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Energy resilience assessment by using SEM approach in the Central Java Province, Indonesia

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Abstract

Energy is one of the critical infrastructure for urban and rural development. Although planning and management of the energy provision tend to centralized, the role of local stakeholder is very significant to achieve energy resilience. An assessment of energy resilience is not only related to the disaster condition, but also associated to any effort to solve of uncertainties in normal condition such as supply shortages, low level of ratio electrification, consistency of provision and standardization. This study defined that energy resilience are influenced by five factors namely, stakeholder effort to understand their needs, effort to understand process of energy provision, effort to understand the facility of energy provision, effort to understand efficiency energy consumption and the behaviour to achieve, and the local government concern. By using SEM approach this study examined a model of the five factors that affect resilience energy. According to the assessment from the 8,528 villages in Central Java province of Indonesia, this study founded that the five factors were evidently influence in energy resilience achievement.

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Keywords: Energy resilience assessment; provincial and local government preparedness; structural equation modelling (SEM).

1. Introduction

Energy is one of the critical infrastructure for urban and rural development. Access enough of energy is very essential to reduce poverty that in turn increasing community resilience in this uncertainty era such as global climate

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change trends and unpredictable of natural disaster. The sustainability of the energy provision should cover any possibility of increasing demand both in normal and disaster situation. Resilience and sustainable of energy is not only providing the quantity, but also ensuring the distribution and balancing of the modern equipment of energy in urban and rural. In 2015, International Bank for Reconstruction and Development/The World Bank stated that there were around 1.1 billion people without access of electricity and 2.9 billion people use non modern equipment and utilize solid fuel such as wood, charcoal, coal, and dung for cooking. The goal of the study is to examining the hierarchical factor model that depicts provincial and local stakeholder creation to improve the energy resilience. This study assesses the effort of stakeholder to understand the importance of energy access to the social growth and poverty countermeasures.

Application of the resilience concept is vary depending on the field, such as socio-ecological socio-economic, engineering and disaster management. In energy, Matzenberger et al., (2015) defined that energy resilience is an ability the system to cope with and maintain the function from the disruptions and possibility of system to exploit positive opportunity to increase or develop the capacity of system. Sharifia, A., & Yamagatab, Y., (2015) introduced energy resilience assessment in the urban level by proposing the criteria of availability, accessibility, affordability, and acceptability. This study combines the two terms of energy resilience, however this study stressing the stakeholder in provincial and local state effort to increase the capability of energy provision in rural level.

2. Method

2.1. Literature review of energy resilience model

Energy requirement is the fundamental aspect on discussing energy resilience. For the basic planning and management in urban and rural development, energy requirements can be adapted from FAO (2001) assessment, that energy requirement can be estimated from measures energy expenditure and additional energy for growth. There were some variables that affect energy requirement such as the growth of population, the life style of the population (Lensen, M , et. al, 2006). The other condition that affects energy resilience is disruption in the location such as disaster event. Since the Planning such as developing scenario of energy needs both in normal condition and disaster event tend to centralized, the effort of local stakeholder to understand and then involve in the planning and management scheme is very essential to achieve the resilience.

Energy supply describes the performance of energy delivery to the point of consumption. Energy supply also indicates the capability of stakeholder to transfer, transport and storage of energy on a period of time. Access of energy should cover all human activity to improving the quality of life in urban and rural. The disruption of energy supply generates both from the delivery process and capability to receive. Understanding of the process of energy provision such as examined stakeholder effort to mapping the unbalance of the distribution of energy provision become one of the importance latent factors of energy resilience. The issues of energy distribution and balancing can be described from the access to energy at house hold (Jorgenson, et. Al, 2010) and poor people (Karekezi, et al, 2008). The key performance of the criteria in this latent factor is consistency and standardization of the provision.

Goldthau, A. (2014) stated that rethinking of the governance of energy infrastructure provision was an essential stage in recent decade to achieve a sustainable of energy provision. There are two main classification of energy infrastructure provision in urban rural. The hard infrastructure at which associated to the physical or technical exploration, production and distribution. The other is soft infrastructure such us information of stock information of delivery. Since the management of delivery then to centralized, the role of local stakeholder to bridges between producer and consumer influence the energy resilience. This study also assess the stakeholder understanding of their responsibility for enhance sufficient energy infrastructure.

Even though behavior of consumption to perform energy efficient demand is worldwide recognized, stakeholder effort to understand and find a novelty and breakthrough is waited. Even though Luaren (1992) stated that very difficult to build a satisfactory model to describe consumption behavior of energy, Stephenson, et. al (2010) has developed a model to identifying opportunity in changing behavior of energy consumption. This study examined that the behavior of energy consumption of energy was describes by community behavior in use of non-modern energy equipment such as use the solid fuel (wood) to fulfill their requirement. Level of education was used to assess the

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