

## Editorial

### **Towards a sustainable bio-economy: Working in harmony with the environment-food-energy-water nexus**

Biomass is seen as one of the crucial resources needed in our future society that obtains its energy and consumer goods in a sustainable and carbon-neutral way, as well as recycling as much waste as possible – indeed, creating a circular economy where goods and services are designed from the beginning to produce as little net waste as possible. However, growing biomass for energy and products requires large amounts of land and water, thus competing with food and often is damaging to the environment and our ecosystems, e.g. through deforestation and resulting biodiversity loss. Thus managing the interactions between the environment, food, energy and water is of paramount importance. The potential of biomass must always be harnessed with the full knowledge of its impacts on the nexus of environment-food-energy-water in order to protect its delicate balance.

There is a wealth of research on biomass valorisation and biorefineries but very little of this has considered the wider impact of biomass production and utilisation on the nexus of food, energy, water, ecosystem services and biodiversity. This special issue aims to cover the lack of scientific literature in this area, to highlight its importance and to provide a platform for dissemination of the state-of-the-art and recent advances in this field.

This special issue of *Food & Bioproducts Processing* presents a collection of papers selected from the best presentations at the 2018 International Conference on Biomass, Environment, Food, Energy and Water (BEFEW) Nexus held in Selangor, Malaysia on 12-13 December 2018, supported by the UK Engineering and Physical Sciences Research Council (EPSRC) through the BEFEW project (Grant No. EP/P018165/1), as well as from invited contributors from the wider international research community working on different aspects of the nexus.

The papers presented show that the nexus issues can be found and analysed at different scales. At a single technology level, improvements to the nexus can be gained by making the process more efficient through understanding the different effects of critical factors on the nexus, but not losing the whole system perspective. There are also several articles in this special issue that highlight the importance of looking at the nexus across the whole value chain. The papers encompass nexus issues worldwide, including studies from North America, Latin America, Africa and South East Asia. Many of the papers dealt with studies on the recovery of important resources from waste, such as spent coffee grounds, orange peel, sugar cane bagasse, bakery products, palm oil effluents and by-products. This shows that many benefits to the nexus can be achieved by forming circular economies and applying a nexus perspective to devise strategic solutions. The papers presented detailed discussions of the opportunities and challenges, which could help shape future directions in this area. Finally, this special issue highlights the wide variety of methodologies that can be used to address nexus issues. Techno-economic analysis, life cycle assessment, multi-objective analysis, value chain optimisation, fuzzy-logic based assessment, geographic information systems modelling, multi-stakeholder investigation are a few examples of the methodologies used in the papers in this special issue. This special issue specifically addresses the United Nations Sustainable Development Goals (UN SDG): SDG 6 on *Clean water and sanitation*, SDG 7 on *Affordable and clean energy* and SDG 12 on *Responsible production and consumption*.

We would like to thank all of the authors for providing high quality, inspiring and timely papers that advance current research on a wide variety of challenges surrounding the nexus. Thanks also to the reviewers for their diligence in ensuring that a high standard has been maintained throughout this collection. We hope that this special issue will invigorate discourse and research activities towards creating a sustainable future where we harness the great potential of biomass for energy and products while at the same time ensuring that we do not harm our ecosystems and wildlife and put pressures on food production and water resources.

**Sheila Samsatli**, Department of Chemical Engineering, University of Bath, UK, [s.m.c.samsatli@bath.ac.uk](mailto:s.m.c.samsatli@bath.ac.uk)

**Elias Martinez-Hernandez**, Biomass Conversion Division, Mexican Institute of Petroleum, Mexico, [emartinez@imp.mx](mailto:emartinez@imp.mx)

**Kok Siew Ng**, Department of Engineering Science, University of Oxford, UK, [kok.ng@eng.ox.ac.uk](mailto:kok.ng@eng.ox.ac.uk)