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Sustainable Development of Energy, Water and Environmental Systems and Smart Energy Systems

Poul Alberg Østergaard[a*], Rasmus Magni Johannsen[a], Neven Duic[b] and Henrik Lund[a]

[a] *Department of Planning, Aalborg University, Rendsburggade 14, 9000 Aalborg, Denmark*
[b] *Department of Energy, Power Engineering and Environment, Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb, Lučićeva 5, 10000 Zagreb, Croatia*

ABSTRACT

This 34th volume of the International Journal of Sustainable Energy Planning and Management includes papers from the 2021 conference on *Sustainable Development of Energy, Water and Environmental Systems* (SDEWES) held October 10-15, 2021, in Dubrovnik, Croatia as well as the *7th International Conference on Smart Energy Systems* held September 21-22 in Copenhagen, Denmark and two normal papers. A focus area of this issue is district heating and district cooling systems, with articles addressing resources for district heating and cooling systems, impacts of having individual district heating metres for consumers and approaches to analysing district heating systems. Another focus area is stakeholder involvement where two groups of researchers focus on stakeholders from an energy island perspective as well as from a positive energy district perspective. Both groups note the importance of factoring in stakeholders when devising transition plans. Plans for increasing the penetration of renewable energy sources for the Estonian, Latvia and Lithuanian systems are analysed using the Backbone model, finding modest increases in system costs. Lastly, an article sets up an indicator system for assessing environmental performance of European Union member states ranking, e.g., Estonian, Latvia and Lithuanian as moderate (Estonia and Latvia) to weak (Lithuania) in terms of sustainable energy performance score, based on 2019 data.

Keywords

District heating;
District cooling;
Stakeholders;
Sustainability indicators;
Energy system transition;

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1. SDEWES Special Issue

In the first article of the SDEWES special issue, Del-Busto & Mainar-Toledo [1] focus on European Union islands tackling climate change targets within a complex stakeholder arena. Based on experience from Málaga and Cádiz (both Spain) and Sète (France) the authors forward a suggested *Participatory Process Protocol*. They apply their methodology to four clusters of islands and use the experience for improving their approach. Rygg et al. previously assessed social acceptance of small hydropower station finding that local ownership is important for local acceptance and participation. This is also in line with extensive previous work by Hvelplund [2–4] showing the merits of local ownership when dealing with implementation and acceptance of energy technologies. Marczinkowski also previously emphasized the importance of island studies in the energy transition[5].

District heating is seen as a key-component of decarbonised energy systems in Balen & Maljković [6]. Using Croatia as an example, the authors investigate the impact of having individual meters for measuring district heating usage as opposed to shared metres. The authors assess that individual meters can affect a reduction in heat usage of about 40% compared to apartment buildings with shared or common metres.

*Corresponding author e-mail: poul@plan.aau.dk

District heating is also the focal point for Pieper et al. [7], who look into the identification of heat sources of large heat pumps using geographical information system (GHIS) software. They investigate both natural sources such as lakes and rivers and man-made sources like industries considering quantities, temperature levels and location with respect to demand areas. Applying their approach to Estonia, Latvia and Lithuania, the authors found TWh-scale industrial excess heat potentials in each country – large proportions even within existing district heating areas.

The energy systems of Estonia, Latvia and Lithuania are also in focus by Putkonen et al. [8] who address the phase-out of fossil-based electricity generation for renewable energy sources as well as a desynchronisation from the Russian electricity grid. Already planned measures would increase renewable energy exploitation from 45% to 92% with only a moderate impact on costs. The analyses by Putkonen and co-authors are based on the Backbone energy systems analysis model developed by Helistö and colleagues [9].

2. Smart Energy Systems Special issue

Volkova et al. [10] set up an approach to assess district cooling and applied it to Tallinn as a case. Through an assessment of cooling demands, distribution grid requirements and heat cooling supply options, the authors devised a district cooling system. The provision of cooling came from a mixture of natural cooling, waste heat-driven absorption heat pumps and electrical chillers. This is what a new article describes as a fourth-generation district cooling system [11]. Volkova has previously assessed district heating regions in Estonia [12] and presented an app for the promotion of 4th generation district heating [13] in this journal.

Fallahnejad et al. [14] investigate the differences in applying two distinct district heating system assessment approaches - the effective width approach versus a more detailed optimisation-based approach with the aim of identifying challenges from using the two approaches. Results from the two are to some extent similar, so a main determinant for the decision on approach is the data availability, where the former requires less data. District heating assessment methods in general is a recurring theme[15–20] in this journal, emphasizing the importance of the technology in the transition towards renewable energy-based energy systems.

3. Ordinary articles

Rankinen et al. [21] focus on stakeholders involved in the transition toward renewable energy-based energy systems. Focusing on positive energy districts, the authors address the diversity of stakeholders engaged in the process of implementing such systems, concluding amongst others that *"management needs to incorporate a stakeholder mindset"* – i.e. keep a focus on the stakeholders affected by the process. Previous work in this journal includes Butu's [22] with a focus on stakeholders' engagement in rural community energy projects as well as the work on small hydro plants mentioned in Section 1. Proimakis also addressed stakeholders – here from a marine energy perspective[23] and Krogh et al. looked into the stakeholders of 4th generation district heating[24] and Bishoge[25], Tricarico [26] and Tomc [27–29] explored various constellations of community energy schemes with a focus on stakeholders.

Szép [30] takes a starting point in COVID 19, the energy crisis and decarbonisation effort and developed a set of indicators to assess the performance of nations. Applying it to the European Union member states, they rate Denmark, Sweden, Austria and France as robust – whereas at the other end of their scale, Bulgaria, Hungary, Poland and Lithuania are rated as weak. Indicators have previously been explored in this journal by Hernandez-Hurtado and Martin-del-Campo[31].

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