Energy Policy 112 (2018) 372–380

Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

What do local stakeholders think about the impacts of small hydroelectric plants? Using Q methodology to understand different perspectives

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ARTICLE INFO

Keywords:
Small hydroelectric plants
Local stakeholders
Impacts
Renewable energies
Q methodology

ABSTRACT

Researchers, politicians and investors are seeking to develop an agenda related to renewable energy technology and its greatest challenges and opportunities. The present study aims to analyze the perceptions of local stakeholders regarding the social, environmental and economic impacts of small hydroelectric plants. The use of Q Methodology revealed the existence of a range of perceptions among local stakeholders. Essentially, five groups with different perceptions were identified, namely: 'I'm critical', "I see regional benefits', 'I want more results', 'I want social well-being' and 'I weigh all sides'. The article recommends policy-makers should increase transparency and communication regarding the activities related to projects of this nature, in addition to emphasizing the need to review the policies that regulate the energy system.

1. Introduction

Today, finding solutions to the environmental problems faced by humanity is one of the challenges on the sustainable development agenda. Additional challenges involve the interaction of the environment with economic and social development, and the development of alternative energy systems. National renewable energy strategies are necessary to meet these challenges (Kousksou et al., 2015). While the use of renewable energy plays an essential role in the quest for sustainable development, there is uncertainty regarding the way such projects are perceived by the different stakeholders involved (Carrera and Mack, 2010; Chen et al., 2015).

Public reaction, coupled with the political interests of the stakeholders involved, is usually considered a key factor for the implementation – or otherwise – of a renewable energy project (Kaldellis et al., 2012). The perceived economic, environmental and energy impacts will, to a certain extent, determine whether a renewable energy project will be accepted (Stigka et al., 2014).

Del Río and Burguillo (2009) argue that most studies into the socioeconomic impacts and benefits of renewable energy projects, such as that conducted by Kousksou et al. (2015) which considered renewable energy at the national level, are very general. In the literature, there is a marked scarcity of studies that focus on regions, and more specifically the local communities directly affected by such projects. Local analyses are important because the impacts caused at the local level determine, fully or partially, the acceptance of renewable energy projects.

Considering the important role that renewable energy sources play in sustainable development and considering the key role played by local stakeholders in the implementation of such projects, this study aims to analyze the perception of such stakeholders regarding the environmental, social and economic impacts caused by small hydropower plants (SHPs).

Among the wide range of renewable energy sources, the present study has chosen to investigate SHPs for two main reasons. The first concerns the part played by water resources in the Brazilian energy matrix. While globally, the share of renewable energy does not surpass 14%, in Brazil it is 46%, with SHPs accounting for approximately 3.9% of the national hydro-electric matrix (Tiago Filho et al., 2011). The second concerns the argument that much greater circumspection is needed vis-a-vis SHPs than is currently being exercised (Abbasi and Abbasi, 2011). The authors believe that if pitfalls are foreseen before SHPs are put to widespread use, and suitable remedial measures are taken, considerable dissatisfaction and environmental damage can be avoided.

Using Q methodology, we identified five distinct perspectives reflecting local stakeholders´ perceptions regarding the impacts of SHPs. The perspectives were named according to the characteristics identified in each of them: (1) 'I am critical', (2) 'I see regional benefits', (3) 'I want more results', (4) 'I want social well-being' and (5) 'I weigh all sides'.

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http://dx.doi.org/10.1016/j.enpol.2017.10.029
Received 20 December 2016; Received in revised form 13 July 2017; Accepted 16 October 2017
Available online 05 November 2017
0301-4215/

The article is structured as follows. First, we review the literature regarding the role of energy in sustainable development, the stakeholders' perceptions and the impacts of renewable energy projects. Following this, we describe how we used Q methodology in our research. In Section 5 the data are presented and analyzed. We then present our results by describing the five perspectives. In the discussion section we highlight the key issues raised in those of perspectives. And, finally, in Section 8, we summarize the research contributions.

2. Energy and sustainable development

Sustainable development aims to achieve a balance between human needs and environmental integrity, a task made more difficult when resources are scarce (Wu, 2013). Inspired by the Brundtland Report, the term 'sustainability tripod' has been proposed to emphasize that economic activities have important social and environmental consequences and each organization must accept its share of responsibility (Elkington, 2004). In addition to the three dimensions of sustainability - social, environmental and economic, inspired by the Brundtland Report, Dincer and Rosen (2005) suggest another dimension: energy and resource sustainability. The authors point out that "renewable energy can play an essential role in sustainable development, in the search for solutions to the current problems involving ecology, economy and development." Energy is also considered the main generator of prosperity and a significant factor in economic development (Kalogirou, 2004).

A variety of natural resources found in the most diverse regions can be used as major sources of renewable and sustainable energy. Such sources are considered complementary in the energy mix policy (Hosseini et al., 2013; Tahseen and Karney, 2016). For Islam et al. (2014), hydroelectric power is one of the most promising sources of energy, since its source is regenerative and ecologically correct. This type of energy has an essential role in the search for clean and renewable sources of energy generation to satisfy a series of human needs (Omer, 2008). The management of water resources, including the provision of safe drinking water and sanitation, ecosystem conservation, disaster mitigation and risk management, has led to the recognition of the role of water as one of the most renewable and cleanest energy sources. Moreover, its potential should be seen as being environmentally sustainable and socially acceptable (Omer, 2008).

However, concern for the environmental and social dimensions related to hydroelectric plants implies more than considering the benefits alone, since the environmental and social integration of such projects is highly complex and possible negative impacts cannot be ignored (Pang et al., 2015). Those potential negative impacts include the disruption of sediment transportation, fish migration, downstream flows, and of estuaries (Abbasi and Abbasi, 2011). Understanding the views of the local community and ensuring people are unaffected should be considered goals in SHP projects, thus avoiding foreseeable impacts (Siciliano et al., 2015). The main criticism concerns the lack of comprehensive analyses of the effects of SHPs, which limits the opportunity, not only to recognize their potential impacts, but also to counter any perceived disregard for sustainable development (Pang et al., 2015; Zhang et al., 2016). The growing demand for energy and the need for lasting economic growth raise concerns about energy efficiency, which is a complex set of social interactions involving various stakeholders (Christopoulos et al., 2016). Given that organizations relate with a wide range of interest groups, there is a need to understand the stakeholders' perceptions of those impacts.

3. The Stakeholders' perspectives and the impacts of renewable energy projects

According to Steurer et al. (2005), sustainable development can be sought through various means, including the management of stakeholder relations. Therefore, it is necessary to identify the stakeholder groups in order to understand and manage their expectations (Mahmood and Humphrey, 2013). The prerequisites for cooperation among different stakeholder groups include cohesion, the elimination of personal interests, transparency of information and representation, such as through the participation of all the stakeholders in the decision-making process (Zoellner et al., 2008). Decisions related to the use of natural resources may undermine the social well-being of a region if the results are perceived as unfair (Gross, 2007). Therefore, by developing a means of representing the perspectives of the stakeholders it should be possible to broaden these issues, facilitating discussion and supporting critical reflection regarding the rationale behind each position (Raadgever et al., 2008).

Wüstenhagen et al. (2007) pointed out that social acceptance has three interdependent dimensions: (a) socio-political acceptance, which is influenced by technological and political aspects, public opinion, key stakeholders and legislators; (b) market acceptance, influenced by consumer adherence, by investors (and also by consumers as investors), and by the internal aspects of organizations related to the allocation of investments in new technologies and political influence, and (c) community acceptance, which is influenced by how local stakeholders (residents and local authorities) perceive issues related to procedural justice, distributive justice, and trust. At the same time as public and private entities involved in the energy sector are invited to develop sustainable, economically vital and socially acceptable technologies (Stigka et al., 2014), the acceptance or rejection of a project by the local community is known to influence the degree to which that project succeeds or fails to contribute to local sustainability (Del Río and Burguillo, 2009). There is a wide variety of research in the literature on the potential barriers to renewable energy projects on how the public perceives and is affected by them (Stigka et al., 2014; Kousksou et al., 2015; Eyre and Baruah, 2015).

According to Del Río and Burguillo (2009), two perspectives must be considered regarding renewable energy deployment, namely: procedural sustainability and substantive sustainability. Procedural sustainability aims to emphasize that the opinions and interests of the different stakeholders must be taken into account, since the impacts are perceived differently and those perceptions may influence the acceptance – or otherwise – of the projects. Substantive sustainability refers to the impacts of renewable energy projects regarding the three dimensions of sustainability (economic, social and environmental). Thus, given the objective of analyzing the perception of local stakeholders regarding the social, environmental and economic impacts caused by SHPs, a search was conducted in the literature to identify such impacts. Fig. 1 constitutes the conceptual framework of this study, as it lists the articles found in the literature on the social, environmental and economic impacts of renewable energy projects and their respective authors.

Knowing the priorities of the stakeholders in relation to the multifaceted impacts of hydroelectric dams can offer useful insights for both decision makers and policy makers, when considering the design of strategies capable of meeting the needs of the different stakeholders (Siciliano et al., 2015). Although the literature contains reports on the impacts of SHPs (as shown in Fig. 1), no publication has analyzed the stakeholders' perspectives in relation to such impacts. Del Río and Burguillo (2009) give us a "big picture" showing the contribution of renewable energy sources to the economic and social dimensions of sustainable development, while Kaldellis et al. (2013) and Stigka et al. (2014) investigate the social acceptance of renewable energy projects, not specifically SHPs. Other studies have focused on SHPs, but not from the stakeholders' perspective. For example, Abbasi and Abbasi (2011) examine whether the prevalent belief in the environmental-friendliness of SHPs is really justified and Tsoutsos et al. (2007) describe the procedures involved in the installation and deployment of an SHP. Finally, whereas Arabatzis and Myronidis (2011) and Siciliano et al. (2015) report on communities and residents (local stakeholders) with SHPs, in each case, the focus differs from that of the present study: Siciliano et al. (2015) focus on the social priorities of affected communities and