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Forum

Evaluating energy security in the Asia pacific: Towards a more comprehensive approach

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ABSTRACT

The energy security conundrum – how to equitably provide available, affordable, reliable, efficient, and environmentally benign energy services – is a technology and policy challenge, perhaps unlike any other. The recent article on an energy security in the Asia Pacific by Vlado Vivoda is an excellent starting point for how to best capture the unique energy security challenges facing the region. This article builds on Vivoda's work, but also points out some shortcomings with his analysis.

1. Introduction

Vlado Vivoda's (2010) recent article on energy security in the Asia Pacific is a pleasure to read. It provides a much needed overview of the energy security challenges facing the region and also develops an energy security assessment instrument, including 11 broad dimensions and 44 attributes that can be utilized to evaluate national performance on energy issues. His study shows quite nicely how energy security cuts across different areas, involving:

- Geological aspects such as resource reserves and the availability of energy technologies and fuels;
- Economic aspects like trade, production of resources, price stability, and affordability;
- Socio-political aspects like governance, resilience, and the ability to cope with climate change;
- Environmental aspects such as insults to land, air, and water.

I also agree wholeheartedly with his statement that "a more comprehensive operating definition of 'energy security' is necessary, along with a workable framework for analysis of energy security policy" (Vivoda, 2010: 5259).

His article largely achieves the task of proposing a novel framework for analyzing energy security dimensions and challenges, but because the topic is of such importance, this article points out shortcomings with Vivoda's framework and then builds on his work to propose more comprehensive dimensions and metrics.

As the article will show, shortcomings fall into two primary areas. First, Vivoda identifies seven dimensions to energy security, but a large research project we are doing at the Lee Kuan Yew School of Public Policy on the same topic – in consultation with dozens of experts in Asia and at authoritative institutions like the U.S. Department of Energy, World Bank, and International Energy Agency – has identified 20 dimensions. Vivoda gets it right with many attributes, but is missing others. For example, Vivoda discusses the salience of fossil fuels like coal and oil for his framework, but in Asia hundreds of millions of people do not use these fuels and instead rely on fuelwood, dung, agricultural residue, biogas, charcoal, kerosene, cookstoves, solar home systems, and other technologies to provide energy services. As another example, Vivoda mentions the fraction of population with access to basic energy services as an important attribute, but does not consider how equitable or affordable that access is.

Second, Vivoda presents 44 "attributes" that he argues can be used to measure energy security performance in Asia. These attributes, however, are incomplete, and at times conflate actual metrics and indicators with dimensions or components. For instance, Vivoda lists the quality of the electricity network as an attribute, but never tells us how that attribute could be measured. Is it by the frequency of blackouts or interruptions in electricity supply? Or the duration of those interruptions? Or their economic cost? Or the average efficiency losses of the transmission and distribution network? Or the average thermal efficiency of power plants? He thus leaves us with no actual way to measure energy security performance. The second part of this article, based on research interviews with Asian energy experts, builds from their insights to propose a list of 200 comprehensive metrics that can be utilized to better assess how countries grapple with energy security dilemmas over time.

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2. Conceptualizing energy security dimensions

Vivoda lists seven salient energy security dimensions: environment, technology, demand side management, socio-cultural or political factors, human security, international elements like geopolitics, and the formulation of energy security policy. Yet an ongoing study we are doing funded by the MacArthur Foundation has identified twenty notable dimensions. As part of this project, the author conducted 64 semi-structured research interviews over the course of February 2009 to June 2010, including visits to the International Energy Agency, U.S. Department of Energy, United Nations Environment Program, Energy Information Administration, World Bank Group, Nuclear Energy Agency, and International Atomic Energy Agency.

To ensure a relatively representative sample of Asian experts, the author also approached participants working at:

- Universities such as Chiang Mai University in Thailand and the University of Tokyo in Japan;
- Government organizations such as the Chinese Academy of Sciences and the Malaysia Energy Centre;
- Civil society groups and nongovernmental organizations, such as the Asia Pacific Energy Research Centre or The Energy and Resources Institute in India;
- Intergovernmental organizations such as the United Nations Environment Program and Association of Southeast Asian Nations.

The author asked participants at these institutions three open-ended questions: what are the most significant energy security challenges facing Asia?; which dimensions of energy security are most important to Asian countries?; and what metrics and indicators best capture these dimensions? Responses were often recorded and always transcribed before being coded and synthesized into the data presented in this article. Though responses must be listed anonymously to protect confidentiality and adhere to Institutional Review Board guidelines at the author's university, the Appendix provides a complete list of all institutions visited.

Without prompting, these participants identified twenty distinct elements or dimensions of Asian energy security, summarized in Table 1. The remainder of this section briefly summarizes each dimension.

Participants argued that *availability* involved "having sufficient supplies of energy" and that "insecurity of supply" could result from "unforeseen weather events, political decisions, military conflicts, or strategic reasons". Keppler (2007) has noted, for example, that energy unavailability can occur for a variety of reasons, including:

- Embargoes or the exercise of monopoly power by a single actor or cartel (such as an OPEC);
- Internal problems with suppliers such as civil war, political tension, or strikes (such as the famous coalminers strike in the United Kingdom);
- Limitations of capacity due to lack of investment, bad management, or lack of foreign direct investment (Asian financial crisis of the late 1990s);
- Political crises (such as the Suez Canal);
- Commercial disputes (think natural gas and Ukraine and Russia);
- Sabotage (such as attacks on Iraqi oil pipelines);
- Extreme weather events (such as Hurricane Katrina);
- Technical accidents (such as the famous 2003 blackout in North America);
- Inadequate capacity (such as the California energy crisis).

Availability thus ensures what another respondent called "having adequate functioning infrastructure to transport, transform, transmit, and use energy".

Dependency involves what respondents called "being independent", "self sufficient", or "free from imports". Dependence on countries like Saudi Arabia or Iran for energy fuels transfers wealth to them that can then be used to "support terrorism" or "fund extremist movements". One study (CNA, 2009) calculated that

Table 1
Energy security dimensions identified by experts.

Dimension	Explanation	Underlying values
Availability	Having sufficient supplies of energy	Self sufficiency, resource availability
Dependency	Being energy independent	Security of supply, independence, imports
Diversification	Promoting a diversified and decentralized collection of different energy technologies	Variety, balance, disparity
Decentralization	Reliance on small-scale sources of energy supply near the point of consumption	Modularity, comprehensibility, physical security
Innovation	Researching and developing new and innovative energy technologies	Development, diffusion
Investment	Making proper investments in infrastructure and maintenance	Investment, employment
Trade	Promoting the trade of energy technologies and fuels	Geopolitics, free trade, transport routes, interconnectedness, security of demand, exports
Production	Producing domestically available fuels and energy resources	Economic growth, reliability
Price stability	Having predictable prices for energy fuels and services	Clarity, predictability
Affordability	Producing energy services at the lowest cost	Competition, subsidization, profitability
Governance	Having stable, transparent, and participatory modes of energy policymaking and permitting	Transparency, accountability, legitimacy, integrity, stability, resource curse
Access	Enabling equitable access to energy services	Energy poverty, equity
Reliability	Delivering high quality and reliable energy services	Safety, quality, accidents
Literacy	Social and community knowledge and education about energy issues	Knowledge, accuracy, information, feedback, internalization of externalities
Resilience	Capacity to adapt and respond to the challenges induced by climate change or disruptions in supply	Adaptation, stockpiling, stockholding
Land use	Minimizing destruction of forests and degradation of land	Stewardship, aesthetics
Water	Possessing sufficient quantities of water	Water quality, water availability
Pollution	Minimizing ambient and indoor levels of air pollution	Human health
Efficiency	Producing energy in the most efficient manner possible	Conservation, energy efficiency
Greenhouse gas emissions	Mitigating greenhouse gas emissions associated with climate change	Mitigation