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Editorial: Perspectives on energy futures, environment and wellbeing

1. Introduction

> "We tend to think of development, not in terms of evolution, but in terms of creation. […] If we talk of promoting development, what have we in mind: goods or people?"
>
> (Schumaker, 1989)

Schumaker (1989) raises doubts about whether the so-called societal development is oriented to an individual and/or collective evolution in its deeper meaning, or oriented to material creation. Development is a widely used term mostly without establishing a properly semantic, usually to sustain the business-as-usual production-consumption behavior claimed as mandatory to societal development. However, the ultimate goal of such behavior is to keep with the material flow and increase the gross economic product rather than a development focused on evolution of human beings in their complex features. Such a production-consumption pattern causes pressure on energy and environmental security (as a provider of resources and receiver of sub products for dilution), which deserves special attention by policy makers when promoting societal development. Currently, energy policies are demanding a reduction in greenhouse gases and toxic emissions, because increased development based on resource consumption by developed and developing countries are placing greater pressure on energy resources, with claims for alternative production systems that respect the Earth's biophysical limits of economic growth.

Although in principle the "creation" of goods may represent an advance towards diffuse welfare and wealth as well as much needed equity, it is at present contributing to a rush for the appropriation of available resources that are directly and indirectly linked to energy consumption and may contribute to planetary instability if not adequately understood and managed. Attention must be paid on what is really needed to support the development of human happiness rather than gadget-oriented lifestyles. As stated by Schumaker (1989), man's needs are infinite and infinitude can be achieved only in the spiritual realm, never in the material, thus a system focused on people's happiness and societal development must replace a system that primarily gives attention to increased ownership and consumption of goods. As is usual in the "free" market of globalized capitalism, enterprises are not concerned with what they produce but mainly with what they gain from production.

A wellbeing-oriented economics implies a profound reorientation of science and technology, and this can only be achieved by organizing and sharing a sustainability and equity knowledge. The Biennial International Workshop Advances in Energy Studies (BIWAES) was purposefully designed and implemented over its editions since 1998 as a deep science-based discussion arena about the most important issues of our modern society that, in some extend, can support the "right kinds of knowledge" through the participation of a critical mass of inter-disciplinary scholars.

This special issue celebrates the 10th edition along with 18 years of strong efforts in working together towards the achievement of a prosperous future for society.

The BIWAES 10th edition covered a large number of inter-disciplinary topics that are aligned to and supported discussion on perspectives of energy futures, environment, and well-being. Scientists presented and discussed their findings on the main following themes:• mobility of passengers and freight;• energy and urban systems;• food, energy, water and commodity nexus;• changing the energy basis of economies;• energy and ecological economics, sustainable finance, new business models for energy;• energy efficiency;• decision making tools for energy management, stakeholders and participatory strategies;• matter and energy flows in the biosphere and human economy;• transition to low-carbon and renewable energies;• energy and industrial cleaner production;• energy related airborne emissions, air quality and monitoring tools;• innovative concepts and frameworks for effective energy strategies;• biomass for energy and biobased materials;• developed and developing economies in the energy market, new actors and new strategies.

Research results were assessed and discussed during the event, as well as the implementation of a collaborative research network towards a much-needed critical mass for worldwide sharing of sustainability knowledge. The expected result is to allow further implementation of innovative joint projects on energy future supporting a sustainable production and consumption patterns focused on societal well-being.

2. This special issue

The main goal of this special issue is to present a set of studies that are meant to provide original scientific contributions to potentially support policy discussions and take decisions focused on energy, environment and well-being. All together they provide a remarkable result of energy policy-oriented research and applied cases, which can be considered as tools for better policy making and better sustainability-oriented research worldwide. The papers hosted in this special issue are grouped according to their main assessment and policy topics, as below indicated.

2.1. Urban metabolism and transport sector

People concentrate in urban centers and move within and around, travelling from living places to work and leisure locations. This is increasingly placing a heavy demand on energy and material resources as well as on environmental sustainability, calling for better resource use (efficiency, circular economy, planning) and less resource-intensive lifestyles.

2.1.1 Options to design and implement a net-zero energy city in Burlington (Vermont, USA) by providing renewable electricity locally, and by replacing the present uses of fuel oil, petrol, and natural gas, by means of renewables, with the notable exception of airplane fuel, are investigated and discussed by Herendeen (2019). The Author also focuses on preventing imports of renewables from far-away locations. This spatial reach has historically been de-emphasized in waves of enthusiasm for energy efficiency, sustainability (often loosely defined), and now renewability-especially in confronting greenhouse gas (GHG) emissions.

2.1.2 Huang et al. (2018) compare nine terrestrial transport modalities in China by considering amount, quality and distribution of re- sources, within monetary, energy and environmental (emergy) perspectives.

2.1.3 Zhang et al. (2019) establish a Long-range Energy Alternatives Planning (LEAP) model to predict greenhouse gases emissions in Beijing, China, by considering household, agriculture, industry, construction, transportation and service sectors, pointing out potentials to cut emissions and priority actions towards a low-carbon society.

2.1.4 Questioning whether urbanization and industrialization are the two main socioeconomic drivers of PM2.5 pollution, Ji et al. (2018) assess the socioeconomic drivers of PM2.5 through the Stochastic Impacts by Regression on Population, Affluence and Technology (STRIPAT), based on remote sensing and a panel data of 79 developing countries over 2001–2010.

2.1.5 Recognizing the climate change consequences of high concentrations of fossil carbon in the atmosphere as well as that carbon emissions are mainly a product of urban metabolism, Meng et al. (2018) apply a global environmentally extended multi-scale input-output model to Beijing, China, to track the carbon flows from production to consumption within a multi-scale economic system.

2.1.6 Perez-Sanches et al. (2019) apply the Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM) approach to assess the resource metabolism of Barcelona, Spain, to support decisions on complex urban systems.

2.2. Energy sources

Focus was placed on both technological and planning aspects of energy resources. No doubt that energy still is a major player in national economies and policies that promote innovative patterns are as important as policies that suggest better management and improvement of conventional sources.

2.2.1 Segantin et al. (2019) analyze the project Affordable Robust Compact (ARC) fusion reactor as a new energy source. Integration with the energy grid as load-following power plant is considered as its main innovative aspect. Such an integration may generate thermal stress- induced failure in some components, among which the vacuum vessel, whose performance is carefully investigated over time.

2.2.2 Better management practices of water use in coastal nuclear power plants in China are designed by Ding et al. (2019) Authors provide a discussion about important aspects that should be considered by guidelines, such as rationality analysis, water source assessment, impact demonstration of water intake and drainage, among others.

2.2.3 Highlighting the existence of a growing concern among policy makers about how electricity is generated and consumed in the context of energy security and global climate change, Reddy (2018) compares the main electricity generation technologies in India by means of a levelized cost approach, capital cost, operating and fuel costs. Ad- ditionally, a forecast for electricity generation in India is obtained through a non-linear Bass diffusion model over a 15-year horizon.

2.2.4 Dealing with the productivity of biofuel technologies in- novation in research and policies, Arnold et al. (2019) assess the productivity of investments in biofuels technologies, based on data avail- able at the U.S. Patent and Trademark Office.

2.2.5 Ajanovic and Haas (2018) analyze the economic prospects of hydrogen energy use by considering the integration of renewables in power systems and the substitution of fossil fuels in the transport sector. The hydrogen production costs and the potential learning effects of the fuel cell vehicles are assessed.

2.2.6 Focusing on the oil extraction in Ecuador, Parra et al. (2018) apply the multi-scale integrated analysis of societal and ecosystem metabolism (MuSIASEM) to assess the efficiency of oil extraction in Ecuador and to build scenarios of oil production increase over the next five years.

2.3. Energy and environmental monitoring, participatory tools and strategies and stakeholders behavior

Energy and material resource use are subject to a variety of factors, including resources availability, market oscillations, stakeholders perceptions and behavior, existence and implementation of policy tools that promote or determine appropriate resource use models. This also affects the environmental performance of economic and social systems. Being able to model, understand and test resource use in specific situation is of paramount importance for policy making and implementation of participatory strategies.

2.3.1 Questioning about the actual efficacy of market-oriented energy models in supporting stakeholder decisions, Di Felice et al. (2019) propose a model to describe the behavior of energy systems in relation to the existing nexus elements (including functional versus structural building blocks models, their hierarchical classification, and the different levels of nexus patterns). The proposed model is applied to the energy sector of Catalonia.

2.3.2 Focusing on eco-efficiency measures, Spangenberg and Lorek (2019) evaluate the challenges, the applicability and the meaningfulness of the Theory of Planned Behavior (TPB) and Social Practice Theory (SPT), for policy recommendations. An integrated TPB and SPT approach is suggested.

2.3.3 Focusing on the increasing demand for accommodation by the students in the UK higher education system, Morris and Genovese (2018) evaluate (from surveys applied to 286 students) the extent to which students factor in energy efficiency and fuel poverty concerns into their accommodation choices, along with the students perception of the low energy efficiency of accommodations in Europe.

2.3.4 Lorek and Spangenberg (2019) provide a basis for broader and more informed debate in policy and research about the potential of sufficiency considerations towards an overall reduction of energy consumption in the residential sector. Examples of housing projects are described depicting the potential role of different actor groups, yielding general policy recommendations.

2.3.5 Recognizing that domains of application of energy performance certificates (EPC) have not been studied systematically, Pasichnyi et al. (2019) provide a literature review of EPC data and propose a new approach structured on six validation levels to assess the quality of EPCs through data analytics.

2.3.6 Aiming at a democratization of local planning and policy- making practices, Pereverza et al. (2019) propose a modular Participatory Backcasting (mPB) framework for long-term planning in the heating sector, based on participatory backcasting (PB), principles of modularity, participatory modelling and transdisciplinarity. The mPB is applied to participatory strategic planning in the Ukrainian city Bila Tserkva and the Serbian city Niš.

2.3.7 To properly investigate the effectiveness of residential demand response (DR) for electricity in energy strategy and policy development, Nilsson et al. (2018) assess the effectiveness of DR and explore the potential of environmental incentives to increased consumer engagement. Authors propose an interdisciplinary evaluation framework to understand variations in household responsiveness to DR strategies, in a Swedish DR field trial in the year 2017.

2.3.8 Considering the pathways for phasing out fossil fuel subsidies in high income countries and their implications on the low-carbon transition, Monasterolo and Raberto (2019) apply the EIRIN Stock-Flow Consistent behavioral model to assess the effects on green growth, employment, credit and bonds market, as well as the distributive effects across heterogeneous households and sectors.

2.3.9 Becerra et al. (2018) attempt to appreciate the gap in the life quality of the people in the context of the indoor environmental quality, by means of the Predicted Mean Vote (PMV) to measure inside thermal comfort, the Predicted Percentage of Dissatisfied (PPD) as dimension- less index, and the CO_2 concentration as indicated by the ASHRAE-55 standard, in the city of Santiago de Chile, across socioeconomically disparate communes. Results highlight economic inequality in thermal comfort aspects across income levels.

2.4. Performance assessments of socio-economic systems in relation to their resource use and development scenarios

Understanding how resource availability and use is going to affect our future is crucial to implement resource policies that are effective and contribute to societal wellbeing.

Economic, investments, energy renewability and resource allocation aspects are dealt with in order to provide a basis for planning and optimization.

2.4.1. Gallopin's paper

Gallopin (2018) revisits the three archetypical scenarios for Planet future, as established two decades ago by the Global Scenario Group (GSG), aiming to assess changes and identifying new trends that could be useful in decisions towards a sustainable global future.

2.4.2. Luzzati's paper

Luzzati et al. (2018) assess the environmental Kuznets' curve (EKC) hypothesis for total primary energy supply and CO_2 from fuel combustion over the period 1971–2015. Authors show evidences supporting the EKC changes depending on the model specification, the sample, and the used variables, explaining why the literature on the EKC provides different results.

2.4.3. Cialani's paper

Cialani and Mortazavi (2018) assess the electricity demand and its determinants for European countries during 1995–2015 years, a period of electricity market liberalization. The elasticities and effects of other variables on electricity consumption are estimated using the Generalized Method of Moments (GMM) and Maximum Likelihood (ML) approaches.

2.4.4. Handayani's paper

Handayani et al. (2019) assess the diffusion of renewable energy in the electricity system of Java-Bali, Indonesia. Long-term scenarios for country's electricity capacity expansion are considered together with the long-range energy alternative planning (LEAP) model based on the integration of technological learning.

2.4.5. Scala's paper

Scala et al. (2019) propose a simplified strategy for portfolio management of renewable energy sources, based on Gaussian fluctuations with tunable correlations; such strategy could be integrated into policy making, to support decisions on renewable energy plans. Authors show how geographical allocation of different types of renewal energy sources can reduce the energy needs for balancing the power system and related uncertainty.

2.4.6. Rehman's paper

Rehman et al. (2019) develop a Pakistan nationwide bottom-up energy optimization model named Pak-TIMES (that includes energy demand and supply, energy costs and GHGs emissions) by employing the ANSWER-TIMES modelling framework, with the purpose to support insights on the energy-environment-economic nexus of Pakistan.

2.4.7. Sapio's paper

Focusing on the Italian electricity prices, Sapio (2019) applies regression models to assess the supply of renewables (photovoltaics and wind power) and the inception of the new cable SAPEI (linking Sardinia with the Italian peninsula) in the 2006–2015 period.

2.4.8. Trotta's paper

Underlining the need for energy efficient retrofit investments in the UK residential buildings, to design effective policies aimed at reducing energy demand and CO_2 emissions, Trotta (2018) applies the Probit model to assess the dwelling-related and the household characteristics that influence energy efficient retrofit investments in the English residential sector.

3. Concluding remarks

The foundations of well-being should not be laid by universal prosperity based on an increase of goods availability. Due to biophysical constraints on growth, such an increase is only partially attainable. Awareness of the planetary limits calls for equity policies—based on sharing, quality, understanding, happiness, and peace. A radical change of the business-as-usual paradigm is needed to allow people development within the Earth's biophysical limits. The further the business-as- usual is allowed to go, the more difficult it will be to reverse it. Thus, efforts by the scientific community, policy makers as well the entire society towards a development based on satisfaction of basic human needs and prosperity within biosphere limits is urgent. Scientific discussions such as those developed within BIWAES 2017 are likely to support policies towards a sustainable future.

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