fuel cell. Energy, 35, 7, pp2796-2806.
29. Kühne R, Electric buses e an energy efficient urban transportation means, Energy, 35, 12, pp 4510-4513.
30. Smith WJ. Can EV (electric vehicles) address Ireland's CO2 emissions from transport? Energy 2010;35(12), pp4514-21.
31. Zhang Q, Mclellan BC, Tezuka T, Ishihara KN. A methodology for economic and environmental analysis of electric vehicles with different operational conditions. Energy 2013; 61, pp118-27.
32. Foley AM, _O Gallach_oir BP, Hur J, Baldick R, McKeogh EJ. A strategic review of electricity systems models. Energy 2010;35(12): pp4522-30.
33. Dicorato M, Forte G, Trovato M. Wind farm stability analysis in the presence of variable-speed generators. Energy 2012;39: pp40-7.
34. Leahy PG, Foley AM. Wind generation output during cold weather driven electricity demand peaks in Ireland. Energy 2012;39: pp48-53.
35. Guti_errez-Martín F, Da Silva-_Alvarez RA, Montoro-Pintado P. Effects of wind intermittency on reduction of CO2 emissions: the case of the Spanish power system. Energy 2013; 61(1): pp08-17.
36. Gill LW, Price C. Preliminary observations of a continuous flow solar disinfection system for a rural community in Kenya. Energy 2010;35(12): pp4607-11.
37. Aljufairi NH. Electric properties and surface structure of TiO2 for solar cells. Energy 2012;39: pp6-10.
38. Hami K, Draoui B, Hami O. The thermal performances of a solar wall. Energy 2012;39: pp11-6.
39. TinaGM Rosa-Clot M, Rosa-Clot P, Scandura PF, Scandura PF. Optical and thermal behaviour of submerged photovoltaic solar panel: SP2. Energy, 2012;39: pp17-26.
40. Gallo Michele, Mescia Luciano, Losito Onofrio, Bozzetti Michele, Prudenzano Francesco. Design of optical antenna for solar energy collection. Energy, 2012;39: pp27-32.
41. Boutelhig A, Bakelli Y, Hadj Mahammed I, Hadj Arab A. Performances study of different PV powered DC pump configurations for an optimum energy rating at different heads under the outdoor conditions of a desert area. Energy, 2012;39: pp33-9.
42. Komatsu S, Kaneko S, Pratim Ghosh P, Morinaga A. Determinants of user satisfaction with solar home systems in rural Bangladesh. Energy 2013;61: pp52-8.
43. Buonomano A, Calise F, Dentice d'Accadia M, Vanoli L. A novel solar trigeneration system based on concentrating photovoltaic/thermal collectors. Part 1: design and simulation model. Energy 2013;61: pp59-71.

44. Calise F, Dentice d'Accadia M, Palombo A, Vanoli L. Dynamic simulation of a novel high-temperature solar trigeneration system based on concentrating photovoltaic/thermal collectors. Energy 2013;61: pp72-86.
45. Tippayawong N, Thanompongchart P. Biogas quality upgrade by simultaneous removal of CO2 and H2S in a packed column reactor. Energy, 2010;35(12): pp4531-5.
46. Rafique R, Poulsen TG, Nizami A, Asam ZZ, Murphy JD, Kiely G. Effect of thermal, chemical and thermo-chemical pre-treatments to enhance methane production. Energy 2010;35(12): pp4556-61.
47. Melts I, Heinsoo K, Nurk L, P€arn L. Comparison of two different bioenergy production options from late harvested biomass of Estonian semi-natural grasslands. Energy 2013;61: pp6-12.
48. S. Tedesco, D. Mac Lochlainn, A.G. Olabi, 2014, Particle size reduction optimization of Laminaria spp. Biomass of enhanced methane production, Energy, 76, pp. 857-862.
49. Han S-H, Cho DH, Kim YH, Shin S-J. Biobutanol production from 2-year-old willow biomass by acid hydrolysis and acetoneebutanoleethanol fermentation. Energy, 2013;61: pp13-7.
50. Szarka N, Scholwin F, Trommler M, Jacobi Fabian H, Eichhorn M, Ortwein A. A novel role for bioenergy: a flexible, demand-oriented power supply. Energy, 2013;61: pp18-26.
51. Tedesco S, Benyounis KY, Olabi AG. Mechanical pretreatment effects on macroalgae-derived biogas production in co-digestion with sludge in Ireland. Energy, 2013;61: pp27-33.
52. Leonard E.N. Ekpeni, K.Y. Benyounis, Fehintola F. Nkem-Ekpeni, J. Stokes, A.G. Olabi, 2015, Underlying factors to consider in improving energy yield from biomass source through yeast use on high-pressure homogenizer (hph), Energy, 81, pp. 74-83.
53. M.E. Montingelli, K.Y. Benyounis, B. Quilty, J. Stokes, A. G. Olabi, Influence of mechanical pretreatment and organic concentration of Irish brown seaweed for methane production, Energy, Volume 118, 2017, pp. 1079-1089.
54. Schneider T, Graeff-H€onninger S, French WT, Hernandez R, Merkt N, Claupein W. Lipid and carotenoid production by oleaginous red yeast Rhodotorula glutinis cultivated on brewery effluents. Energy 2013;61: pp34-43.
55. Yoshimoto Y, Kinoshita E, Shanbu L, Ohmura T. Influence of 1-butanol addition on diesel combustion with palm oil methyl ester/gas oil blends. Energy, 2013;61: pp44-51.
56. Darwish MA, Al Awadhi FM, Bin Amer AO. Combining the nuclear power plant steam cycle with gas turbines. Energy 2010;35(12): pp4562-71.
57. Ishida M, Yamamoto S, Ueki H, Sakaguchi D. Remarkable improvement of NOxePM trade-off in a diesel engine by means of bioethanol and EGR. Energy, 2010;35(12): pp4572-81.
58. Powell EE, Hill GA. Carbon dioxide neutral, integrated biofuel facility. Energy, 2010;35(12): pp4582-6.
59. Patil RH, Colls JJ, Steven MD. Effects of CO2 gas as leaks from geological storage sites on agro-ecosystems. Energy 2010;35(12): pp4587-91.
60. Chouchene Ajmia, Jeguirim Mejdi, Favre-Reguillon Alain, Trouv e Gwenaelle, Le Buzit Gerard, Khiari Besma, et al. Energetic valorisation of olive mill wastewater impregnated on low cost absorbent: sawdust versus olive solid waste. Energy, 2012;39: pp74-81.
61. Allione Cristina, De Giorgi Claudia, Lerma Beatrice, Petruccelli Luca. From ecodesign products guidelines to materials guidelines for a sustainable product. Qualitative and Quantitative multicriteria environmental profile of a material. Energy 2012;39: pp90-9.

62. Dassisti M, Carnimeo L. Net modelling of energy mix among European Countries: a proposal for ruling new scenarios. Energy 2012;39: pp100-11.
63. Arnesano M, Carlucci AP, Laforgia D. Extension of portfolio theory application to energy planning problem e the Italian case. Energy 2012;39: pp112-24.
64. Karaca F, Camci F, Graham Raven P. City blood: a visionary infrastructure solution for household energy provision through water distribution networks. Energy, 2013;61: pp98-107.
65. Jouhara H, Meskimmon R. Experimental investigation of wraparound loop heat pipe heat exchanger used in energy efficient air handling units. Energy, 2010;35(12): pp4592-9.
66. Bakhtiari B, Fradette L, Legros R, Paris J. Opportunities for the integration of absorption heat pumps in the pulp and paper process. Energy 2010;35(12): pp4600
67. Jouhara Hussam, Merchant Hasnain. Experimental investigation of a thermosyphon based heat exchanger used in energy efficient air handling units. Energy 2012;39: pp82-9.
68. Jouhara H, Ezzuddin H. Thermal performance characteristics of a wraparound loop heat pipe (WLHP) charged with R134A. Energy 2013;61: pp128-38.
69. Jouhara H, Ajji Z, Koudsi Y, Ezzuddin H, Mousa N. Experimental investigation of an inclined-condenser wickless heat pipe charged with water and an ethanolewater azeotropic mixture. Energy 2013;61: pp139-47.
70. Rokni M. Biomass gasification integrated with a solid oxide fuel cell and Stirling engine. Energy 2014;77: pp6-18.
71. Yoon S-Y, Han S-H, Shin S-J. The effect of hemicelluloses and lignin on acid hydrolysis of cellulose. Energy 2014;77: pp19-24.
72. Woolmington T, Sunderland K, Blackledge J, Conlon M. The progressive development of turbulence statistics and its impact on wind power predictability. Energy, 2014;77: pp25-34.
73. Saljnikov E, Saljnikov A, Rahimgalieva S, Cakmak D, Kresovic M, Mrvic V, et al. Impact of energy saving cultivations on soil parameters in northern Kazakhstan. Energy, 2014;77: pp35-41.
74. Jovanovic M, Vu cicevic B, Turanjanin V, Zivkovic M, Spasojevic V. Investigation of indoor and outdoor air quality of the classrooms at a school in Serbia. Energy, 2014;77: pp42-8.
75. Okadera T, Chontanawat J, Gheewala SH. Water footprint for energy production and supply in Thailand. Energy, 2014;77: pp49-56.
76. Sorsak M, Leskovar VZ, Premrov M, Goricanec D, Psunder I. Economical optimization of energy-efficient timber buildings: case study for single family timber house in Slovenia. Energy, 2014;77: pp57-65.
77. Savic IM, Savic IM, Stojiljkovic ST, Gajic DG. Modeling and optimization of energy-efficient procedures for removing lead (II) and zinc (II) ions from aqueous solutions using the central composite design. Energy, 2014;77: pp66-72.
78. Al-Mansour F, Sucic B, Pusnik M. Challenges and prospects of electricity production from renewable energy sources in Slovenia. Energy, 2014;77: pp73-81.
79. Danielewicz J, Sayegh MA, Sniechowska B, Szulgowska-Zgrzywa M, Jouhara H. Experimental and analytical performance investigation of air to air two phase closed thermosyphon based heat exchangers. Energy, 2014;77: pp82-7.
80. Costa M, Marchitto L, Merola SS, Sorge U. Study of mixture formation and early flame development in a research GDI (gasoline direct injection) engine through numerical simulation and UV-digital imaging. Energy 2014;77: pp88-96.

81. Glotic A, Glotic A, Kitak P, Pihler J, Ticar I. Optimization of hydro energy storage plants by using differential evolution algorithm. Energy 2014;77: pp97-107.
82. Tic V, Tasner T, Lovrec D. Enhanced lubricant management to reduce costs and minimise environmental impact. Energy 2014;77: pp108-16.
83. Sencar M, Pozeb V, Krope T. Development of EU (European Union) energy market agenda and security of supply. Energy 2014;77: pp117-24.
84. Trop P, Anicic B, Goricanec D. Production of methanol from a mixture of torrefied biomass and coal. Energy 2014;77: pp125-32.
85. Bruni G, Cordiner S, Mulone V. Domestic distributed power generation: effect of sizing and energy management strategy on the environmental efficiency of a photovoltaic-battery-fuel cell system. Energy 2014;77: pp133-43.
86. Soares A, Antunes CH, Oliveira C, Gomes A. A multi-objective genetic approach to domestic load scheduling in an energy management system. Energy, 2014;77: pp144-52.
87. Burman E, Mumovic D, Kimpian J. Towards measurement and verification of energy performance under the framework of the European directive for energy performance of buildings. Energy 2014;77: pp153-63.
88. Lacko R, Drobnic B, Mori M, Sekavcnik M, Vidmar M. Stand-alone renewable combined heat and power system with hydrogen technologies for household application. Energy 2014;77: pp164-70.
89. Chontanawat J, Wiboonchutikula P, Buddhivanich A. Decomposition analysis of the change of energy intensity of manufacturing industries in Thailand. Energy, 2014;77: pp171-82.
90. Friedman C, Becker N, Erell E. Energy retrofit of residential building envelopes in Israel: a cost-benefit analysis. Energy 2014;77: pp183-93.
91. Weiller C, Neely A. Using electric vehicles for energy services: industry perspectives. Energy 2014;77: pp194-200.
92. Zhang S, Qin J, Bao W, Feng Y, Xie K. Thermal management of fuel in advanced aeroengine in view of chemical recuperation. Energy 2014;77: pp201-11.
93. Goricanec D, Pozeb V, Tomsic L, Trop P. Exploitation of the waste-heat from hydro power plants. Energy 2014;77: 220-5.
94. Zapletal D, Herman P. Photosynthetic complex LH2 e Absorption and steady state fluorescence spectra. Energy 2014;77: pp212-9.
95. Seljak T, Opresnik SR, Katrasnik T. Microturbine combustion and emission characterisation of waste polymer-derived fuels. Energy 2014;77: pp226-34.
96. Knez Z, Markocic E, Leitgeb M, Primozic M, Knez Hrncic M, Skerget M. Industrial applications of supercritical fluids: a review. Energy 2014;77: pp235-43.
97. Costa M, Massarotti N, Indrizzi V, Rajh B, Yin C, Samec N. Engineering bed models for solid fuel conversion process in grate-fired boilers. Energy, 2014;77: pp244-53.
98. Barbarelli S, Florio G, Amelio M, Scornaienchi NM, Cutrupi A, Lo Zupone G. Design procedure of an innovative turbine with rotors rotating in opposite directions for the exploitation of the tidal currents. Energy 2014;77: pp254-64.
99. Dobersek D, Goricanec D. An experimentally evaluated magnetic device's efficiency for water-scale reduction on electric heaters. Energy 2014;77: pp271-8.
100. Jouhara H, Meskimmon R. Heat pipe based thermal management systems for energy-efficient data centres. Energy 2014;77: pp265-70.
101. Recka L, Scasný M. Impacts of carbon pricing, brown coal availability and gas cost on Czech energy system up to 2050. Energy 2016;108: pp19-33.
102. Alami AH. Synthetic clay as an alternative backing material for passive temperature control of photovoltaic cells. Energy 2016;108: pp195-200.

103. Zheng T, Qiang M, Chen W, Xia B, Wang J. An externality evaluation model for hydropower projects: A case study of the Three Gorges Project. Energy, 2016;108: pp74-85.
104. Danielewicz J, Sniechowska B, Sayegh MA, Fidorow N, Jouhara H. Three dimensional numerical model of heat losses from district heating network pre-insulated pipes buried in the ground. Energy 2016;108: pp172-84.
105. Premrov M, └ Zegarac LV, Mihali └ c K. Influence of the building shape on the energy performance of timber-glass buildings in different climatic conditions. Energy, 2016;108: pp201-11.
106. Gajic D, Savic-Gajic I, Savic I, Georgieva O, Di Gennaro S. Modelling of electrical energy consumption in an electric arc furnace using artificial neural networks. Energy 2016;108: pp132-9.
107. Trop P, Goricanec D. Comparisons between energy carriers' productions for exploiting renewable energy sources. Energy 2016;108: pp155-61.
108. Jouhara H, Milko J, Danielewicz J, Sayegh MA, Szulgowska-Zgrzywa M, Ramos JB, Lester SP. The performance of a novel flat heat pipe based thermal and PV/T (photovoltaic and thermal systems) solar collector that can be used as an energy-active building envelope material. Energy 2016;108: pp148-54.
109. Urbancl D, Zlak J, Anicic B, Trop P, Goricanec D. The evaluation of heat production using municipal biomass co-incineration within a thermal power plant. Energy 2016;108: pp140-7.
110. Bruni G, Cordiner S, Mulone V, Sinisi V, Spagnolo F. Energy management in a domestic microgrid by means of model predictive controllers. Energy, 2016;108: pp119-31.
111. Wang G, Zhang Q, Mclellan BC, Li H. Multi-region optimal deployment of renewable energy considering different interregional transmission scenarios. Energy 2016;108: pp108-18.
112. Allocca L, Lazzaro M, Meccariello G, Montanaro A. Schlieren visualization of a GDI spray impacting on a heated wall: Non-vaporizing and vaporizing evolutions. Energy 2016;108: pp93-8.
113. Di Iorio S, Sementa P, Vaglieco BM. Analysis of combustion of methane and hydrogen-methane blends in small DI SI (direct injection spark ignition) engine using advanced diagnostics. Energy 2016;108: pp99-107.
114. Caf A, Urbancl D, Trop P, Goricanec D. Exploitation of low-temperature energy sources from cogeneration gas engines. Energy 2016;108: pp86-92.
115. Hur J, Baldick R. A new merit function to accommodate high wind power penetration of WGRs (wind generating resources). Energy 2016;108: pp34-40.
116. Nizami AS, Ouda OKM, Rehan M, El-Maghraby AMO, Gardy J, Hassanpour A, Kumar S, Ismail IMI. The potential of Saudi Arabian natural zeolites in energy recovery technologies. Energy 2016;108: pp162-71.
117. Sucic B, Al-Mansour F, Pusnik M, Vuk T. Context sensitive production planning and energy management approach in energy intensive industries. Energy, 2016;108: pp63-73.
118. Pusnik M, Al-Mansour F, Sucic B, Gubina AF. Gap analysis of industrial energy management systems in Slovenia. Energy 2016;108: pp41-9.
119. Merola SS, Tornatore C, Irimescu A, Marchitto L, Valentino G. Optical diagnostics of early flame development in a DISI (direct injection spark ignition) engine fueled with n-butanol and gasoline. Energy 2016;108: pp50-62.

120. J.G. Carton, A.G. Olabi, Three-dimensional proton exchange membrane fuel cell model: Comparison of double channel and open pore cellular foam flow plates, http://dx.doi.org/10.1016/j.energy.2016.02.010
121. Z. Ajji, H. Jouhara, Investigation of the effects of thermal, oxidative and irradiation treatments on the behaviour of poly-ethylene glycol as a phase change material in thermal energy storage systems, http://dx.doi.org/10.1016/j.energy.2016.01.104
122. Kun Zhou, Qizhao Lin, Hongwei Hu, Huiqing Hu, Lanbo Song, The ignition characteristics and combustion processes of the single coal slime particle under different hot-coflow conditions in N2/O2 atmosphere, http://dx.doi.org/10.1016/j.energy.2016.02.038
123. Amir Amini, Jeremy Miller, Hussam Jouhara, An investigation into the use of the heat pipe technology in thermal energy storage heat exchangers, http://dx.doi.org/10.1016/j.energy.2016.02.089
124. Ajit Sharma, Byeong-Kyu Lee, Energy savings and reduction of CO2 emission using Ca(OH)2 incorporated zeolite as an additive for warm and hot mix asphalt production, http://dx.doi.org/10.1016/j.energy.2016.03.085
125. Jiayin Ling, Yuan Tian, Renata Alves de Toledo, Hojae Shim, Cost reduction for the lipid production from distillery and domestic mixed wastewater by Rhodosporidium toruloides via the reutilization of spent seed culture medium, http://dx.doi.org/10.1016/j.energy.2016.04.008
126. Bilge Albayrak Çeper, Melih Yıldız, S. Orhan Akansu, Nafiz Kahraman, Performance and emission characteristics of an IC engine under SI, SICAI and CAI combustion modes, http://dx.doi.org/10.1016/j.energy.2016.08.038
127. M. Pusnik, F. Al-Mansour, B. Sucic, M. Cesen, Trends and prospects of energy efficiency development in Slovenian industry, http://dx.doi.org/10.1016/j.energy.2016.09.027
128. H. Jouhara, M. Szulgowska-Zgrzywa, M.A. Sayegh, J. Milko, J. Danielewicz, T.K. Nannou, S.P. Lester, The performance of a heat pipe based solar PV/T roof collector and its potential contribution in district heating applications, http://dx.doi.org/10.1016/j.energy.2016.04.070
129. Y.N. Kontos, K.L. Katsifarakis, Optimal management of a theoretical coastal aquifer with combined pollution and salinization problems, using genetic algorithms, http://dx.doi.org/10.1016/j.energy.2016.10.035
130. F. Millo, C. Cubito, L. Rolando, E. Pautasso, E. Servetto, Design and development of an hybrid light commercial vehicle, http://dx.doi.org/10.1016/j.energy.2016.04.084
131. J. Mooney, A. Alaswad, A. Cruden, A new pH phenomenon to predict polarity reversal in lead-acid cells, http://dx.doi.org/10.1016/j.energy.2016.04.083
132. Francesco Di Maria, Caterina Micale, Energetic potential of the co-digestion of sludge with bio-waste in existing wastewater treatment plant digesters: A case study of an Italian province, http://dx.doi.org/10.1016/j.energy.2016.04.081
133. Katharina Karner, Matthias Theissing , Thomas Kienberger, Modeling of energy efficiency increase of urban areas through synergies with industries, http://dx.doi.org/10.1016/j.energy.2015.12.139
134. Aleksandar Brkovic, Dragoljub Gajic, Jovan Gligorijevic, Ivana Savic-Gajic, Olga Georgieva, Stefano Di Gennaro, Early fault detection and diagnosis in bearings for more efficient operation of rotating machinery, http://dx.doi.org/10.1016/j.energy.2016.08.039
135. Min Wei, Yilin Fan, Lingai Luo, Gilles Flamant, Design and optimization of baffled fluid distributor for realizing target flow distribution in a tubular solar receiver, http://dx.doi.org/10.1016/j.energy.2016.04.016

136. Bing Wang, Pei-Gao Duan, Yu-Ping Xu, Feng Wang, Xian-Lei Shi, Jie Fu, Xiu-Yang Lu, Co-hydrotreating of algae and used engine oil for the direct production of gasoline and diesel fuels or blending components, http://dx.doi.org/10.1016/j.energy.2016.03.084
137. D. Goulding, D. Fitzpatrick, R. O'Connor, J.D. Browne, N.M. Power, Supplying bio-compressed natural gas to the transport industry in Ireland: Is the current regulatory framework facilitating or hindering development? http://dx.doi.org/10.1016/j.energy.2016.08.037
138. A. Madhlopa, Theoretical and empirical study of heat and mass transfer inside a basin type solar still, http://dx.doi.org/10.1016/j.energy.2016.09.126
139. F. Al-Mansour, V. Jejcic, A model calculation of the carbon footprint of agricultural products: The case of Slovenia, http://dx.doi.org/10.1016/j.energy.2016.10.099
140. Noel Finnerty, Raymond Sterling, Daniel Coakley, Sergio Contreras, Ronan Coffey, Marcus M. Keane, Development of a Global Energy Management System for non-energy intensive multi-site industrial organisations: A methodology, http://dx.doi.org/10.1016/j.energy.2016.10.049