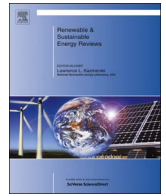




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Cultural factors of sustainable energy development: A case study of geothermal energy in Iceland and Japan

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ABSTRACT

Energy is important for sustainable development, yet multidimensional challenges exist for policy makers in transformations to sustainable energy systems. Sustainable development is generally recognised as having a three-lens approach: development must balance impacts in the economic, environmental and cultural dimensions. While cultural themes such as governance, motivation, and social values are widely acknowledged in the literature as critical for transformations to sustainability, however, research on these themes has been scant. Culture influences many aspects of society; hence it is important to consider culture when developing policies for sustainable development. Understanding national cultures can lead to greater understanding of what shapes national policy and strategies for transformations to sustainable energy systems. Understanding cultural influences on policy can help other countries to overcome similar challenges in policy making, planning or local resource management. Comparisons between countries serve to further advance the understanding of approaches to such challenges. This paper examines transformations towards sustainable energy through the lens of culture, through a case study of geothermal development in Iceland and Japan. Using Hofstede's cultural theory framework, we highlight cultural variables relevant to sustainability transformations, with particular emphasis on the challenges of the management of geothermal energy resources, and the management of related conflicts and public participation. We present our findings garnered from interviews with key players in the energy industry in both countries reinforced by an extensive literature review. We find that culture clearly influences the approach to geothermal energy development in both countries and we identify benefits and disadvantages to approaches on overlapping issues and challenges in both countries.

1. Introduction

Energy is one of most critical components of sustainable socio-economic development. National and international government bodies face significant challenges in energy policy-making and transformations to sustainable energy use. Transformations to sustainability require a shift in the organization of society so that existing social patterns are re-evaluated and reconfigured -this will only be achieved by generating useful knowledge and experiences that can be applied in local settings. Therefore, a critical challenge in designing and implementing transformations to sustainable energy systems is to assemble and evaluate cases in different regions, taking into account such factors as geographical location, levels of technology, economic conditions, and cultural influences. While previous studies have examined economic, technical, and geographical factors there have been few studies examining how cultural characteristics influence transformations to

sustainable energy systems [57].

Cultural characteristics can be defined as socially constructed phenomena resulting in collective meanings in a shared social environment. Common cultural characteristics within a nation, including perception of identity, values, and history can be defined as embodying a national culture [9,16]. Cultural factors are deeply rooted in a society, are slow to change, and determine the behaviour of individuals and groups towards risk, conflict resolution, and the social and institutional capacity for sustainable transformations [11,42,43,54,17]. A deep understanding of a nation's cultural characteristics can strengthen the overall understanding of the underlying dynamics shaping a country's policies, governance systems, and transformation strategies for sustainable energy systems. The determination of the cultural suitability of these policies in other regional contexts may help other countries to overcome their own similar challenges.

Geothermal energy is regarded as an important component of

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transformations for sustainable energy systems in tectonically active countries such as Japan and Iceland; both countries have geothermal resources and many years of experience of geothermal development. Energy security is a global concern in these days of dwindling fossil reserves and growing energy demand [22]. In this avenue, geothermal energy has been identified by the international community as playing an important part in the transformation to sustainable energy systems. As well as having relatively low carbon emissions [7], it is an indigenous resource and hence can contribute to a nation's energy security. It is even more attractive when its low leveled cost [29], high capacity factor, reliability [51] and flexibility [30] are taken into account. Research suggests that by 2050, geothermal electricity generation could supply around 3.5% of global electricity production, thus avoiding almost 800 megatonnes (Mt) of CO₂ emissions per year. Furthermore, geothermal sources could contribute up to 3.9% of energy for heat by 2050 [21]. Japan and Iceland are among the top producers of geothermal energy for heat and electricity in the world. In 2015, the USA had the highest installed capacity for geothermal electricity generation with 3450 MW, with Iceland in 7th place with 665 MW and Japan in 9th place with 519 MW [4].

Culture, commonly seen as part of the social dimension, one of the three pillars advanced in the sustainability discourse, or even a pillar in its own right [52] has received less attention in the literature and has been less clearly defined [10,35]. Despite its evasiveness, culture is critical in understanding the development and consumption of energy resources, especially where events do not clearly fall in line with classical economic or efficient resource usage models [55]. Furthermore, sustainability assessments of energy technologies often fail to account for social or cultural impacts and the long-term repercussions of energy systems development. While economic and ecological sustainability assessments of energy systems are common, little social research has been carried out on the topic [6]. Whilst such aspects may be difficult to define, it does not mean that they are less important, or should not be measured [8].

This paper focuses on the cultural dimensions of transformations to sustainability. Specifically, based on semi-structured interviews, examination of policy reports, and a comprehensive literature review this paper examines geothermal energy developments in Japan and Iceland through the lens of Hofstede's cultural framework. Towards this end, this paper attempts to first determine the main challenges faced by policy-makers with regard to the sustainable development of geothermal energy resources and second examine the extent to which national culture or other factors shape geothermal energy policy in Japan and Iceland. This paper is organized as follows: Section 2 introduces Hofstede's cultural framework. Section 3 provides the background of geothermal energy development in Japan and Iceland. Section 4 describes the methods used to identify challenges to sustainable geothermal energy development in both countries. Section 5 elaborates on the identified challenges and provides a discussion of cultural and other factors influencing the policy approaches to these challenges as well as recommendations. A conclusion follows in Section 6.

2. Hofstede's cultural framework

Cultural context is taken into account in Hofstede et al.'s [16] cultural dimensions theory as a basis for comparison and understanding. Hofstede's framework uses six dimensions to compare cultures, by assigning scores for each dimension. These dimensions consist of power distance, individualism, masculinity, uncertainty avoidance, long-term orientation and indulgence [16]. This theory, using a structure derived from factor analysis, helps to describe or predict the effects of a society's culture on, among other things, decision-making behaviour. This framework has been used to compare countries based on key characteristics. For instance, examining the affect of culture on emissions [11]. The theory has proven to be accurate and useful when carrying out comparisons of policies and

strategies in international business [31] and in various other sectors, such as transportation [53], tourism [25] or health [5]. It has also been shown to be accurate in predicting communication styles [32] and the capacity to innovate [59] in different countries. Comparisons such as these allow greater understanding of country approaches to various issues, such as policy making, planning and local resource management.

Uncertainty Avoidance refers to the way a society deals with the unknowable future and how comfortable it feels with uncertainty and ambiguity. Countries exhibiting strong uncertainty avoidance will tend to maintain strict formal rules affecting life and decision-making and are less open to unorthodox behaviour, or new technologies [48], whereas those with weak uncertainty avoidance tend to have a more relaxed attitude in which practice counts more than principles.

Long-Term Orientation describes how a society manages its connection to the past while also attempting to deal with present and future challenges. Societies with low long-term orientation are said to be "normative" in that they prefer to maintain time-honoured traditions and norms while viewing societal change with suspicion. Cultures with high scores, have a greater tendency to prepare for the future for instance by investing in education or by saving.

Indulgence refers to the extent to which people try to control their desires and impulses. In a society with high indulgence, people have a tendency toward a relatively weak control over their impulses and such societies place a high emphasis on enjoying life and having fun, whereas in cultures of restraint, people have a relatively strong control over their urges. Such cultures will establish strict social norms in order to suppress gratification of needs.

Power Distance expresses the attitude of a culture towards inequalities in society. Power Distance is defined as the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally. In societies with high power distance, people will have greater respect for superiors or elders, whereas in societies with low power distance, people will tend to take decisions more independently.

Individualism refers to the degree of interdependence a society maintains among its members and how much people are motivated by norms and duties imposed on the whole group. In Individualist societies people are expected to look after themselves and their direct family only. In Collectivist societies, people belong to groups that take care of them in exchange for loyalty.

Masculinity refers to how much societies will be driven by competition, achievement and success, with success being defined as being the best in ones field with material rewards for success. "Feminine" societies have dominant values of caring for others and quality of life. Collaboration and consensus are seen as important for decision-making. A Feminine society is one where quality of life is the sign of success and standing out from the crowd is not admirable.

3. Country backgrounds: culture and geothermal energy

Japan and Iceland are island nations, in many ways vastly different, but sharing several common characteristics. Both are prosperous nations possessing abundant geothermal resources, many of which are within or adjacent to important national parks that draw many tourists. Japan's current energy policy centres around providing reliable, secure, local energy which must also be environmentally friendly, cost effective and where possible, renewable. Since the Fukushima nuclear accident in 2011, the government decided to deactivate nuclear reactors around the country and serious thought was given to the future of the country's energy security. Japan is therefore in urgent need of new alternatives to fossil and nuclear energy since the country does not possess such resources. Iceland's culture of independence and approach to social welfare has meant that in recent decades, energy security has been good. Indigenous energy sources like geothermal and hydropower have been harnessed to

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