AIRLANGGA DEVELOPMENT JOURNAL
ADJ
p-ISSN: 2528-3642

Sekolah Pascasarjana Universitas Airlangga
Jalan Airlangga No. 4-6, Surabaya - 60286
Telp. : (031) 5041566, 5041536
Email : adj@journal.unair.ac.id
Website : https://e-journal.unair.ac.id/ADJ

IDENTIFYING FACTORS OF RISK MANAGEMENT IN SECONDARY CITIES TO FACE THE ENERGY CRISIS IN REALIZING A RESILIENT CITY

Aditya Zulmi Rahmawan
Master of Disaster Management, Postgraduated School, Airlangga University
Email: zulmi.mail@gmail.com

Received:
September, 14 2022

Revised:
June 17, 2024

Accepted:
June 18, 2024

ABSTRACT

The challenge of the energy crisis will be a phase experienced by cities. This can be seen in the projected urban population which continues to increase by 67%. This will be a shock as well as a new pressure for city life in addition to the burden of climate change. This study aims to provide a new approach and steps in assessing the energy crisis through risk management. The system of risk management will help make it easier to analyze the energy security situation and concepts that must be faced during an energy crisis. The establishment of this management system to prevent and control the energy crisis indicated that there were still misunderstandings and disagreements regarding the factors that should be a risk. This risk management consists of the concept of strategy, goal setting, resource requirements, risk identification, risk assessment, action planning, and risk communication that dominate various literatures. The results of the identification of risk management factors will make it easier to understand the strategies and policies that will be applied to improve and improve the quality status of urban management in order to create a resilient city.

Keywords*: Risk management, secondary city, energy crisis, resilient city.*

ABSTRAK

Tantangan krisis energi akan menjadi sebuah fase yang dialami perkotaan. Hal tersebut terlihat pada proyeksi jumlah penduduk perkotaan yang terus mengalami peningkatan hingga sebesar 67%. Hal ini akan menjadi sebuah guncangan sekaligus tekanan yang baru bagi kehidupan kota disamping adanya beban dari perubahan iklim. Penelitian ini bertujuan memberikan sebuah pendekatan dan langkah-langkah baru dalam menilai krisis energi melalui manajemen risiko. Sistem dari manajemen risiko akan membantu memudahkan dalam menganalisis situasi keamanan energi dan konsep yang harus dihadapi saat krisis energi. Pembentukan sistem manajemen ini untuk mencegah dan mengendalikan krisis energi yang diindikasikan masih adanya kesalahpahaman dan ketidaksepakatan mengenai faktor-faktor yang seharusnya menjadi risiko. Manajemen risiko ini terdiri dari konsep strategi, penentuan tujuan, kebutuhan sumber daya, identifikasi risiko, penilaian risiko, perencanaan tindakan, dan komunikasi risiko yang mendominasi berbagai literatur. Hasil identifikasi faktor manajemen risiko akan mudah memahami strategi dan kebijakan yang akan diterapkan untuk memperbaiki dan meningkatkan status kualitas pengelolaan di perkotaan demi mewujudkan kota Tangguh.

Kata Kunci: Kota sekunder, kota tangguh krisis energi, manajemen risiko.

INTRODUCTION

Secondary cities emerged in the 21st century as the most rapidly developing areas. The emergence of these cities is developing as a major area of urbanization. A secondary city is defined by its population size, economic importance, function, and regional influence within the country. The population of a secondary city can range between 10% and 50% of the largest city in a country. They are urban centers that provide important support functions for government, transportation, and production services. Characteristically, the area has achieved good mapping, but the available data and information is still limited on infrastructure, land

tenure, and planning and shows a pattern of rapid informal and unplanned growth (Rahayu and Mardiansjah, 2018). This is due to high dynamics and creates many environmental safety and sustainability problems. On the other hand, it also has an impact on the government's ability to carry out development efforts, respond to emergencies, and design a sustainable future (Laituri, et, all 2021).

Energy needs that have driven a new urban agenda in realizing a resilient city. This challenge is increasingly seen in the estimated 2035 population of Indonesia living in urban areas with an estimated increase of 67%. A significant increase in population triggers large energy consumption. So there is a need for new approaches to environmental protection to spark hopes for infrastructure development and sustainable energy management systems. On the other hand, the world's energy needs are increasing. According to estimates by the International Energy Agency (2020), by 2030 the world's energy needs will increase by 45% or an average increase of 1.6% per year. most or about 80% of the world's energy needs are supplied from fossil fuels. The role of coal in providing energy to increase the demand for power plant development in the regions caused by economic and income growth. demand for coal demand grew about 2% per year (in the period 2006-2007 coal grew 4.8%). For the world's energy needs, coal contributed 26% in 2006 to 29%.

In addition to being supported by coal, the world's energy supply is also contributed by gas, biomass, nuclear, hydro and new and renewable energy sources. The role of new and renewable energy sources for electricity services continues to increase. It is projected that starting in 2010 the role of new and renewable energy in electricity will occupy the second position after coal and hydro (Poudyal, 2019). However, based on the IEA analysis, the trend of world energy use is still overshadowed by various problems related to social, environmental, and economic aspects. Oil and gas reserves and imports support Security in OPEC. On the other hand, the increasing use of fossil fuels triggers climate change. For this reason, the IEA recommends the use of clean and efficient energy to reduce carbon emissions.

The growing awareness and knowledge about the environment that developed in urban communities began to attract great interest with the emergence of discourse about the energy crisis. The availability of energy, which is currently still considered uncertain, has given rise to the concept of energy efficiency and the use of renewable energy sources. Accordingly, it is very important to develop policies and approaches in the form of risk management in the energy crisis. The energy crisis can be said to be a disaster because it disrupts human activities. Therefore, an eco-efficiency management and approach is needed by conducting risk assessment and risk management in creating a sustainable space for future generations (Delgado-Antequera, et.all, 2021) For this reason, this paper seeks to build a conceptual framework in the form of parameters that can be used in risk management related to the effectiveness and efficiency of energy use in realizing a resilient city, especially in facing the challenges of climate change. This concept approach is in accordance with the development of science with a comprehensive planning concept from the collaboration of all elements that are integrated with each other in the fields of spatial planning, social, economic, technology, transportation and environment.

Risk management in the energy crisis in sustainability efforts in urban life is influenced by the deployment and effectiveness of resources, policies, practices, and procedures. It is also sometimes associated with technical problems and social and individual failures (Chen, S., et.all, 2020). However, from the investigations that have been carried out in the past, the importance of risk management has been highlighted. For example, the reference to the fuel oil crisis in Indonesia in several years has increased in price and in 2022 it will reach the

price of IDR 10,000 or an increase of 30%. This suggests that changes in the way urban management can affect industrial institutions and projects within the city.

METHOD

This research is a literature study by collecting information relevant to energy policy in realizing a resilient city. Studies in this area tend to focus on analyzing specific risks from a stakeholder point of view. Therefore, in the results section of this study, a mapping of the factors that exist in the range of risks will be analyzed.

The collecting information is through the process of reviewing the literature, which has a relationship with the context of the problem being solved. The data analysis technique uses the content analysis method, namely in obtaining clear characteristics of the discourse in the form of theories and concepts studied, the authors use these analytical techniques for inference that can be replicated (imitated) and the truth of the data to pay attention to the context of the problem.

RESULTS AND DISCUSSION

Energy Crisis

The reason risk management in energy sustainability is worth considering or pursuing is to improve project performance and urban living. This increase in the effectiveness of risk management has been associated with an increase in the culture that will shape the alignment between the present and the future. Performance in this risk will be better if it is associated with a positive culture with dominance in institutions, organizations and industries. The prevailing culture is very important in relation to increasing the effectiveness of the city. These observations lead to the argument that it appears that efforts to improve the record of failure in the energy crisis will not fully materialize until the resulting culture of risk reduction is enhanced.

Risk is an unavoidable condition of life and affects every human being everywhere because it contains choices that must be decided by individuals and society. Risk at the individual level can usually be managed and reduced once the individual realizes that something can be avoided. In the regional scope, risk reduction is the responsibility of the government which is carried out collectively by all its citizens (Mousavi, et.all, 2021). Energy crisis risk can be broadly understood as the potential loss and disruption to human activities resulting from an energy crisis in a certain area and time (Gasser, 2021). Energy crisis risk assessment can be identified by analyzing the following variables, namely:

a. Hazard is a dangerous condition or event that threatens or has the potential to cause harm to human life. Threats are things that need to be known before taking action on energy crisis management such as recognizing the types and characteristics of threats that will occur, so that appropriate and effective planning and mitigation can be carried out. The danger in the energy crisis can be categorized as energy scarcity. Assessment of scarcity can be assessed from the amount of energy reserves, energy production costs and energy projections (Zhang, 2021). The parameters of the amount of reserves and production costs represent the physical conditions that affect the shocks experienced by the community or organization, while the energy projection is to see information on energy conditions as an appropriate mitigation effort against energy scarcity.
b. Vulnerability, has a definition as the inability of the community, structure, service, or condition of the area when exposed to the impact and disturbance of the hazard. Vulnerability is closely related to objects exposed to the energy crisis, namely humans. This vulnerability includes the parameters of population quality, namely, education,

health and income. In addition to such production, health services and industry.

c. Capacity, defined as the resources or strengths possessed by the community and its environment that allow it to prevent, prepare for and remedy an impact. The capacity parameters in the energy crisis assessment can be determined from the existence of institutions, the availability of alternative energy and infrastructure development. The institutional parameters consist of community organizations, environmental programs and regulations regarding energy. The availability of alternative energy becomes a strong capacity to sustain conventional energy. Meanwhile, infrastructure development includes technological advances and transportation accessibility (Raza, et,all, 2020). High capacity strength automatically reduces the level of vulnerability, which is expected by the community to be able to overcome the energy crisis.

Energy crisis risk assessment is a relationship and unity that influences each other, this can be described in the form of equations and diagrams as follows:

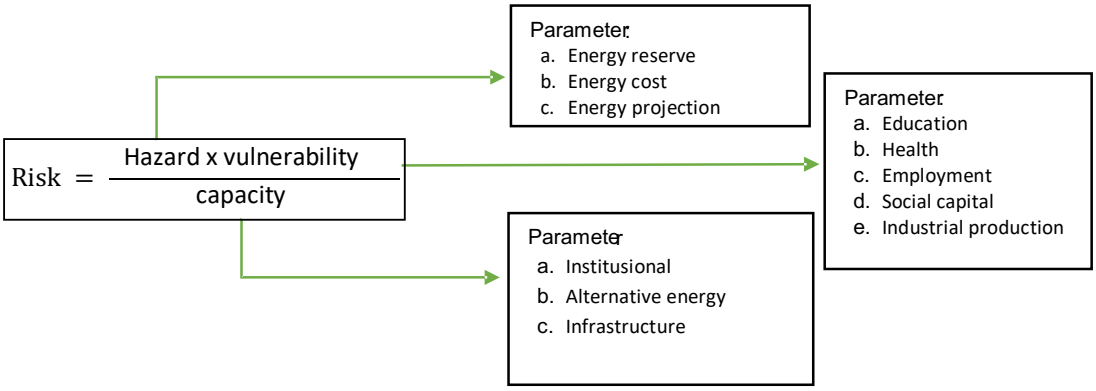

Figure 1. The risk equation of the energy crisis

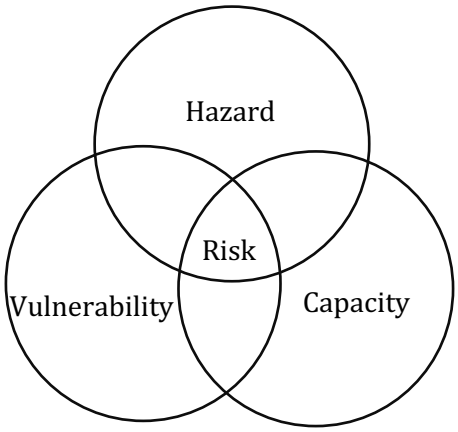

Figure 2. The relationship between risk, hazard, vulnerability, and capacity in the energy crisis
Source: International Strategy for Disaster Reduction, 2005

The City of Resilient Energy

After good implementation of risk assessment and continued with risk management, a resilient city will be created well. The realization of a resilient city is formulated in more detail which includes: Resilient People and Living, Resilient Government, Resilient Infrastructure and Resilient Economy which are described simply as follows:

a. Resilient of People and Living is manifested in the ability of the community and the environment independently to anticipate and recover from the energy crisis which includes mitigation, adaptation and innovation. Mitigation in this case is intended as an effort to reduce risk through awareness and capacity building in dealing with energy scarcity. Furthermore, at the adaptation stage, the community begins to get used to renewable energy innovation and strengthening environmental self-sufficiency (Balogun, et.all, 2020).
b. Resilient of Government builds government system and management capabilities in anticipating and recovering from unexpected crises in an effective manner through policies, integrated planning, synchronous funding and facilities from National, Provincial, City/District, to Village (Ullah, et.all, 2021). Innovations that can be made include:
    - An early warning system during an energy crisis with production and distribution tracking
    - Provision of big data information by mapping production, distribution and energy consumption
    - Optimization of ICT (Information and Communication Technology)-based public services to achieve energy efficiency
    - Ensure the implementation of order in the supply of energy
c. Resilient of Infrastructure establishes infrastructure management capable of anticipating crises through innovation and technological engineering based on the decentralization of various sectors. In this energy crisis, it is undeniable that human movement is reduced in several services such as economy, health, education, and security (Kelnberger, 2018). The following are innovations that can be applied:
    - Supply chain optimization in logistics management that runs smoothly through the construction of transportation networks
    - Development of digital infrastructure to realize a smart city for efficient public services
    - Maximize the integration of systems built into the city's resilience strategy
d. Resilient Economy is a manifestation of the concept of an economy that is able to survive in this energy crisis so as not to sink. The concepts and strategies of innovation development that can be applied are:
    - Optimization of digital-based exchange of goods and services
    - Division of the hierarchical system of economic areas by grouping regions into categories of raw material distributor area, production area, and supplier/market area.
    - Improve the community's ability and knowledge about industry 4.0.

This section identifies the risk factors in the energy crisis that are said to affect the sustainability of urban life. Term used with regard to operational parameters that focus on the

active description. In a survey conducted in each reference, four core elements of risk management that affect accuracy in the area of energy sustainability are determined, namely risk identification and assessment, risk measurement, risk communication and risk management. Each of these elements must be developed and linked so that they work as a unified whole.

The goals in the energy sector in the form of infrastructure security and resilience are very important to be developed and achieved through collaborative efforts between industry and government. Infrastructure in energy is critical to tackling all hazards, increasing the resilience of information systems, and encouraging learning and adaptation to change. There are many activities and programs that support this goal, developed and maintained by various public and private organizations. Most of the energy infrastructure is owned and operated by the private sector, so the security and resilience of the energy sector is a shared responsibility. This section aims at some of the approaches and efforts taken to help achieve national energy security goals.Through the conceptual framework that has been sorted, the following is an energy crisis management system which can be seen in the following figure:

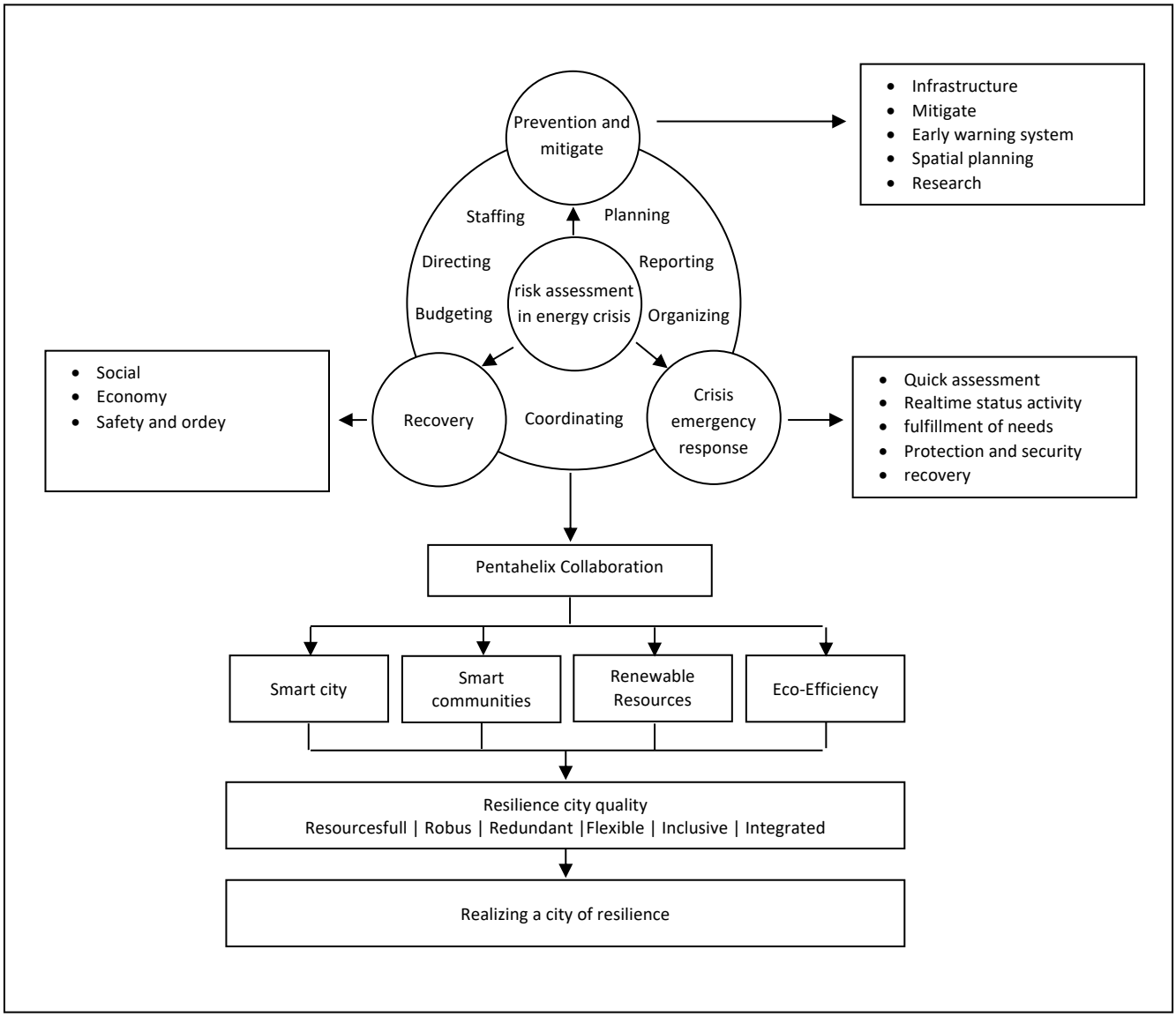

Figure 3. Conceptual framework of risk management and a strategy of a resilient city

Most resilience studies focus on technical matters only and not resilience planning. Few studies have focused on evaluating the various layers and phases of resilience, and the consequences of disturbances that would preclude the opportunity to use all of the resilience capacity of the system. The lack of comprehensive treatment of the three layers of resilience as proposed here, i.e. consisting of risk identification, risk assessment, and risk communication. It is evident in figure 3 that using the proposed resilience framework can potentially lead to more integrated and comprehensive energy system design options, and ultimately, improved community system resilience as a whole.

The section on conceptualizing and estimating energy security based on the framework presented here can provide several benefits to stakeholders. Expert energy planners and engineers, facility managers, community owners, and local governments can combine proposed resilience frameworks to develop informative system designs, minimize operational risks, make effective investment decisions, and create sustainable policies and regulations (Balzarova and Castka, 2012). System resilience in the application of the principles of quality resilience, namely, resourcesfull, robust, redundant, flexible, inclusive, and integrated. This encourages existing local and international standards, collaborating with each other to ensure the design of structures that are event-resistant in the presence of uncertainty (Zhu, et.all, 2020). In the future, measurements of the level of energy security in communities could be similarly developed to provide consistent and comprehensive design guidelines/standards that predict resilient energy performance not only at the community level, but also for the larger energy system.

The availability and use of energy in each region has its own differences, especially in urban areas. If the availability of critical energy, the dynamic state of the city will turn into static. This reminder should encourage all of us to truly create a city that has resilience in facing any challenges that may arise in the future (Kalinin, 2020). With the implementation of this risk management concept, the resilience of the physical aspects of the area will increase accompanied by an increase in the resilience and welfare of the social and economic aspects of the community in the future (Stoner, 2000). The integration of an efficient energy management system actually has an impact on environmental issues that lead to reducing the risk of climate change and participating in becoming a smart community in realizing society 5.0 (Salgues, 2018).

The Risk function should provide a comprehensive view and cover all risks that may affect the sustainability of the city. The central and most basic role in this view is risk mapping, which establishes what risks are significant and defines risk management and control accountability. The risk map serves not only to provide a full profile of risk, but is also a starting point for determining the roles and responsibilities of various functions in the risk management and control process in the face of uncertainty in the future. In this type of identification, what is done is to determine the basic elements of the risk management model across resources and which have the basic function of developing general action guidelines across institutions and industries (eg mapping of collateral and joint guarantees).

The resilience of the city in the energy crisis is firstly, namely, creating an area that has complex energy security, i.e. the absence of significant threats to its existence, and secondly, the lack of energy threats to the lives of individuals and their various communities and organizations at the macro level. Energy security includes a low level of security threat to the functioning and development of energy complexes in a country, and a low level of possible threats to the development of society from the energy complex itself. This threat is

closely related to the problem of preventing and liquidating emergency situations at the facilities of the state energy complex. Measures that ensure energy security include measures to prevent emergency situations through accidents or acts of sabotage at power facilities in peacetime and wartime. If this becomes a reality, the steps taken are liquidating emergency situations, population security and protection, the environment and reducing material losses (Chang, 2004).

In all case studies, the need for better planning and management of secondary urban development is a strong message. The suburbs of most secondary cities have grown significantly in recent years without adequate planning and control over urban development. Case studies demonstrate the reluctance of local governments to establish planning rules, plans, standards and regulations. The uncontrolled spread of urban settlements with low density has caused many new urban areas to lack basic infrastructure and people, so that energy requirements are used inefficiently (Roberts and Anyumba, 2022)

The Challenge of Institutional Collaboration In Secondary City

A country in considering the choice of energy system, which is carried out by policy makers and stakeholders must take into account the state of the economy, environment, and security. Energy security appears to have taken a backseat to the economy, this is due to inflation and the relative global economy reaching agreed prices (Zhilkina, 2014). Security may also be undervalued compared to environmental concerns. The marketplace is a powerful tool for minimizing prices, sending investment signals, and catalyzing innovative clean energy technologies but there are important attributes of energy systems that the market won't deliver.

The impact of the energy crisis greatly affects all sectors, but the heavy burden is on the economic sector which bears the cost of production and has the potential to spread to all walks of life. The government has re-optimized intensive cooperation between ministries through a cross-sectoral approach, including environmental consolidation, energy and infrastructure development (Wijoyo, et.all, 2022). Meanwhile, the role of local governments is very important by conducting an inventory of local energy in their area as a starting point for development planning. In addition, local communities and NGOs need to be involved through assistance from the planning stage to implementation. Meanwhile, the private sector can play a role in various things, both from providing alternative energy development funds through CSR programs as well as providing consultation and construction implementation of development. This collaborative planning and work must be supported by political commitment and simplification of the government bureaucracy.

CONCLUSION

Although the energy system is managed by a state, the majority of energy use is in regional units. City-levels are generally seen as more resilient than energy systems to events that are normally expected to be extremely extreme. The level of risk in terms of hazard, vulnerability, and capacity indicates the short-term and long-term impacts on the various component systems. To produce the effect of resilience, a risk management system is needed which consists of, risk identification, risk assessment, and risk communication. Combining the concept of urban resilience with the challenges of the energy crisis will result in strategic planning that is beneficial to stakeholders. The development of a community-level energy security framework is able to address the engineering design, planning, and assessment of community-level energy systems as well as to determine mitigation strategies. In addition, the disaster risk management approach to the energy crisis in the community resilience planning

flowchart shows that this framework supports many things in proposing the consequences of various design alternatives and improving the energy security of community systems that can provide benefits to stakeholders.

BIBLIOGRAPHY

Balogun, A. L., Marks, D., Sharma, R., Shekhar, H., Balmes, C., Maheng, D., ... & Salehi, P. (2020). Assessing the potentials of digitalization as a tool for climate change adaptation and sustainable development in urban centres. *Sustainable Cities and Society*, *53*, 101888.

Balzarova, M. and Castka, P. (2012), "Stakeholders' influence and contribution to social standards development: the case of multiple stakeholder approach to ISO 26000 development", Journal of Business Ethics, Vol. 111 No. 2, pp. 265-279.

Chang SE, Shinozuka M. (2004). Measuring Improvements in the Disaster Resilience of Communities. Earthquake Spectra. 2004;20(3):739-55.

Chen, S., Kharrazi, A., Liang, S., Fath, B. D., Lenzen, M., & Yan, J. (2020). Advanced approaches and applications of energy footprints toward the promotion of global sustainability. *Applied energy*, *261*, 114415.

Delgado-Antequera, L., Gémar, G., Molinos-Senante, M., Gómez, T., Caballero, R., & Sala-Garrido, R. (2021). Eco-efficiency assessment of municipal solid waste services: Influence of exogenous variables. *Waste Management*, *130*, 136-146.

Gasser, P., Lustenberger, P., Cinelli, M., Kim, W., Spada, M., Burgherr, P., ... & Sun, T. Y. (2021). A review on resilience assessment of energy systems. *Sustainable and Resilient Infrastructure*, *6*(5), 273-299.

International Energy Agency–IEA. (2020). World Energy Balances 2020 edition.

International Strategi for Disaster Reduction (ISDR). (2005). Hyogo Framework for Action 2005-2015-Building the Resilience of Nation and Communities to Disaster, Japan: United Nations Publication.

Kalinin, M., Krundyshev, V., & Zegzhda, P. (2021). Cybersecurity risk assessment in smart city infrastructures. *Machines*, *9*(4), 78.

Kelnberger, M. (2018). The smart city concept: A review concerning sustainable risk management. *Sustainable Risk Management*, 235-249.

Laituri, M., Davis, D., Sternlieb, F., & Galvin, K. (2021). SDG Indicator 11.3. 1 and Secondary Cities: An Analysis and Assessment. *ISPRS International Journal of Geo-Information*, *10*(11), 713.

Mousavi, S. R., Rashedi, H., & Nabi Bidhendi, G. (2018). Role of crisis management in reducing socio-psychological vulnerabilities after natural disasters (case study: citizens of Bam city). *Environmental Energy and Economic Research*, *2*(3), 187-196.

Nalbandyan, G. G., & Khovalova, T. V. (2018). The Concept Of Internet Of Energy In Russia: Drivers And Perspectives. *Strategic decisions and risk management*, (3), 60-65.

Poudyal, R., Loskot, P., Nepal, R., Parajuli, R., & Khadka, S. K. (2019). Mitigating the current energy crisis in Nepal with renewable energy sources. *Renewable and Sustainable Energy Reviews*, *116*, 109388.

Rahayu, P, and, Mardiansjah, F. H. (2018). Characteristics of peri-urbanization of a secondary city: a challenge in recent urban development. IOP Conf. Ser.: Earth Environ. Sci. 126 012164.

Raza, M. Y., Wasim, M., & Sarwar, M. S. (2020). Development of Renewable Energy Technologies in rural areas of Pakistan. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, *42*(6), 740-760.

Roberts, Brian O, and Anyumba, Godfrey O. (2022). The Dynamics of System of Secondary Cities in Africa: Urbanisation, Migration, And Development. Cities Alliance: African Development Bank.

Salgues, B. (2018). *Society 5.0: industry of the future, technologies, methods and tools*. John Wiley & Sons.

Stoner, A.F. James. (2000). Management. New Jersey: Prentice-Hall Inc.

Ullah, F., Qayyum, S., Thaheem, M. J., Al-Turjman, F., & Sepasgozar, S. M. (2021). Risk management in sustainable smart cities governance: A TOE framework. *Technological Forecasting and Social Change*, *167*, 120743.

Wijoyo, S., Thalib, P., & Kholiq, M. N. (2022). Reconstruction Of Good Corporate Governance In The Order To Realize Indonesia Incorporated As A Welfare Country (Regulatory-Deregulation-Reregulation Perspective Of The Jatimnomic Model). *Airlangga Development Journal*, *6*(1), 44–54. https://doi.org/10.20473/adj.v6i1.33531 (Original work published June 20, 2022)

Zhang, J., Huang, G., Liu, L., Zhai, M., Xie, Y., Xin, X., & Meng, H. (2021). Economic sensitivity analysis of dual perspectives induced by energy scarcity for energy-dependent region. *Science of The Total Environment*, *768*, 144876.

Zhilkina. (2014) Economic mechanism of innovative management of energy security, III. Manyakin readings. Materials of the international scientificpractical conference.

Zhu, D., Mortazavi, S. M., Maleki, A., Aslani, A., & Yousefi, H. (2020). Analysis of the robustness of energy supply in Japan: Role of renewable energy. *Energy Reports*, *6*, 378-391.