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Dimensions of energy security in Small Island Developing States

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ABSTRACT

For Small Island Developing States (SIDS) that import oil, energy security is very important and dealt with seriously. This paper attempts to fill a gap in the literature by identifying the dimensions that shape a secure and sustainable supply of energy in SIDS. Seven dimensions were identified and incorporated into a framework for conceptualising and assessing SIDS energy security which are: import dependency; energy prices; climate change and resilience; governance; infrastructure; equity; and energy efficiency. This study also recommends selected strategies and actions to improve energy security in SIDS.

1. Introduction

Energy security has been broadly defined in the scientific literature (Ebinger, 2011). While some have conceptualised energy security relative to economic development, others see energy security in terms of energy availability, resource affordability, environmental sustainability, energy efficiency, and technology (APERC, 2007; Lefèvre, 2010; Sovacool and Mukherjee, 2011; Cao and Bluth, 2012; Hughes, 2012; Chuang and Ma, 2013; Selvakkumaran and Limmeechokchai, 2013; Martchamadol and Kumar, 2013; Misila et al., 2015; Phdungsilp, 2015). Kucharski and Unesaki (2015) supported Winzer (2012) and Leal Filho and Voudouris (2013), who stated that energy security is concerned about risks and vulnerabilities whether caused by geopolitical events or natural disasters. Cherp and Jewell (2011) discussed robustness, sovereignty, and resilience as three aspects of energy security. Chester (2010) discussed the polysemous nature of energy security, critiquing the often vague, elusive, inherently difficult, abstracted, and blurred concepts of energy security in the literature. Rosen (2009) looked at the key energy-related steps in addressing climate change.

While it is widely agreed that 'energy' refers to both primary (oil, coal, natural gas, and renewable energy) and secondary sources (electricity), numerous studies in the literature on energy security focus predominantly on the reliability of oil supply (Vivoda, 2010; Stringer, 2008). This is probably because oil is the most consumed primary energy resource in the world, accounting nearly 33% of the global energy market (BP, 2016; Vivoda, 2010), and because oil prices often fluctuate as a result of political instability and conflicts in major oil producing countries (Asif and Muneer, 2007). Volatile oil prices have negative repercussions on both oil exporters (as they are faced with varying revenues) and oil importers as they perceive significant uncertainty about imports costs and fuel subsidies. In this context, several studies were conducted to better understand, define and characterise the broad concept of energy security (Rentschler, 2013; Narula and Reddy, 2016).

Policymakers often measure energy security through energy indicators and indices derived from suitable dimensions or assessment instruments, which are factors that influence a stable energy supply in a country (Narula and Reddy, 2015). Hence, Vivoda (2010) proposed 11 dimensions and several attributes to gauge energy performance, Sovacool (2011) presented 20 dimensions. von Hippel et al. (2011) provided six dimensions and numerous attributes and strategies to characterise energy security performance. A number of authors have developed indices based on these dimensions, including the Energy Security Price Index (ESPI) by Lefèvre (2010), the Oil Vulnerability Index (OVI) by Gupta (2008), ex-ante and ex-post indicators by Löschel et al. (2010), and the Aggregated Energy Security Performance Indicator (AESPI) by Marchamadol and Kumar (2013), among others. Research on energy security in Small Island Developing States (SIDS) member states (see Table 1 for a list) is of high relevance as they are net energy importers and are intricated by unique geographic, demographic, economic and environmental challenges (Blancard and Hoarau, 2013; UNEP, 2014). SIDS are geographically located in the Atlantic, Indian Ocean, Mediterranean and South China Sea (AIMS),

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Table 1
List of Small Island Developing States (SIDS).[a]
Source: UNEP, 2014

SIDS region	SIDS countries
AIMS	Cape Verde, Comoros, Guinea–Bissau, Maldives, Mauritius, Sao Tome and Principe, Seychelles, [b]Singapore
Caribbean	Antigua and Barbuda, Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St Kitts and Nevis, St Lucia, St Vincent and Grenadines, Suriname, Trinidad and Tobago
Pacific	Fiji, Kiribati, Marshall Islands, Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, Vanuatu

[a] While brief references are made to Papua New Guinea (PNG) and Trinidad & Tobago, the hypothesis elaborated made in this article are less applicable to PNG. PNG and Trinidad & Tobago are an energy exporter, and energy importers and exporters have different dimensions on which their supply of oil to their population depends. Energy security aspects of oil exporters are beyond the scope of this paper.

[b] Singapore is not a developing state but a developed country but is part of the SIDS group. The findings in this study are equally applicable to Singapore as the country share similar environmental and economic challenges as other SIDS members.

Caribbean and Pacific region. The total population of the SIDS is around 61.5 millions with the largest share in the Caribbean which represents 65% followed by Pacific with 18% and AIMS 17% (World Bank, 2017). Research on energy security in SIDS is in its infancy and to our knowledge, this study is the first of its kind to come up with relevant indicators of energy security applicable to island states. So far the World Energy Trilemma 2017 can be used a suitable proxy with Denmark ranked first, and the only SIDS that figured among 125 countries are Singapore (22nd), Mauritius (47th), Dominican Republic (79th), Jamaica (85th) and Trinidad and Tobago (88th) (Leal Filho, 2015; WEC, 2017). It appears to be little progress on indicator development because, so far, little has been done to identify meaningful dimensions on which a stable energy supply on islands depends. The uniqueness of this paper is that, first, it develops a conceptual framing of relevant energy security dimensions for SIDS; and second, based on a review of potential initiatives, it draws out some recommendations of selected strategies and measures to improve energy security in the SIDS context. The article thus contributes by filling a literature gap on energy security and seeks to refocus attention to initiate further research on energy-sector development in SIDS.

2. Methods for data collection

Two methodological approaches were simultaneously used to characterise key dimensions of energy security that are relevant to SIDS. First, a review of present literature based on energy development in SIDS and energy security was conducted. The literature on energy sector of islands was obtained mostly from intergovernmental and think–tank reports. The aim of the literature search was to identify major energy security dimensions and their applicability to small islands. To gauge some arguments, statistical data were collected from various international databases, such as the World Development Indicators of the World Bank, the International Disaster Database from the Centre for Research on the Epidemiology of Disasters (CRED) and the Electricity Database from the International Energy Agency (IEA). Where data were unavailable from these sources, information was retrieved from governmental statistical publications, reports from development banks, regional agencies, and national organisations along with a wide range of peer-reviewed papers. Efforts have been made to gather, as far as possible, the most up–to–date data. Accuracy and authenticity of the data collected were maintained by cross-checking with other statistical reports.

Second, to consolidate the findings of the literature review, a qualitative survey was carried out among energy practitioners in Mauritius, Fiji, Samoa, Vanuatu, Tonga, Tuvalu, and the Federated States of Micronesia. The survey was carried out in 2014 as part of the L^{3}EAP Project (www.project-l3eap.eu), which aims to develop and provide lifelong learning approaches and strengthen local capacities on energy access, security, and efficiency in SIDS. Respondents were chosen purposively and constituted of energy professionals working for non–-governmental organisations (NGOs), the private and public sectors, utility companies, and renewable energy agencies. The survey received 32 respondents from Mauritius and 29 from the Pacific Island Countries (PICs), 61 in total. From PICs, four participants were energy analysts from the Department of Energy, 12 participants were from NGOs, seven participants were from utility companies, and six were from private companies working in the energy domain. In Mauritius, 28 participants were from the power producing companies, three from utility companies and one from a research institution. Most respondents search for securing energy resources as part of their professional responsibility. Respondents with practical knowledge of energy security were sought rather than experts with predominantly theoretical knowledge. A survey in the Caribbean islands was not be conducted in this study, although this research should be generalizable to their experience as well. Respondents were asked basic bio–data information and to give their views on ‘energy security’ in open-ended questions.

3. Data analysis and discussion

Responses obtained were processed as per Miles and Huberman (1994) and Patton (2002), and as previously applied in Blumer et al. (2015). Recurrent themes from the wide range of views from the survey were used to develop a set of codes which were labelled as (i) import dependency, (ii) energy prices, (iii) climate change and resilience, (iv) governance, (v) energy infrastructure, (vi) equity and (vii) energy efficiency. Some responses, such as one energy expert said: “Energy security has two key dimensions – “reliability and resilience”; “reliability” is attributed to code (i) and “resilience” is attributed to code (iii).

The summary results in Table 2 give the proposed dimensions for a secure energy system in SIDS based on the responses by the survey sample. The percentage recurrence is the number of parameters applicable to a particular code divided by the total number of codes recorded. Most experts claimed *import dependency* and affordable *energy prices* as mandatory parameters for a secure energy system on islands.

Table 2
Survey results from open-ended question and percentage recurrence in responses.

Some keywords and phrases	Dimensions	Percentage
Availability; adequate; reliability; Consistent	Import dependency	46%
Reasonable and affordable prices; economic performance	Energy prices	15%
Clean energy; sustainability; resilience; shocks; withstanding threats; external forces	Climate change and resilience	14%
Management of energy supplies; requirements of a nation	Governance	8%
Generation and distribution system; fuel storage facilities	Energy Infrastructure	6%
Equal distribution; the right; not discriminated against	Equity	6%
Efficient; intelligent use	Energy efficiency	3%