

EDITORIAL

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Energy landscapes of today and tomorrow

Daniela Thrän^{1,2}, Erik Gawel¹ and Dagmar Fiedler^{1*}

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The transition of energy systems toward renewable energy sources (RES) is a key issue for sustainable development. To execute this transformation, a tremendous number of renewable energy provision as well as infrastructure units are necessary. Thus, new energy landscapes will emerge changing energy provision from "energy for space" to "energy from space". Such energy landscapes not only include traditional landscape patterns, but also renewable resource potentials, conversion units and related infrastructure, and also humans being affected by the transition in very different ways: as investors, neighbours, local decision-makers, energy consumers and many more. Likewise, landscapes need to secure manifold functions such as food and material provision, nature protection and recovery. With increasing RES shares, a variety of sustainability challenges have become evident: consideration of the limited land availability by combining material and energy use in agriculture, unlocked potentials to increase local energy efficiency and awareness of concerns associated with the spatio-ecological and spatio-social effects of RES deployment (land use conflicts, public acceptance, NIMBY). Hence, spatial disutility should be taken into account when using energy landscapes for decentralized energy provision.

Thus, the spatial dimension of the "Energiewende" turns out to be an important issue of further interdisciplinary research. Regional and spatial analyses need to complement the traditional energy systems research. They may contribute to understanding the various drivers of regionally specific RES deployment, identifying regional

and local patterns, e.g. of environmental impacts, developing and integrating methods of spatial modelling, conducting spatial optimizations and respective conflict management, developing innovative spatially explicit governance concepts.

In light of this, addressing the manifold challenges connected with newly emerging energy landscapes and exploring possible solutions was the focus of the UFZ Energy Days 2018 held in Leipzig from the 24–25 September 2018.

This article collection originates from a selection of papers based upon presentations at the Energy Days. It aims at fostering the exchange between energy research at the UFZ and the national and international scientific community. It is with pleasure and pride that we not only present the carefully reviewed and edited conference papers in this special issue of *Energy, Sustainability and Society*, but also some recent novel papers from this area, giving our readers an overview of the research activities in this field. To better understand the sustainability hurdles, characterized by more decentralized and consequently more land-intensive production patterns than conventional energy supply systems, this collection provides strategies and concepts for a wide range of scientific disciplines surveyed. Several papers deal with Germany as a case study, where—with the policy effort to bring forward the "Energiewende"—energy landscapes have been created during the last decades.

The topics included in this issue range from wind power to photovoltaic systems [1–3] and from biomass to bioliquids and biofuels for heat, electricity, and transport [4–6], (1A, 3A). They cover the entire innovation process, ranging from scientific research to innovative approaches for technology implementation and the politics of energy landscapes [5, 7] (4A). Furthermore, this

*Correspondence: dagmar.fiedler@ufz.de

¹ UFZ–Helmholtz-Zentrum für Umweltforschung GmbH, Leipzig,

Permoserstrasse 15, 04318 Leipzig, Germany

Full list of author information is available at the end of the article



edition comments on the societal debate on the benefits and risks of Germany's "Energiewende" and the conservation aspects of future energy landscapes [8, 9].

Here, one important contribution deals with combined heat and power production from biomass as one way to efficiently provide renewable heat. Likewise, the gross quantities as well as the economically viable potential of Germany's current bioenergy plant stock is investigated from the viewpoint of supplying renewable heat [6]; whereas, another article focusses on the selection process of different fuel types in detail, where technical aspects such as production, utilization and handling are evaluated by means of a thermodynamic analysis. Based on this analysis, the ecological and economic aspects are assessed to yield a set of recommendations of suitable synthetic transport fuels produced in decentralized plants with CO₂ supply from biogas plants [4]; and a third article in this collection quantifies the role that biomethane produced from straw could potentially play in the transport sector. Interestingly, the world's first large-scale industrial plant using the principle of straw mono-digestion is already successfully being operated in Germany, which among others provides a great short-term contribution to reduce GHG emissions in the transport sector (1A).

The focus of some papers is also on Transnational Sustainability Certification for the Bioeconomy (2A), climate targets [10] and carbon and energy footprints [11].

To conclude, we would like very much to seize the opportunity to express our gratitude to our authors for their sustained confidence and also to our valued referees for their tremendous work and generous help in editing this thematic issue. We hope that the readers will enjoy this collection.

Daniela Thrän, Erik Gawel & Dagmar Fiedler.

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Author details

¹ UFZ-Helmholtz-Zentrum für Umweltforschung GmbH, Leipzig, Permoserstrasse 15, 04318 Leipzig, Germany. ² Deutsches Biomasseforschungszentrum (DBFZ), Torgauer Straße 116, 04347 Leipzig, Germany.

The following articles have been positively reviewed and are now revised by their authors:

- (1A) ESSO-D-20-00036R2
Temporal and Spatial Availability of Cereal Straw in Germany - Case Study: Biomethane for the Transport Sector
André Brosowski; Ralf Bill; Daniela Thrän
- (2A) ESSO-D-20-00096
Transnational Sustainability Certification for the Bioeconomy? Patterns and Discourse Coalitions of Resistance and Alternatives
Thomas Vogelpohl
- (3A) ESSO-D-20-00104R1
A consolidated potential analysis of bio-methane and e-methane using two different methods for a medium-term renewable gas supply in Germany
Michael Steubing, Master of Science; Patrick Matschoss; Joachim Pertagnol; Yue Zheng; Bernhard Wern; Martin Dotzauer; Daniela Thrän
- (4A) ESSO-D-20-00146
Effects of the German Renewable Energy Act and environmental, social and economic factors: biogas plants adoption and agricultural landscape change
Xueqing Yang; Yang Liu; Daniela Thrän; Alberto Bezama; Mei Wang

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10. Wiehe J, von Haaren C, Walter A (2020) How to achieve the climate targets? Spatial planning in the context of the German energy transition. *Energy Sustain Soc* 10:10. <https://doi.org/10.1186/s13705-020-0244-x>
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