



# Energy Justice and Smart Grid Systems: Evidence from the Netherlands and the United Kingdom

Christine Milchram<sup>a,\*</sup>, Rafaela Hillerbrand<sup>b,a</sup>, Geerten van de Kaa<sup>a</sup>, Neelke Doorn<sup>a</sup>, Rolf Künneke<sup>a</sup>

<sup>a</sup> Faculty of Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, The Netherlands

<sup>b</sup> Institute for Technology Assessment and Systems Analysis, Karlsruhe Institute of Technology, P.O. Box 3640, 76021 Karlsruhe, Germany

## HIGHLIGHTS

- This paper broadens current conceptualizations of energy justice for smart grids.
- The study explores values in the public debates on smart grids in two countries.
- Value conflicts show the importance of distributive and procedural justice.
- It is debated if the systems lead to more equity or reinforce injustices.
- Energy justice needs to be broadened to include data privacy and security issues.

## ARTICLE INFO

### Keywords:

Smart grid systems  
Energy justice  
Sustainability  
Values  
Public debate  
Content analysis

## ABSTRACT

Smart grid systems are considered as key enablers in the transition to more sustainable energy systems. However, debates reflect concerns that they affect social and moral values such as privacy and justice. The energy justice framework has been proposed as a lens to evaluate social and moral aspects of changes in energy systems. This paper seeks to investigate this proposition for smart grid systems by exploring the public debates in the Netherlands and the United Kingdom. Findings show that smart grids have the potential to effectively address justice issues, for example by facilitating small-scale electricity generation and transparent and reliable billing. It is a matter of debate, however, whether current smart grid designs contribute to cost and energy savings, advance a more equitable and democratic energy system, or reinforce distributive and procedural injustices. The increased use of information and communication technology raises value conflicts on privacy and cyber security, which are related to energy justice. This research contributes by conceptualizing energy justice in the context of smart grids for the first time. The energy justice framework is broadened by including values and value conflicts that pertain directly to the increased use of information and communication technology. For policy makers and designers of smart grids, the paper provides guidance for considering interconnected social and moral values in the design of policies and smart grid technologies.

## 1. Introduction

Driven by policy objectives on climate change mitigation and advancements in communication technologies, electricity distribution networks are changing to become ‘smarter’ [1,2]. The European Technology Platform Smart Grids defines a smart grid system as “an electricity network that can intelligently integrate the actions of all users connected to it -generators, consumers and those that do both- in order to efficiently deliver sustainable, economic and secure electricity supplies” [3]. The definition reflects the European energy policy triad of environmental sustainability, economic efficiency, and the security of

power supply [4,5]. Smart grid systems (in the remainder of the paper referred to as smart grids) target all three core objectives by facilitating the integration of decentral and intermittent renewable energy sources like wind and solar into distribution networks. The intentions are to automatically balance supply and demand flows within networks, accounting for weather-induced intermittencies and reducing peak demand or supply. By reducing electricity peaks, smart grids should help to avoid expensive network expansions [6]. They also target demand reductions by visualizing energy use and connecting it with daily behavior like the use of household appliances [7]. Smart grids are thus framed as key enablers in the transition to more sustainable energy

\* Corresponding author.

E-mail address: [c.milchram@tudelft.nl](mailto:c.milchram@tudelft.nl) (C. Milchram).

<https://doi.org/10.1016/j.apenergy.2018.08.053>

Received 29 September 2017; Received in revised form 3 August 2018; Accepted 11 August 2018

0306-2619/ © 2018 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

systems.

Despite their prominent role in the energy transition, the development of smart grids has spurred critical public debates. For example, perceptions that energy companies are not open about benefits or do not pass on financial savings to their customers indicate trust and justice issues [8–10]. Further concerns stem from the automatic, more frequent and more fine-grained transfer and storage of information on consumers' energy use to central databases. This raises fears that consumers' privacy might be violated and that these data could be threatened in cyberattacks [11,12]. Such concerns can form barriers for the acceptance and adoption of smart grids and have already proven challenging in smart grid pilot projects [13]. Importantly, however, these societal concerns do not represent mere opposition against smart energy systems. They contain legitimate arguments that the systems touch upon core values such as privacy, security, or justice.

The exemplified societal concerns show that smart grids are not only a matter of the energy policy triad, but that a broader evaluation of the social and moral values affected by smart grids is needed, including how these values may be in conflict. We define values here as “general convictions and beliefs that people should hold paramount if society is to be good” [14, p. 1343]. For socio-technical systems such as smart grids, social and moral values provide criteria for design that go beyond the core technological functionalities of a system. They are normative principles that guide the design of technological systems [15].<sup>1</sup>

The concept of ‘energy justice’ has been proposed as one of the most comprehensive approaches that considers social and moral aspects of energy systems beyond the energy policy triad [16,17]. In the words of Sovacool & Dworkin [18 p. 441], assessing energy justice means “asking what this energy is for, what values and moral frameworks ought to guide us, and who benefits”. Up to now, energy justice research has focused on the supply and use of energy as well as the energy system as a whole [19], and has – to the best of our knowledge – not examined smart grids. These systems, however, entail a convergence between the energy and the information and communication technologies (ICT) sector, and hence the range of ethical challenges goes beyond those related to energy supply and use. They include aspects pertaining to digitally connected systems, automation, and the increased recording and sharing of real-time data.

In this paper, we investigate the proposition that energy justice can serve as an approach to address social and moral aspects beyond the energy policy triad for the case of smart grids. To do so, we pursue two related aims. Firstly, we take a broad starting point to gain a deeper understanding of the moral and social values that underlie arguments used in public debates on smart grids in general. By relying on empirical material, we provided a descriptive account of how values are framed in the public debate. Secondly, we aim to set these values in context with energy justice. Thereby, we broaden evaluations of justice issues pertaining to energy supply and use by analyzing justice aspects in systems that operate at the intersection of the energy and ICT sectors. For policy makers and designers of smart grids, our research provides a basis for understanding values as design requirements and thus allows accounting for a range of interconnected social and moral dimensions within system design and decision-making processes. Our descriptive/empirical account can be a basis for a future normative account to answer the questions how injustices *should* be solved, or who *should* be involved to what extent and how in decision-making processes.

We take the public debates in the Netherlands and the United Kingdom as cases. Both countries have a density of smart grid pilot projects which is above EU average [12,20,21]. In addition, the

political process and implementation of smart metering systems – sometimes called the backbone of smart grids – started relatively early, and with it a controversial public debate. While the Dutch and British debates may not be representative for other countries, underlying core values and conflicts can provide ample learning material beyond the two cases. To understand values in the public debate on smart grids, we conduct a qualitative content analysis of newspaper articles and analyzed extracted arguments with respect to underlying values, their interpretations in the smart grid context, and perspectives of stakeholder groups.

This paper is structured as follows. Section 2 provides a theoretical background on smart grids, the role of values in the design of socio-technical systems, and energy justice. Section 3 describes the methodology and smart grid developments in the Netherlands and the United Kingdom. Section 4 presents and discusses the results of the qualitative content analysis.

## 2. Background

### 2.1. Smart grid systems

The concept “smart grid” is used as an umbrella term to capture the digitalization of power systems (focusing on the distribution networks) with the aim to facilitate the transition to more sustainable energy systems. Sub-systems include smart metering, which is generally considered as the cornerstone of smart grids, smart home energy management systems (HEMS), demand-side response (DSR), household storage, and the integration of electric vehicles (EVs) through vehicle-to-grid and grid-to-vehicle solutions [22,23]. Smart grids are emerging systems and currently mostly implemented in pilot projects. The technologies are thus constantly changing. However, the use of ICT to achieve a more sustainable energy system is the combining factor.

Despite a strong focus on technological development, the changes smart grids imply for the energy system are not purely technological. Smart grids are socio-technical systems and their performance depends on the interaction between technologies, institutions, and social actors [24,25]. The technological advancements in communication technologies, through which distribution networks change from physical grids of copper to networks enforced by an advanced ICT infrastructure, also pose institutional questions on data property and market access rights [6]. Institutions are the legislation and regulations around smart grids; they form the (human-made) rules that govern their development and introduction [26]. Other differences between smart grids and ‘conventional’ networks include changes in roles and an increased diversity of actors. Probably the most prominent is the role change of the consumer, who can evolve from a largely passive energy consumer to an ‘energy citizen’, who becomes an active ‘prosumer’ and is an engaged actor in the energy transition [8].

### 2.2. Considering values in the design of smart grid systems

This paper aims at understanding how moral and social values that underlie the public debate on smart grids can be conceptualized under the comprehensive framework of energy justice. Studying how values are affected by smart grids is important for several reasons. Firstly, given the socio-technical nature of smart grids and the fact that energy systems deeply affect every-day life and well-being in modern societies, a focus on techno-economic aspects is too narrow to understand the intertwined nature of technological, institutional, and social developments. Despite this, the majority of literature on energy systems and policy has focused on techno-economic aspects [27]. In an extensive review of energy research, for example, Sovacool [28] found a prevalence of economics, mathematics, physics, and engineering and an underrepresentation of the social sciences and humanities. Only 20% of the authors of 4444 analyzed academic research papers were affiliated to a social sciences discipline.

<sup>1</sup> This conceptualization of ‘values’ from philosophy needs differentiation from how the concept is used in social psychology and sociology. In the latter disciplines, value orientations or values are individuals’ personality characteristics [94]. ‘Values’ in philosophy and particularly ethics of technology are normative principles for system design [15].

Download English Version:

<https://daneshyari.com/en/article/11000864>

Download Persian Version:

<https://daneshyari.com/article/11000864>

[Daneshyari.com](https://daneshyari.com)