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Exploring the Social Dimension of Sustainability within the Geothermal Sector in Iceland: A Preliminary Investigation

Fe Amor Parel Gudmundsson and Sveinn Agnarsson

School of Business, University of Iceland, 101 Reykjavik, Iceland

fap4@hi.is

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ABSTRACT

This paper is a preliminary investigation of the social dimension of sustainability with special emphasize on geothermal energy in Iceland. It is relevant to conduct this study due to the limited research on social sustainability, specifically in the geothermal sector. The inquiry will cover three criteria: communication, socio-economic and social acceptance. These three criteria are essential to explore the current social impact of utilizing geothermal energy. The primary objective of this paper is to provide insights to conduct a further in-depth investigation of the three criteria.

1. INTRODUCTION

In the last half-century, it has become abundantly clear that the globe is getting warmer. The Intergovernmental Panel on Climate Change (IPCC), set up by the World Meteorological Organisation (WHO) in 1988, has to date published five reports with the last one stating that the ´´Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia´´ (IPCC, 2014,p.4). The United Nations Framework Convention on Climate Change (UNFCCC) entered into force in 1994. The accord, though, did not include binding commitments on reduced greenhouse gas emissions, but such aims were set in the Kyoto Accord of 1995 which came into effect in 2005 and were then extended with the Paris Agreement of 2015 that came into effect a year later. So far, 183 of the 197 parties to the Paris Agreement have ratified the agreement, including Iceland (United Nations, 2018). Members of the Paris Agreement promised to reduce their carbon output and to do their best to keep global warming in the 21st century to well below 2 °C. Iceland has initially pledged to reduce emissions so that net emissions in 2030 will be 40% lower than in 1990. Recently, the new action plan of the Icelandic Government sets Iceland the goal of becoming a carbon-neutral country before 2040 (Government Offices of Iceland, 2018).

For climate change mitigation, energy is a vital component of sustainability goals (United Nations, 1987). It is in this regard that many economies are shifting their focus to clean energy and calls for the urgency of policy change to accelerate alternative energy development (Stern, 2010). The road to sustainable development in the energy sector is both highly complex and fraught with uncertainties including decarbonization of the energy system that resulted in utilizing alternative energy sources which have increased rapidly in the past two decades (Li, Bao, Xiu, Zhang, & Xu, 2010).

Geothermal energy is considered to be sustainable alternative energy (Tester, Drake, Golay, Driscoll, & Peters, 2005). The direct applications of geothermal heat include geothermal heat pumps, space heating, greenhouse heating, aquaculture pond heating, agriculture drying, industrial uses, bathing and swimming, and colling/snow melting — the direct use of geothermal energy experienced in over 82 countries from six regions: Africa, Americas, Asia, Commonwealth of-of Independent States, Europe and Oceania (Lund & Boyd, 2016). Accessibility and sufficient reservoir productivity are two requirements for geothermal resources viability (Tester et al., 2005).

Iceland is strategically located in a geographical abundance for the geothermal resource, and it is one of the worldwide leaders in the direct utilization of geothermal energy, with 6.26 MWt (Lund & Boyd, 2016). Iceland has seven geothermal power plants with a total of, approximately, 707 MW installed capacity in 2017, see Table 1. These power plants are owned by the three big players in the energy market in Iceland. Theistareykir is the first geothermal power plant that is owned by Landsvirkjun, from the concept of the project to commissioning the power plant while Bjarnarflag and Krafla were purchased from other energy companies. Theistareykir is a 90MW power plant and has initially commissioned the 45MW plant in 2017. For electricity production in Iceland, ON Power has the largest combined installed capacity from its two power plants, Hellisheiði and Nesjavellir. Moreover, Hellisheiði is the largest geothermal power plant in the world in terms of installed capacity. On the other hand, Svartsengi, owned by HS Orka, is one of the oldest power plants which is located in the vicinity of five municipalities in Iceland.

Table 1 List of Geothermal Power Plants in Iceland (Orkustofnun, 2018)

Geothermal Power Plants	Installed Capacity (MW) Electricity Production	Production Capacity (MW) Heat	Owner	Date of Commissioned
Gufustöðin / Bjarnarflag	3.2		Landsvirkjun	1969
Hellisheiði	303	133	ON Power	2006
Krafla	60		Landsvirkjun	1978
Nesjavellir	120	300	ON Power	1990
Reykjanes	100	-	HS Orka	2006
Svartsengi	76	190	HS Orka	1977
Theistareykir	45		Landsvirkjun	2017

The acceleration of geothermal energy utilization in Iceland is a combined effort of the Icelandic government, energy companies and research and educational institutions. In recent years, several Icelandic studies have been undertaken on energy system modeling which has primarily focused on transportation and industries (Fazeli & Davidsdottir, 2017), (Shafiei, Davidsdottir, Leaver, Stefansson, & Asgeirsson, 2015), (Guðmundsson, 2017). Other recent projects are responding to the challenge of incorporating the influence of key stakeholders to energy development decision-making (Shortall, Davidsdottir, & Axelsson, 2015), (Cook, Davíðsdóttir, & Kristófersson, 2018).

Given increasing energy demand, Shortall et al. (2015) argue that the contribution of geothermal resource to the sustainable energy system lies in the utilization of the resource and its significant impacts. The authors lay a foundation for sustainability assessment (SA) framework for geothermal energy developments highlighting the environmental, social and economic effects.

The work for this research project advances the work of Shortall et al. (2015) by (1) conducting a preliminary investigation on the three criteria (communication, socio-economic, social acceptance) which are essential for the Operation/Maintenance (O&M) phase of the geothermal projects, and subsequently (2) conducting a thorough study on the chosen criteria. The selection of the three criteria is based on the social dimension for geothermal energy development by Shortall et al., (2015) and the development of the Geothermal Sustainability Assessment Protocol in Iceland.

The Geothermal Sustainability Assessment Protocol (GSAP) was developed as a partnership project of Landsvirkjun, Reykjavik Energy, HS Orka, and the Icelandic Environment Agency. The GSAP is based on the sustainability protocol for hydropower (International Hydropower Association Sustainability Assessment Protocol – IHA-SAP) which Iceland is a part of the development of the protocol. The new GSAP has been initially tested on two geothermal power plants in Iceland, Theistareykir and Hellisheiði. The first assessment was conducted during the pre-commissioning of Theistareykir geothermal power plant in 2017. There were challenges experienced in the evaluation since the project is still under construction during the time of assessment (Hartmann, 2017). On the other hand, the second assessment was carried out on the Hellisheiði Geothermal Power Plant which had been commissioned for over ten years. The evaluation was more satisfactory than the first one due to the sufficient amount of documents and the participation of both internal and external stakeholders (Hartmann, 2018). The primary objective of GSAP is to examine how the application of a sustainability protocol could be useful for the geothermal industry (Hartmann, 2018).

2. LITERATURE REVIEW

Social sustainability may be referred to as meeting people´s need and expectation (Vallance, Perkins, & Dixon, 2011). It is an important pillar for sustainable development, yet it is the most challenging dimension to be studied and some studies rarely focused at all on this (Dempsey, Bramley, Power, & Brown, 2011; Boström, 2012; White & Lee, 2009).

This section will draw significant attention to the three criteria: communication, socio-economic and social acceptance which are vital to explore the social sustainability of geothermal energy.

2.1 Communication

In the complexity of the nature of sustainability, communication is fundamental in the pursuit of reaching sustainable development goals (Genç, 2017). The importance of sustainability communication is observed in various sectors such as educational institutions (Kim, Sadatsafavi, Medal, & Ostergren, 2018), tourism (Tölkes, 2018), agriculture and food system (El Bilali & Allahyari, 2018) and fashion (Arrigo, 2018).

In the recent sustainability assessment (SA) of geothermal power plants in Iceland, communication was used as one of the criteria (Hartmann, 2017; Hartmann, 2018). It captures, mainly, how energy companies engage with relevant stakeholders by itemizing the communication tools used by energy companies. For the effectiveness of SA, Nawaz and Koç (2018) recommended that SA should be analyzed and communicated to the stakeholders through the creation and implementation of sustainability initiatives. The establishment of such initiatives allows stakeholders involved in the assessment process, which is vital in the development of the criteria (Sala, Ciuffo, & Nijkamp, 2015). However, the valuable formation of SI depends on the internal management of sustainability that is translated into effective sustainability communication (von Kutzschenbach & Brønn, 2006). Sustainability assessment includes strategic focus (Nawaz & Koç, 2018) in which energy companies have to integrate sustainability into their strategic planning. Calabrese, Costa, Levialdi, and Menichini (2018) identified the incorporation of sustainability into business strategy as beneficial for long-term societal impact. However, Mahoney, Thorne, Cecil, and LaGore (2013) identified that managers tend to balance the negative social perception of the firm´s sustainability performance by enhancing sustainability communications. The research

findings of Stacchezzini, Melloni, and Lai (2016) on the role of integrated reporting for communicating corporate sustainability management conform to the claim of Mahoney et al. (2013). Failure to disclose to relevant stakeholders can result in opposition by the local community (Pellizzone, Allansdottir, De Franco, Muttoni, & Manzella, 2017). In this light, social acceptance is an essential criterion for SA.

2.2 Social Acceptance

The social acceptance framework of Wüstenhagen, Wolsink, & Bürer (2007) which is composed of three dimensions (socio-political acceptance, community acceptance, and market acceptance) are less explored in the literature than the updated framework of Upham, Oltra, and Boso (2015) (Gaede & Rowlands, 2018). According to Wüstenhagen et al. (2007), the overall social acceptance of energy development depends on the distinction between the three dimensions. On the other hand, Upham et al. (2015) introduced the three levels (macro, meso, and micro) to analyzed social acceptance with three underlying components (public acceptance, stakeholder acceptance and political acceptance) and emphasizing that acceptance includes beliefs and feelings (cognition and affect). The latter integrated the work of the former into their newly developed framework for social acceptance and highlighted the distinction between three levels of social acceptance emphasizing the context of recognition by each level, precisely that of the energy technology.

In the geothermal sector, the lack of appropriate communication and awareness of geothermal energy to relevant stakeholders resulted in negative community reactions and perceptions (Dowd, Boughen, Ashworth, & Carr-Cornish, 2011). The study findings of Çetiner, Ertekin, and Gültay (2016) on the initial assessment of public perception and acceptance of geothermal energy applications identified that though geothermal is widely accepted energy resource in Turkey, it earned roughly the same level of acceptance. Those findings are echoed in the study of Vargas Payera (2018) in which the authors distinguished that a low level of understanding of the technology affects public perception. The findings of Cetiner et al. (2016) and Vargas Payera (2018) are in line with the claim of Stoutenborough and Vedlitz (2016) that there is a need to increase technological awareness to be able to gain positive public perception. However, acceptance is still a concern in the geothermal sector even in the light of how well the technology is perceived. Batel, Devine-Wright, and Tangeland (2013) suggested exploring more on the relationship between people and technology. Since geothermal energy is associated with force when it comes to social acceptance (Kunze & Hertel, 2017), it is crucial to focus on the meaning of a particular technology to the local community.

Furthermore, one essential aspect of investigating social acceptance further is the socio-economic status (Dowd et al., 2011). The next section briefly explores the literature on the socio-economic criteria of the social dimension of sustainability.

2.3 Socio-economic

The determination on how best to measure the socio-economic impact of renewable energy utilization is a continuous discourse in the literature. The importance of investigating the socio-economic benefits of renewable energy is to provide a scenario relating to one dimension of sustainability and should not be treated as the mere solution for decisions (Lambert & Silva, 2012).

The study of Llera Sastresa, Usón, Bribián and Scarpellini (2010) illustrates the fundamental characteristics of job creation through the phases of project development. These characteristics are identified in three phases (P): technological development (P1), Installation/uninstallation (P2); and operation and maintenance (P3). The authors suggested to simplify a strategy on analyzing the quality of employment on each stage and recommended that primary data through the extensive survey are more reliable when conducting a study on the local impact of renewable energy on employment. Pahle, Pachauri, and Steinbacher (2016) asserted that deployment stages (P1 and P2) only generates short-term socio-economic benefits. Long-term social benefits (P3) are mostly the objectives of power plant companies (Manzella et al., 2018).

Moreover, Lambert and Silva (2012) emphasized that input-output (I-O)model is an appropriate method to use when analyzing the impact of renewable energy on employment on a national or international level, but the authors further pointed out that job ratios should not be mistaken for job creations. Due to the limited studies of the socio-economic impact of geothermal energy, it is difficult to provide in-depth insights on the topic other than looking into the broader aspect (renewable energy) (Manzella et al., 2018).

3. DISCUSSION

As geothermal energy is an essential technology (Pellizzone et al., 2017), it is crucial to understand how to delegate scientific knowledge to relevant stakeholders, with regards to the impact of the exploitation of geothermal. In the preliminary review of related literature and a brief investigation of the geothermal sector in Iceland, the three criteria (communication, social acceptance and socio-economic) of social dimension are identified as three important underlying pillars for geothermal development. The examination of these criteria varies in the different phases of geothermal project development and the different levels of actors in the sector.

Energy companies play a vital role in the Sustainable Development Goals, more importantly in energy production. Sustainability is identified as a critical factor in organizational operations. However, the incorporation of sustainability into corporate strategy is not well explored in the energy sector, especially in the geothermal arena. In light of this new evidence, it is vital to conduct an in-depth investigation on the internal environment of energy companies in Iceland, with regards to the current status of how important sustainability is in their operations and how they communicate their sustainability initiatives and practices with relevant stakeholders. What are the challenges of doing such integration?

Furthermore, Dowd et al. (2011) highlighted the link between communication and social acceptance, negative or positive. Clear communication provides a better understanding to those people who are directly or indirectly impacted by geothermal projects. Also, effective communication will more likely create a positive acceptance even with a negative perception. But communication, also, depends on the strategy of companies. How energy company, which is, let´s say, more than three decades in the business, disrupt the status quo of doing things? How people within a company react to the transition to reach sustainability goals? How energy companies integrate sustainability into their operations? These are a just few questions raised when it comes to establishing a good rapport of energy companies to convey their sustainability agenda to respective stakeholders. Effective communication, therefore, cannot be underestimated when companies aimed at a long-term relationship with the local community.

The literature discusses different levels of social acceptance. However, the experience of the local people is not well explored. Therefore, it is crucial to explore the ‘’lived experience’’ of the local people where the geothermal power plant is located. Lived experience is a unique approach. It is a personal life story of an individual about a phenomenon (Van Manen, 2016). Personal life story involves beliefs and feelings which are underlined by Upham et al. (2015). It is how local people perceived an existing geothermal project. Perhaps, asking the question, ‘’What is the meaning of geothermal energy to them?’’

Moreover, there are limited studies on the socio-economic impact of the geothermal sector in Iceland. A further study will be significant to the sector to assess its long-term social benefits. A focus can be on (1) the number and activity of successful firms utilizing geothermal, and (2) the number and quality of employment. The former look at companies which directly or indirectly utilizes geothermal energy in their operations. Information may include, year founded, type of company, turnover, number of employees (permanent/temporary), kind of business (product/service/IT, etc.), importance on the location of the geothermal resource, etc. While the latter is more on a survey, Llera Sastresa et al. (2010) proposed to use primary data in an industry-focused investigation on the impact of renewable energy on employment to reduce the complexity of the quality of employment as the literature shows more complex data analysis aiming at the national level. Primary data which is focused on the regional level is more likely valuable to the sector because it captures the quality of job created.

A further investigation of the three criteria responds to the need to explore the social dimension of sustainability for geothermal energy. The increasing geothermal energy utilization raises the concern of assessing social sustainability in addition to the environmental and economic impact.

Based on this preliminary investigation, the researcher aims to study further the three criteria explored in this paper taking Iceland as a case study. The impact of further investigation may contribute to the literature on social sustainability in geothermal energy utilization.

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