Renewable energy technology developments, trends and policy implications that can underpin the drive for global climate change

Renewable energy technology developments, trends and policy implications that can underpin the drive for global Climate Change

Aoife Foley[1,*], Abdul Ghani Olabi[2]

[1]School of Mechanical & Aerospace Engineering

Queen's University Belfast

Ashby Building, Stranmillis Road

Belfast BT9 5AH, United Kingdom

E-mail address: a.foley@qub.ac.uk

[2]School of Engineering and Computing

University of the West of Scotland

D163a, McLachlan Building

Paisley PA1 2BE, United Kingdom

abdul.olabi@uws.ac.uk

* = corresponding author

Abstract

This special issue is dedicated to the research presented and discussed at the 8th International Conference on Sustainable Energy & Environmental Protection held from the 11th to the 14th August 2015 in Paisley, Scotland. The contents of this special issue are within the aims and scope of Renewable and Sustainable Energy Reviews. The aim of the International conferences on Sustainable Energy & Environmental Protection is to gather experts, practitioners and early career researchers together in a relaxed environment to present their research findings. The articles published in this special issue summarise a snapshot of the diverse range of topics from bioenergy and biogas, energy storage and district heating and energy in buildings to carbon emissions, carbon flux in soil and social aspects of carbon discussed at the conference within the framework of sustainable development. A total of eighteen extended manuscripts were invited by for consideration for publication following the conference and after a robust review process by experts in the field a total of ten articles were accepted.

Keywords

Renewable energy technology, biogas, bioenergy, industry, batteries, district heating, policy, carbon emissions, economics, social aspects, energy storage

List of abbreviations

BEM = Building Energy Modelling

CHP = combined heat and power

CO_2 = carbon dioxide

EU = European Union

GHG = greenhouse gas

SEEP = Sustainable Energy & Environmental Protection

TRL = technology readiness level

UK = United Kingdom

1.0 Introduction

The annual international Sustainable Energy & Environmental Protection conferences and associated special issue journals gather together leading experts, practitioners and early career researchers in the diverse and multi- and inter- disciplinary field of renewable energy and sustainable development to discuss, solve and debate the challenges facing society due to global warming and climate change [1], [2], [3]. The 8th International Conference on Sustainable Energy & Environmental Protection (SEEP2015) was held in Paisley, Scotland from the 11th to the 14th August 2015. The guest editors have a diverse background, expertise and knowledge in the field of renewable and sustainable energy including natural gas [4], [5], [6], hydrogen [7], biomass [8], [9], biogas [10], [11], wind integration and optimisation [12], [13], [14], [15], [16], [17] energy storage [18], [19], [20], [21], fuel cells [22], [23], [24], electricity markets [25], [26] and climate change [27], [28]. As experts, practitioners and early career researchers our challenge is to offer direction, guidance and solutions to the 21st century 'energy quadrilemma' challenge facing the planet, this generation and future generations [29]. This editorial concisely overviews ten articles published in this SEEP2015 special issue that aim to solve this energy and environmental challenge.

2.0 Overview

In [30]

[31]

[32]

[33]

[34]

[35]

[36]

[37]

[38]

[39]

[40]

5.0 Conclusion

In conclusion, this SEEP2015 special issue of Renewable and Sustainable Energy Reviews highlights some of the ground breaking technology, policy and trends research currently on-going across Europe and the world in the field of renewable energy and sustainable development. This work provides critical policy signposts and technology solutions to the public, industry and decision-makers to solve the energy quadrilemma.

Acknowledgements

The two guest editors of the SEEP2015 special issue express their gratitude to the Editor-in-Chief of Renewable and Sustainable Energy Reviews, Lawrence Kazmerski and the Renewable and Sustainable Energy Reviews team including Wendy Ye (Publishing Content Specialist - STM Journals), Janaki Bakthavachalam (Journal Manager), Katherine Eve (Executive Publisher) and Rosanna Diogini (Senior Publisher) for their support and advice. We also recognise all the numerous unnamed reviewers' diligence, commitment and effort.

References

[1] Olabi AG. 100% Sustainable Energy, Guest Editor's Introduction. Energy, 77, 1-5, 2014.
[2] Olabi AG. State of the art on renewable and sustainable energy, Guest Editor's Introduction. Energy, 61, 2-5, 2013.
[3] Olabi AG., Sustainable Energy and Environmental Protection, Energy, 39(1), 2-5, 2012.
[4] Devlin J, Li K, Foley A. The Importance of Gas Infrastructure in Power Systems with high Wind Power Penetrations, Applied Energy, 167, 294 – 304, 2016. doi.org/10.1016/j.apenergy.2015.10.150
[5] Devlin J, Li K, Higgins P and Foley A. A Multi Vector Energy Analysis for Interconnected Power and Gas Systems, Applied Energy, 2016. In Press. doi.org/10.1016/j.apenergy.2016.08.040
[6] Devlin J, Li K, Higgins P and Foley A. Gas Generation and Wind Power: A Review of Unlikely Allies in the United Kingdom and Ireland, Renewable and Sustainable Energy Reviews, 2016. Accepted.
[7] Carton JG, Olabi AG. Wind/hydrogen hybrid systems: Opportunity for Ireland's wind resource to provide consistent sustainable energy supply. Energy, 135(12), 4536-4544, 2010.
[8] Montingelli ME, Benyounis KY, Stokes J, Olabi AG. Pretreatment of macroalgal biomass for biogas production, Energy Conversion and Management, 108, 202–209, 2016. 10.1016/j.enconman.2015.11.008
[9] Tedesco S, Mac Lochlainn D, Olabi AG. Particle size reduction optimization of Laminaria spp. Biomass of enhanced methane production, Energy, 76, 857-862, 2014. doi.org/10.1016/j.energy.2014.08.086
[10] Alaswad A, Dassisti M, Prescott T, Olabi AG. Technologies and developments of third generation biofuel production, Renewable and Sustainable Energy Reviews, 51, 1446–1460, 2015.
[11] Tedesco S, Marrero Barroso T, Olabi AG. Optimization of mechanical pre-treatment of Laminariaceae spp. biomass-derived biogas, Renewable Energy, 62, 527-534, 2014. 10.1016/j.renene.2013.08.023
[12] Martin Almenta M, Morrow DJ, Best RJ, Fox B and Foley AM. An Analysis of Wind Curtailment and Constraint at a Nodal Level, IEEE Transactions on Sustainable Energy, 2016. In Press. doi.or.10.1109/TSTE.2016.2607799
[13] Foley AM, Ó Gallachóir BP, Leahy P.G, Milborrow D and McKeogh EJ. Addressing the Technical and Market Challenges to High Wind Power Integration in Ireland, Renewable & Sustainable Energy Reviews, 19, 692-703, 2013.

[14] Yan J, Bai E-B, Yang Z; Li K, Foley A. Time Series Wind Power Forecasting based on Variant Gaussian Process and TLBO, Neurocomputing, 189, 135-144, 2016. doi.org/10.1016/j.neucom.2015.12.081
[15] Foley AM, Marvuglia A, Leahy PG and McKeogh EJ. A Review of Current Methods and Advances in Wind Power Prediction and Forecasting. Renewable Energy, 37(1), 1-8, 2012. doi.org/10.1016/j.renene.2011.05.033
[16] Higgins P, Foley A, Douglas R, Li K. Impact of Offshore Wind Forecast Error in a Carbon Constraint Electricity Market. Energy, 76, 187-197, 2014. doi:10.1016/j.energy.2014.06.037
[17] Fitzgerald N, Foley A and McKeogh E. Integrating Wind Power using Intelligent Electric Water Heating. Energy, 48(1), 135-143, 2012. doi:10.1016/j.energy.2012.03.014
[18] Foley AM, Diaz Lobera I. Impacts of Compressed Air Energy Storage Plant on an Electricity Market with a Large Renewable Energy Portfolio, Energy, 57, 85-94, 2013. doi.org/10.1016/j.energy.2013.04.031
[19] Devlin J, Li ., Higgins P, Foley A. System Flexibility Provision Using Short Term Grid Scale Storage, IET Generation, Transmission & Distribution, 7, 2015. Online ISSN 1751-8695 doi.org/10.1049/iet-gtd.2015.0460
[20] Foley AM, Leahy PG, K. Li, Morrison A, McKeogh EJ. A Long-term Analysis of Pumped Hydro Storage to Firm Wind Power, Applied Energy, 137, 638-648, 2015. doi.org/10.1016/j.apenergy.2014.07.020
[21] Foley A, Tyther B, Calnan P and Ó Gallachóir B. Impact of Electric Vehicle Charging under Electricity Market Operation, Applied Energy, 101, 93-102, 2013. doi.org/10.1016/j.apenergy.2012.06.052
[22] Carton JG, Lawlor V, Olabi AG, Hochenauer C, Zauner G. Water droplet accumulation and motion in PEM (Proton Exchange Membrane) fuel cell mini-channels. Energy, 39(1), 63-73, 2012. doi.org/10.1016/j.energy.2011.10.023
[23] Carton JG and Olabi AG. Three-dimensional proton exchange membrane fuel cell model: Comparison of double channel and open pore cellular foam flow plates, Energy, 2016. In Press. doi.org/10.1016/j.energy.2016.02.010.
[24] Carton JG, Olabi AG. 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), 2796-2806, 2010.
[25] Higgins P, Li K, Douglas R & Foley A. The Significance of Interconnector Counter-trading to reduce the Dispatch-down of Wind Power, Energy Policy, 87, 110–124, 2015. doi.org/10.1016/j.enpol.2015.08.023
[26] Martin Almenta M, Morrow DJ, Best RJ, Fox B, Foley AM. Domestic Fridge-Freezer Load Aggregation to support Ancillary Services, Renewable Energy, 87(2), 954–964, 2016. doi.org/10.1016/j.renene.2015.08.033
[27] Heidrich O, Reckien D, Olazabal M, Foley A, Salvia M, De Gregorio Hurtado ., Orru H, Flacke J, Geneletti D, Pietrapertosa F, Hamann JJ-P, Tiwary A, Feliu E and Dawson RJ. National Climate Policies across Europe and their Impacts on Cities Strategies, Journal of Environmental Management, 168, 36-45, 2015. doi.org/10.1016/j.jenvman.2015.11.043
[28] Reckien D, Flacke J, Dawson RJ, Heidrich O, Foley A, Olazabal M, Hamann JJ-P, Orru H, Salvia M, De Gregorio S, Hurtado D, Geneletti F, Pietrapertosa F Climate Change response in Europe: What's the reality? Analysis of Mitigation and Adaptation plans from 200 urban areas in 11 countries, Climatic Change, 122(1-2), 331-340, 2014. doi.org/10.1007/s10584-013-0989-8
[29] Olabi AG, Energy quadrilemma and the future of renewable energy, Energy, 108, 1-6, 2016.
[30]
[31]
[32]
[33]
[34]
[35]
[36]
[37]

[38]
[39]
[40]