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ASEAN Energy Security: An indicator-based assessment

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Abstract

As ASEAN is now pursuing regional energy cooperation, it is important to measure the status of energy security performance of member nations. This paper assesses the security of energy supply among nine ASEAN member nations and examines whether and how it has evolved over the past decade. The analysis uses 35 indicators selected based on three dimensions of energy security: supply security, socio-economic and environmental dimension. The evaluation findings show how concept of energy security differs among ASEAN member nations. Despite uneven economic and energy development, existing intra-regional energy markets are interconnected. The concept of regional self-reliance could be useful in designing and promoting ASEAN energy security cooperation.

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1. Introduction

The concept of energy security has raised controversies over the definition, scope, and approaches for decades. For higher-developed countries, energy security refers to “a resilient energy system with uninterrupted availability of energy sources at an affordable price” [1]-[2]. On the other hand, lesser-developed countries define energy security simply as access to modern energy services [3]. Yet, one consensus on energy security is that it is vital to both state and human security.

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The Association of Southeast Asian Nations (ASEAN) aims to enhance energy security and sustainability by promoting regional cooperation in the field of energy. The action plans consist of seven components including: ASEAN Power Grid, Trans-ASEAN Gas Pipeline, Coal and Clean Coal Technology, Renewable Energy, Energy Efficiency and Conservation, Regional Energy Policy and Planning, and Civilian Nuclear Energy. Regardless of the urge for cooperation, focusing on energy security assessment of ASEAN, the gap, however, exists, as there are a limited number of available comparative studies on energy statistics regarding supply security of ASEAN.

This study evaluates energy security of nine ASEAN member nations (excluding Lao PDR) with regards to supply, socio-economic, and environmental dimensions. This paper composes of four sections. Following this introduction, Section two describes the methodology and indicators used to assess energy security. Section three presents the results and its analyses whereas Section four concludes the findings and remarks.

2. Methodology

Using an indicator-based assessment, this study aims to quantitatively measure the energy security of nine ASEAN member nations: Brunei Darussalam (hereafter referred to as Brunei), Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The study examines whether and how the performance of energy security of each ASEAN member nations has evolved over the past decade.

Indicators of energy security were determined based on the three dimensions of energy security including supply security, socio-economic dimension, and environmental dimension. However, the study put an emphasis on security of energy supply, the physical availability of energy sources, which is the central dimension of energy security [4]. Threats to supply security range from reliance on imported to insufficiently diversified energy sources. Socio-economic and environmental dimensions highlight energy efficiency from a macroeconomic perspective as well as carbon challenges. An indicator-based assessment allows wide range of issues to tackle since the selected indicators are not explicitly linked, and is thus able to identify wider vulnerability issues.

2.1. Selecting energy security indicators

The assessment was conducted by using 35 individual indicators adapted from earlier energy security studies [5]-[7]. Selected indicators were identified and categorized to six components including (1) overall energy balance, (2) demand management, (3) security of domestic resources, (4) vulnerability to overseas resources, (5) diversification of energy supply, and (6) environmental sustainability.

Under the overall energy balance component, 'primary energy mix' was selected to show the development and trend of ASEAN primary energy mixes. Primary energy sources referred to in this indicator includes coal, crude oil, natural gas, and renewables. In addition, 'electricity generation by sources' represents energy mix specifically on power sector. The sources are coal, hydroelectricity, natural gas, oil, and other renewables.

The second component reflects energy accessibility and its efficiency. 'Access to electricity' shows whether modern energy is utilized while 'total primary energy supply per capita,' 'final energy consumption per capita' and 'electricity consumption per capita' reflect the intensity of energy use among population. Energy efficiency of the economy was measured by 'total primary energy supply intensity' and 'electricity intensity' showing the amount of energy/electricity consumed to produce one unit of GDP. Since this indicator shows the energy efficiency of the economy. The lower the value of energy intensity implies the higher energy efficiency.

As the third component heightens the security of domestic energy resources, 'self-sufficiency' indicator was used to assess the share of indigenous energy production in total supply of energy. Besides energy self-sufficiency rate, the indicator includes explicit sources namely coal, crude oil, and natural gas. Renewable energy was not included because of its indigenousness. Self-sufficiency rate shows the capacity of the country to cover its energy demand using domestic resources. Self-sufficiency rate ranges from 0 to 1. The higher the value is the better while the value over 1 implies export capability.

'Reserves-to-production' ratio was chosen to represent the availability of domestic proven energy resources (particularly fossil fuels) of the country through the number of years resources are available presuming the

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