



Research article

Updating energy security and environmental policy: Energy security theories revisited

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ABSTRACT

The energy security theories are based on the premises of sufficient and reliable supply of fossil fuels at affordable prices in centralized supply systems. Policy-makers and company chief executives develop energy security strategies based on the energy security theories and definitions that dominate in the research and policy discourse. It is therefore of utmost importance that scientists revisit these theories in line with the latest changes in the energy industry: the rapid advancement of renewables and smart grid, decentralization of energy systems, new environmental and climate challenges. The study examines the classic energy security concepts (neorealism, neoliberalism, constructivism and international political economy) and assesses if energy technology changes are taken into consideration. This is done through integrative literature review, comparative analysis, identification of 'international relations' and 'energy' research discourse with the use of big data, and case studies of Germany, China, and Russia. The paper offers suggestions for revision of energy security concepts through integration of future technology considerations.

1. Introduction

Energy security is one of key parameters for assuring a stable development of countries and regions. Today energy demand has been growing faster than ever, particularly in the developing countries, making energy security is an integral part of national security. Energy security is also an important element and the source of interdependence in international relations (de Mattos Fagundes et al., 2016). There is a close interlink between energy policy (energy governance) and dominant ideologies through which groups of stakeholders debate key energy issues (Victor Valentine et al., 2017). This interlink has major implications in the event of energy transitions that reveal how energy systems function and how they may develop in the future (Tarasova, 2018).

Energy security, as perceived by international development organizations and national policies, often focus on fossil fuels, while neglecting energy equity and environmental sustainability (Moore, 2017). This is particularly a problem for the developing countries. Therefore integration of energy governance and energy security perspectives is required to understand and address the difficulties of a just energy transition in the context of the standard energy trilemma (Zaman and Brudermann, 2018). At the same time, energy policy should avoid excessive securitization of all energy issues (Leung et al., 2014).

Energy security issue emerged on the political agenda in the early 20th century (Benneer and Stavins, 2007a). However, energy security

concepts were included in the research discourse only in the 1960s. Further interest of researchers in this subject had a wave-like nature, following changes in the energy markets. In recent years the energy security concept has experienced a revival, with a renewed interest from researchers, managers and policy makers (Månsson et al., 2014).

The term 'energy security' has evolved accordingly. If in 1970s and 1980s the researchers gave the top priority to a stable supply of cheap oil, despite the restrictions and price manipulations of exporting countries (Hay, 2009). Some attention was given to the need for better management of energy enterprises, included state-owned (Chocklin, 1993), and for more effective management of energy technology (Coates, 1977). In the 2000s attention was paid to ensuring equal access of all social groups to safe energy sources and reducing negative impact of the energy sector on the environment (Cherp and Jewell, 2011) and climate (Nyman, 2018).

The approaches to energy security vary depending on a discipline in which this concept is used: the theoretical analysis of energy security can be found in both social sciences and liberal arts (in political science, international relations and economics), and in natural sciences (in math, physics) (Månsson et al., 2014). The social scientists usually focus their energy security research either on the analysis of international (geopolitical) relations and policy analysis (Kessler and Kessler, 2017) or on discursive and contextual dimensions of politics (Teräsväinen et al., 2011; Ciut and Klinke, 2010). A number of studies underline the interdisciplinary approach to energy security (Månsson, 2014;

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Cipollaro and Lomonaco, 2016).

The classic approach is to assess the four key parameters of energy resources: their availability, accessibility, affordability and acceptability (Wang et al., 2018a; Kruyt et al., 2009), of which availability and affordability seem to be more significant in terms of impact on other elements of energy security (Ren and Sovacool, 2014). The main energy security elements that are usually included in the definition of the term are resource nationalism (Childs, 2016), secure supplies of affordable energy resources, diversification of energy sources in the energy mix and through different suppliers, secure energy and fuel transportation (transit) and corresponding infrastructure, prospective geopolitical and market changes, and *threats that are caused by or have an impact on the energy supply chain* (Winzer, 2012). The traditional national security concepts today merge with more recent concepts of human rights and individual security, energy justice and sustainable development (Sovacool, 2016).

Dayer and Trombetta claim that energy security implies *continuous access to various forms of energy in sufficient quantity and at affordable prices* (Dyer and Trombetta, 2013). This definition is similar to the International Energy Agency's (IEA) long-term energy security understanding: *uninterrupted availability of energy sources at an affordable price*. The short-term IEA approach to energy security underlines *the ability of the energy system to react promptly to sudden changes in the supply-demand balance*. New research in energy security also takes account of environmental and social aspects (Energy Supply Security. O, 2014). Other researchers define energy security as *assuring citizens', state, societal and economic protection from energy shortages (deficit) and blackouts, provision of quality energy resources* (Senderov and Smirnova, 2012). A more compound and, at the same time, wider definition by Cherp and Jewell, states that energy security is *low vulnerability of vital energy systems* (Cherp and Jewell, 2011).

Markovska et al. argue that the top 10 energy security challenges are decarbonising the world economy; enhancing the energy efficiency and energy savings in buildings; advancing the energy technologies; moving towards energy systems based on variable renewables; electrifying the transport and some industrial processes; liberalizing and extending the energy markets; integrating energy sectors to Smart Energy Systems; making the cities and communities smart; diversifying the energy sources; and building more biorefineries (Markovska et al., 2016). There are other security concerns, including *terrorism or more mundane forms of crime, such as fraud, in management of nuclear waste* (Vander Beken et al., 2010), and nuclear power generation more generally. This positions energy security at the interlink of three perspectives: sovereignty, robustness, and resilience, of which the last one covers technology changes (Valdés Lucas et al., 2016).

These challenges listed above better reflect the relation between energy and security and should be better analyzed within energy security concepts (Johansson, 2013). Moreover, various aspects of global competition for energy resources, wide application of renewables (García-Gusano and Iribarren, 2018), interdependence of the economies and energy systems (infrastructure), climate change (Wang et al., 2018b) and environment impact issues, as well as technological innovations (Victor Valentine et al., 2017) in the energy sector are also considered in the studies on the topic.

Many researchers admit that the existing multiple understandings of energy security and underlying concepts are rather vague and contradictory (Sovacool, 2011; Chester, 2010). There are several obstacles that prevent the formulation of a single universal approach to energy security, as each country or non-governmental actor has its own, subjective perception of the issue that may change with the evolution of social and other conditions (Valentine, 2011; Escribano Francés et al., 2013). Governments and organizations may choose the energy security concept that justifies their policy and actions (Korin and Luft, 2009), which leads to the manipulation with the term. In this interpretation energy security can be compared to Rorschach inkblot test: you see what you want to see (Sovacool, 2011). Due to a number of problems in

the approach and understanding of energy security, energy security policy and energy security management also remain an under-researched subject (Radovanović et al., 2018). This makes researchers call for reconceptualizing the process and practice of energy policy itself (Victor Valentine et al., 2017).

Despite the relatively high number of publications on energy security, there are a number of remaining research gaps. First, more future research is required to *link the de-coupled areas of energy security, access and climate change* (Goldthau, 2011). Second, many previous studies rely on one-sided definitions of energy security focused on particular technical and economic aspects, while overlooking social and political elements such as good governance. Moreover, many energy security publications focus only on a particular sector, an individual state, or a specific technology (Sovacool, 2013). Unlike earlier studies this paper is not devoted to energy security of particular countries (Zeng et al., 2017) and regions (Chalvatzis and Ioannidis, 2017), is not focused on particular energy segment (Nyman, 2017) or a single energy security concept (Bompard et al., 2017). This paper focuses on the theoretical approaches to energy security from the perspective of International Relations theory and offers outcomes that may be applied to any country and the entire industry within the realms of the four key energy security concepts.

Although there are many publications on energy security, most of them relate to the analysis of particular countries, inter-country relations, regional and global energy security difficulties. Very few studies attempt to conceptualize energy security, analyze this phenomenon through the prism of key energy security concepts, and none attempt to revisit those concepts in a comprehensive manner in the light of new developments in the energy industry. The paper aims to bring more clarity to a *dizzying variety of fragmented and contradictory interpretations of energy security in scholarly and policy literature* (Tarasova, 2018) by examining and revisiting the four major theoretical approaches developed in the realm of International Relations theory (Victor Valentine et al., 2017). The hypothesis is that energy security concepts are based on outdated security paradigms and do not reflect the meaningful energy trends that have surfaced over the last three decades (Brown et al., 2014). As energy theories have their practical application, i.e. are used in international, national and corporate energy management and policy-making, neglecting the latest developments involves high costs (Kessler and Kessler, 2017). Moreover, the transformations of energy security may transform the international system itself (Nyman, 2017).

2. Methods

The methods of this study include comparative analysis of the major energy security concepts in international relations that was performed through an integrative literature review for a mature topic – ‘energy security’, followed by critique and reconceptualization based on the expanding knowledge base of energy systems and energy industry and a more diversified understanding of the concept (Torraco, 2005).

The theoretical groundwork publications, mainly books, were selected for analysis of key energy security concepts in International Relations theory. Further, the analyses was limited to the contemporary debate related to energy security theory. To this end, only research and review articles, books chapters, encyclopedia and editorials published in 2000–2018 were chosen through ScienceDirect, Web of Science (through big data algorithms), and Google Scholar using keywords listed in Annex 1, Table 1. Of all ScienceDirect research and review articles and editorials on international relations 535 containing ‘energy security’ as keywords were selected. Based on analysis of these publications, four energy security concepts were chosen: neorealism, neoliberalism, political economy and constructivism (Victor Valentine et al., 2017; Mohapatra, 2017; Keohane, 1984).

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