



Original research article

A state of fracking: Building Poland's national innovation capacity for shale gas



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ARTICLE INFO

Article history:

Received 23 June 2016

Received in revised form 5 November 2016

Accepted 7 November 2016

Available online 21 November 2016

Keywords:

Innovation

Governance

Renewable energy

Shale gas

Energy transitions

ABSTRACT

Innovation in energy technology is framed as having the potential to advance renewable energy technologies (RET) towards an environmentally and technologically sustainable energy system. Innovation, however, involves more than RET. New energy technologies include fossil fuels which contribute to a country's 'innovativeness.' The ability of states to foster innovation rests on their regulatory capacity, social acceptability and underlying ecological perspective. In this article a theory of state innovation builds upon National Innovation Capacity (NIC), bringing together state regulatory capacity and the ec sophistication of society to determine acceptable energy technologies. To frame this investigation, a case study is developed about Poland's attempt to foster a shale gas industry. Poland is chosen as a case study due to its low ranking for innovation, weak RET deployment plans, and use of coal as a primary energy source; it is a 'low achiever' on a comparative basis of states with limited innovation capacity. Poland provides two lessons in relation to state innovation: a) Institutional and regulatory action is underpinned by ecological choices made by society influencing institutional and technology preferences; and b) technology cannot simply be bought and imported, but instead needs to be integrated into an existing NIC and a conducive regulatory system.

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1. Introduction: national innovation capacity of Poland

Innovation and progress in energy technology is often framed as having the potential to advance renewable energy technologies (RET) towards an environmentally and technologically sustainable energy system [1–4]. However, technological innovation in the energy sector is not strictly limited to renewables, and the advancement of fossil fuel technologies can also contribute to a country's 'innovativeness.' As the process of innovation comes before technology deployment, consideration should be given to all types of energy technologies and their potential for improving a country's national innovation capacity (NIC) [5–7], rather than framing fossil fuels as purely part of the entrenchment of technology. The findings of the research described in this paper explicitly contradict the assumption that RET development can be associated with the presence of a more innovative state [4], or that green technologies are the only challengers to traditional fossil fuels [2]. But, just as technology 'stretches' or 'fits and conforms' to national settings [2], state institutions and society are pliable with regard to the implementation of new energy technologies.

The contribution of this research is to expose the regulatory adjustments a state makes to match both its NIC and its objective of fostering the uptake of new energy technologies. Building on theories of state innovation, the results highlight the necessity for institutional cooperation and the translation of social and environmental perspectives into incentives to foster new energy technologies [6,3,4]. National innovation capacity (NIC) is extended beyond an expression of patent ratios [5,7] to encompass the broader quantitative and qualitative assessments that drive NIC in relation to environmental and socio-political choices. Such an exercise assists in understanding why countries choose fossil fuel energy technologies justifying the decision that the "immediate benefits of low-carbon energy services may not be apparent to consumers, and the cost may be higher than for conventional energy" (Lamy and Lowe in [8] p. 5). Many countries choose fossil fuels to power their future [9] p. 5, and it is important to establish both the underlying motivation for this, and the nature of the internal state reorganization processes associated with the decision.

Poland provides a relevant case study for the exploration of this situation due to its low innovation ranking [10] and RET deployment plans [11], in addition to the country's strategy of maintaining coal as the primary energy source. Poland attempted to jump-start shale gas development by deploying the type of incentives

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and state restructuring processes normally used to encourage RET. Despite these efforts, no new hydraulically fractured wells have been completed since 2014. In 2012, there were 115 active exploration concessions and 84 others had been returned to the state, shrinking the total area under exploration from 30% of Poland's territory to 7.8% [12]. Meanwhile, at the time of writing in 2016, Polish energy and innovation policy appears to have shifted away from the use of shale gas to the pursuit of coal technologies, such as gasification and liquefaction [13]. Regardless of the lack of success, much can be learned from the Polish experience with reforming the state to foster innovation for a new technology. Poland is classified as low in innovation capacity and environmental awareness, requiring imports of energy technologies, rather than deploying domestically fostered technologies [4]. Findings indicate that significant institutional and societal transformation still needs to occur in order for imported energy technology to be integrated into the domestic system.

This article examines the interaction between innovation and the state in the following manner: The following section justifies the use of Poland as a case study and frames the necessity of exploring NICs. The third section develops and applies the theoretical concepts to state innovation and social influences on energy technologies, and also defines the importance of institutional and social pliability. The fourth section contains a case study about Poland's attempt to develop its shale gas industry, while the fifth section specifies how energy technologies are deployed based on the NIC and environmental awareness of a country. The article concludes that using fossil fuel technology does not imply the existence of a perilous environment for innovation, but that energy technology – regardless of the natural resources being consumed – requires making changes in institutional practices that correspond to the technology requirements and social ecological values.

2. Background: the state of fracking in Poland

The attempt to locate the story of Polish shale gas within the theoretical considerations of innovation fits with the numerous calls to create better understanding of state innovation processes. This article sheds light on internal state efforts, thereby addressing the “shortage of systemic empirical analysis of governance arrangements and how they affect the innovation process” [14] p. 404, including the necessity of exploring niche development by analyzing the activities of advocates and the strategies used to deploy “path-breaking innovations” [2] p. 1034. Drawing these efforts together creates a study of societies' involvement in energy systems, including the “rise of hydraulic fracturing technologies for oil and gas extraction” and technology's relationship to society [15] p. 30. As is evident from the US context, hydraulic fracturing technology is a disruptive innovation that reflects decades of changes in policy development, private effort, and property rights [16]. Exporting this technology may require that the receiving state has significant innovation capacity. Two related outcomes for Poland are supported by the technology diffusion literature: 1) Technology diffusion will enable Poland's NIC to build a domestic industry without the initially high costs incurred by US, thereby shifting Poland from being an importer of technology to an exporter, similar to Portugal's experience with wind power [17]; or 2) the import of technologies and regulation will increase the probability of policy transfer failure [18], regardless of the level of Foreign Direct Investment (FDI) [19] aimed at policy and technology transfer. The successful integration of foreign technology is based on the regulation and action of state institutions and reflects the political, social and environmental justification for integration. By focusing on examining the actions and processes of the Polish state, a richer picture emerges to inform theories about state innovation.

Only Poland and the United Kingdom (excluding Scotland) among European Member States encourage shale gas extraction, restricting the number of sites which may be examined to understand how state innovation works in relation to the import of hydraulic fracturing technology into Europe. Shale gas deposits are found across Europe, with the largest potential reserves in France and Poland. France maintains a ban on exploration, as does Austria, while Poland displayed the most promising signs of creating a profitable environment for shale gas in 2013 [20] p. 101, 108. Countries with a strong legal basis for supporting hydraulic fracturing include France, Germany, Sweden [21] and the UK. In 2016, Germany banned the extraction of shale gas [22]. In Europe, this leaves only the governments of Poland and the UK, minus Scotland, as consistent supporters of shale gas—despite changes in political leadership. The UK already excels at innovation and has strong environmental awareness, making it a favorable setting for RETs; it also already possesses an effective NIC. In contrast, Poland has ‘low achiever’ status with limited innovation capacity and long timeframes for deployment of new energy technologies [23,24,4]. Poland is fighting against historical trends by importing hydraulic fracturing techniques and building up its own NIC, along with attempting to build a nurturing regulatory and investment environment. The focus of this article is on the state innovation processes of low-achieving countries, therefore Poland provides the backdrop.

The analysis of this quest for shale gas in Poland draws on existing literature, the present author's publication contributions [25];[26] forthcoming, original research involving 27 interviews in Poland, material from energy-related conferences in Poland, and secondary sources. This previous work and the experience derived from it inform the analysis which is designed to contextualize the events and processes in the field of energy technology innovation for the reasons outlined above. In terms of methods, the article does not attempt to explicitly justify the interviewee selection process or the process of collecting secondary data or its analysis, but interview data is employed. Other related publications [25];[26] forthcoming address similar empirical and methodological issues; the focus here is innovation capacity in Poland. Complimentary literature provides greater perspective about Polish environmental opposition [27], geological and legal technicalities [28,11,29–32], hydraulic fracturing as an innovative technology [16,33,34], and the existence of multiple policy narratives in Eastern Europe [35]. Accordingly, this article makes no attempt to comprehensively explain the Polish shale gas story.

The American innovation of hydraulic fracturing and attempts to export this technology provide lessons about technology diffusion [17,19] and state reform. The significant production of domestic US oil and gas from hydraulic fracturing technology has impacted the domestic market and, through exports to Europe, sent geopolitical signals [36]. In 2015, Fifty-two percent of US crude oil production came from tight oil resources (shale-like formations) [37] which use hydraulic fracturing to extract oil and gas. Outside of North America, the technology itself does not contribute to any measurable degree to economic development, but it is prompting an examination of governance processes [38,25,39]. Rather than directly engaging with the governance literature regarding shale gas, this article contributes to the literature on state innovation processes within the energy sector [5,24,2–4], by specifically challenging the assumption that state innovation support can only be applied to renewable energy technologies. Rather than assuming “more renewable energy technology/product specific support may be very important to enhance industry growth” [40] p. 54, this paper proposes that promoting fossil fuel technology is one way that governments can contribute to NIC and industrial competitiveness.

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