



Interface between appropriate technology and sustainable energy policy in vulnerable societies



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ABSTRACT

Vulnerable societies are communities which are susceptible to damage when exposed to recurring triggers of natural disaster and/or socio-political conflicts, due to their geospatial and economic characteristics. It is proposed that additionally, access to sustainable energy influences the vulnerability of societies and vice versa. Although technological solutions exist, it is not sufficient to ensure access to sustainable energy systems.

Political will and commitment has been identified as the corresponding measure. However, policy needs to know what it needs to do, thereby requiring the technical know-how and managerial capabilities in selecting the most appropriate energy generation, distribution, and utilisation technology for a given set of social, political, environmental, and economic circumstances. Hence, there is a clear need for technocrats and politicians to work on the same platform for a sustainable energy framework, more clearly so in the case of vulnerable societies.

This paper aims to bridge the gap in theoretical and applied sustainable energy policies by constructing an interface between appropriate technology and energy policies, particularly within the context of vulnerable societies. Integration of historical perspectives, cultural standpoints, and local knowledge into policymaking and institutional development, directed towards technological independence, has been identified as the main foundation to this interface.

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1. Introduction

Access to energy relates to economic development and political stability; the way it is provided and utilised influences the natural environment and society. Technological solutions exist for provision of equal access to energy. However in vulnerable societies, technology on its own is not sufficient in providing sustainable energy provision due to overlapping stakeholders' interests and interrelated limitations. Political will and commitment as the newly identified fourth leg of sustainable practice by Kruijssen, Owen, Turner, and Garniati (2012), for formulation and implementation of policy, policy measure, and strategy for sustainable energy systems is proposed to be the corresponding measure to technological solutions.

Based on a review of the limited available publications on sustainable energy policies in vulnerable societies, no peer-reviewed study or global report has been published on the methodology of developing or enhancing existing sustainable energy policies which takes into account elements of appropriate technology (Collier & Hoeffler, 2004; MacDonald, 2005; Mainali & Silveira, 2011; Weynand, 2007). This is considered to be a substantial gap within the area of sustainable energy technology, because the sustainability aspect of an energy technology calls for the incorporation of local community engagement, affordability, and social acceptability, which are all measures of how appropriate a technology is for a given local population and circumstances. Therefore, a mechanism of incorporating both the commonly acknowledged and the somewhat neglected appropriateness elements of a technology (which will be discussed in the analysis section of this paper) at its design, manufacture, installation, and maintenance stages is needed at policy and implementation levels.

As there are limited resources on sustainable energy policies in vulnerable societies, this paper also draws on the experience of sustainable forest resources management policy and strategy.

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Forest resources management policies usually also deal with marginal and vulnerable communities living in the forest boundaries. Within this remit, it is also found that the sustainable utilisation of forest resources frequently fails due to the lack of policies which facilitate local wisdom and which could have strengthened technological independence (Contreras, 2000; Katerere & Mohamed-Katerere, 1996; Langil, 1999).

1.1. Aim

This paper aims to present an interface for bridging the gap between appropriate technological solutions and policies for sustainable energy in the context of vulnerable societies.

1.2. Objectives

In the context of vulnerable societies, the paper will deliver the following objectives:

1. To illustrate the concept of sustainable energy policy and appropriate energy technology.
2. To analyse the gaps between technological solutions and policy for sustainable energy systems.
3. To provide an interface for bridging the identified gaps.

1.3. Methods

A case study of a particular community in Aceh representing a vulnerable society was used to address the objectives stated in Section 1.2. The remote rural community studied is located deep in Terangon District, Aceh Province, Indonesia (Latitude, Longitude: 4.104684, 96.983514). A gap analysis was performed to identify the missing elements of existing technological solutions and the corresponding policy for a sustainable energy system. An interface was provided as the synthesis in bridging the identified gaps.

2. Theory: background concepts and contexts

2.1. Vulnerable societies

Ingrained economic, social and political characteristics in the form of mindsets, views and capabilities, and the resulting behaviour from these characteristics provide the foundations for vulnerability (Hovden, 2004). Natural disasters and/or human induced catastrophes such as social/political conflicts act as triggers to susceptibility of a society to damage (Brooks, 2003). Lack of access to energy is suggested as an additional reason for vulnerability in societies. Therefore, for the purpose of this report, 'vulnerable societies' is understood as a group of communities in a disadvantaged position due to its inherent geospatial characteristics, economic development stage, and access to energy which makes it especially susceptible to economic and/or social collapse when exposed to external hazards in the form of natural disasters or political/social conflicts.

2.2. Sustainable energy policy

Political commitment is the identified fourth dimension of sustainable energy added to the balanced composition between energy security and the three dimensions of sustainability: economic development, social equity, and environmental protection (Kruijssen et al., 2012). Therefore, for the purpose of this report, sustainable energy policy is understood as interwoven and interdependent sets of decisions, which has community support, encourage investments from the private sectors, present clear

business cases to its strategies, and is developed through participatory, transparent, and accountable way, to achieve energy use, generation, and distribution, which are economically viable, environmentally responsible, socially acceptable, and politically committed for the long-term.

Specificity of policy development in vulnerable societies is characterised by their developing economies, rapidly changing geospatial characteristics, and potential for recurring disaster and political/social conflict. Information collected from both published papers and global databases has indicated that policy development process is one of the main deficiencies found in all vulnerable societies' sustainable energy policy areas (sustainable energy use, energy generation, and energy distribution) (IEA, 2011; Iwaro & Mwashia, 2010; WEC, 2011a, 2011b). Part of this identified gap is the need for institutional creation, strategic planning, and enhancement of existing policies to be performed as an iterative process in policy making.

2.3. Appropriate technology

Appropriate technology has historically been viewed to not prioritise growth and to consist more of elementary techniques (Kaplinski, 2011). However, before putting any arguments into the above perspective, reconsiderations must first be given to the goal and extent of growth itself, as well as its implications (Meadows, Randers, & Meadows, 2004). The subjective definitions of appropriate technology since the beginning of its existence have been influenced by culture and politics (Bowonder, 1979; Kaplinski, 2011), but as a general agreement, appropriateness is considered fulfilled when elementary, intermediate, or advanced technologies use natural, human, and capital resources available locally (Chatel, 1979). This paper views appropriate technology in the light of the United Nations Development Programme's (UNDP) vision of enhancing human capabilities through technology advancement and economic development (UNDP, 2001, 2005) and Technologies for Freedom's (T4F) community driven technology conceptualisation to implementation in achieving social transformation (Fernandez-Baldor, Hueso, & Boni, 2009).

3. Case study: Aceh remote off-grid community

3.1. Challenges for provision of electricity to off-grid remote areas in Aceh

In general, as outlined in a previous work conducted by Urmee, Harries, and Schlapfer (2009), the basic and most common challenges for provision of energy, particularly electricity to off-grid areas are summarised in Table 1.

Indonesia (Aceh) and Timor Leste are two areas in the developing economies of South East Asian environment, which has undergone and has the potential of facing recurring social/political conflict. Indonesia (Aceh) additionally has the potential of facing a recurring natural disaster threat of tsunami and earthquakes. Therefore, a case study of one off-grid remote, rural community in Aceh named Terangengon Village, is given in the following section to illustrate a specific situation of a vulnerable society, facing the challenges which are grouped into the categories outlined in Table 1.

3.2. Case study of Terangengon

Terangengon is a village located in the centre of Aceh Province, Indonesia. It is located about 1 km from a small river, which runs at the bottom of the village. The surrounding landscape is still covered in local vegetations, with a new access road only recently under

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