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Sustainable Energy Planning and Management with cooking and maritime transport electrification, household energy savings and heating sector integration

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ABSTRACT

This 43rd volume of the International Journal of Sustainable Energy Planning and Management presents contemporary research within the diverse field of energy planning. The issue starts with analyses of an Indian programme targeting the replacement of fossil fuel-based stoves with induction stoves. Another electrification analysis targets maritime transportation and floating offshore charging stations. Third, analyses are presented regarding the potential impacts of household energy savings in Iran, and whether to optimally use savings for unmet demands in industry or for export – or indeed to lower production correspondingly. Two Hungarian studies focus on a comparison of using heat atlas and using measured data for heat planning and on the feasibility of using individual heat pumps as a flexibility provider for the electricity system. Taking a Danish case as a starting point, the role of the heating system in the overall energy system transition is analysed and lastly, a study reviews the literature on city energy planning approaches.

Keywords

Cooking;
Electric maritime transport;
Household energy consumption;
Spatial heat demand analyses;
Flexibility;
Heating in transition studies.

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1. Issue Contents

In [1], Damayanti targets India's transitioning of liquid petroleum gas (LPG)-based stoves to induction stoves. Targeting CO_2 emission, the transition project has phased some uncertainties regarding its sustainability. Thus, the present study analysed five aspects - economic, social, environmental, technical, and institutional through a survey conducted among 315 citizens. Costs were influential on the viability of the transition – while environmental impact was influenced by electricity in the system. Narula previously assessed the "Sustainable Energy Security" of different energy sources for residential use in India in this journal, ranking LPG high in urban areas while low in rural settings. The low ranking in rural settings is due to low availability and low affordability there.

In [2], V & K analyse the prospects of floating offshore charging stations for maritime transportation with a starting point in an Indian application. The study finds good prospects for renewable energy integration into such systems and stresses the potential. While the journal has previously presented work on the electrification of transportation [3–5], the present work is the first with a focus on maritime transportation.

In [6], Godarzi & Rokni explore three scenarios for household energy consumption in Iran. Iran is a very energy intensive country and also with unmet demands. Thus, curbing energy demand in households can have more effects on the energy system. In their work, Godarzi & Rokni explore impacts of savings provide more energy for industry, if savings provide more potential for exports or if savings simply translate into reductions of domestic supply. Channelling energy savings for the industrial sector can create large profits for society according to their findings. In this journal, Barkhordar [7] previously investigated energy efficiency measures and rebound effects in

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Iranian industry, finding substantial energy efficiency potentials. Godarzi has also previously published studies on the Iranian energy system, with a focus on greenhouse gas emission reductions from power generation[8,9].

In [10], Csontos and coauthors probe in the spatial distribution of energy demands. In their work, they compare analyses made using the heat atlas Hotmaps to analyses made with actual measured data and secondly, investigate impacts on energy system configuration of spatial aspects. They find that for areas with annual heating demands higher than 5000 MWh, Hotmaps provide a sufficient basis for assessments. For areas with high proportions of individual solid fuel usage, local information is however required. Current heat atlases do not necessarily capture these well. Grundahl and Nielsen previously published a study with a similar ambition, albeit in a Danish context, finding that the heat atlas approach was mainly valid for groups of single-family houses, while other building types needed more attention [11]. Furthermore, Moreno and coauthors previously presented their ODHeatmap tool [12] and Edtmayer presented a high-resolution tool for heat mapping [13].

In [14], Campos and Munkácsy apply the widely used EnergyPLAN energy systems analysis model [15,16] to analyse and develop a methodology to assess the potential provision of flexibility from individual heat pumps. Taking a Hungarian case, they analyse how flexible demand can decrease surplus power production. The flexibility provided does not, however, fully remove the surplus power in their scenario, and the authors find the value of the solution limited. On the other hand, it could be argued that flexibility-providing solutions should not stand alone but should contribute along with other measures in line with the smart energy systems approach [17,18]. EnergyPLAN has previously been applied in several studies reported in this journal including studies on Ireland [19–21], Denmark [22,23], the Italian Alps [24], Jordan [25], La Gomera [26], and the Faroe Islands [27].

Nielsen and coauthors [28] also address the heating sector – here with a focus on the integration of heating in overall energy system transition pathways. In their work, they take a multifaceted approach to heating – analysing the role of savings, excess heat, and integration of variable renewable energy sources. In their work, they underline the importance of the heating sector in energy system transition scenarios. Previous research on the transition of the heating sector in this journal has covered most of these aspects individually, but not brought all together in a single comprehensive study. Pieper et al. dealt with applying GIS-based approaches to identify heat sources for heat pumps in district heating [29], Lund et al. proposed and modelled strategies for balancing heat savings and heat production [30], and Jürgens et al. evaluated the potential for covering district heating demands with excess heat from data centres[31].

In [32], Gupta and Ahlgren review the scientific literature within city energy planning, finding that cases in the literature are diverse in terms of modelling approach. The findings also show that there are limitations in modelling approaches in terms of e.g. local air pollution which is underdeveloped in the field – as well as areas less easily quantifiable like stakeholder participation. Marczinkowski previously presented an analysis [33] of island energy planning, linking this to the smart energy systems approach.

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