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Nuclear Energy Policy Draft as an Alternative to Support National Resilience

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Abstract. *This article analyses the nuclear energy policy model relevant to such countries as the United States of America, Russia, France and Japan. Moreover, this article also considers the international organizations, for example the International Atomic Energy Agency, as the supervising body in the field of nuclear energy programs and their security. The process of developing nuclear energy program must be well planned and must incorporate security, safety and environmental factors. Consequently, this nuclear energy policy must address all factors technical, economic, social-political and environmental factors underlying nuclear energy production.In this case, the IAEA and other international organizations contributing to stable and secure nuclear power usage are quite significant to the fulfillment of this requirement.great potential as an energy source that can reduce dependence on the use of fossil energy sources that are increasingly scarce and are often claimed to cause environmental damage. However, the use of nuclear energy also has risks that must be managed properly, such as nuclear accidents and the risk of terrorism. Several countries have developed their nuclear programs with the aim of meeting domestic energy needs and also as a national defense strategy. However, the development of this nuclear energy program also poses challenges in terms of security and safety. This article discusses the nuclear energy policy model that has been implemented in countries such as the United States, Russia, France, and Japan.*

Keywords: *Policy Model, Nuclear Energy, Alternative Energy, National Defense*

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INTRODUCTION

Energy is one of the most valuable resources for every country, in fact, man can only survive with water, food, and energy. Agriculture, industries, domestic use, all needs energy; if this is not available, all activities of production and consumption will be affected in their process of development of a country. So, it is absolutely necessary for every country in the world to seek for a secure, efficient and renewable energy supply. As one of the prospective energy sources, nuclear energy is already under development by several counties. This of course because energy is essential in sustaining life as well as fuelling development of people and the economy. As the result, in 2019, more than 26,000 TW/hour of electricity was produced globally through fossil fuels, nuclear energy, solar and water and wind among others. Electricity generation and consumption are comprehensively responsible for emissions of greenhouse gases and hence globally, climate change. Climate change which is also referred to as Global warming is among the toughest issues the world has to work on right now. The Intergovernmental Panel on Climate Change (IPCC) has described global warming as the warming of the average land, air and sea surface temperature calculated for the period, 30 years in a year.

China's coasts dislocated from the locations of producing coal and gas while, the fast-growing economy brings energy deficiency. It is clear, therefore, that there is this need and a

crying need to foster nuclear energy. Furthermore these areas have abundant and suitable site availability for building nuclear factories to effectively harness nuclear energy. The speed to construct buildings for what is known as the "three supporting legs" of Hydroelectricity power station, Nuclear power station, and Coal power station is helpful toward sustaining economic development but can decrease emission (Peng et al., 2019). As a policy model of an alternative energy for nuclear energy in supporting the needs of national defense, it should be taken into account by every country that wants to strengthen its defense capabilities. This is because nuclear energy carries some perquisites over other conventional energy forms like fossil based and renewable energy (Suman, 20180.

The first of such benefits is the high efficiency of utilization of nuclear energy when compared with other types of energy available in the market today. In one nuclear reactor, the same amount of energy is generated as in a hydroelectric power plant with larger territory. Also, nuclear energy has comparative advantage over fossil fuels since it has the least impact to the natural environment owing to non-emission of greenhouse gases. Nuclear energy derives from the nucleus, the inner center of the atom which is made up of two types of particles in the atom that we have already learnt as protons and neutrons (Murray & Holbert, 2014). Nuclear energy can be produced in two ways: Nuclear fission where a large atomic nucleus breaks up into a number of pieces; or nuclear fusion where two light atoms combine to form one (Mathew, 2022). Nuclear energy has attracted full attention of policymakers globally, since it has so much potential in preventing environmental degradation and sustaining the economic development rate. The previous studies also indicated that Based on the survey conducted by online questionnaires in China, with a sample size of 933, the perspective taking had a significant and positive correlation to the energy policy involvement. There is significant correlation between energy policy involvement and trust in government and perceived benefits however, energy policy involvement has negative relationship and has significant correlation with perceived risks. It was evidenced in the study by Wang et al. (2020) that the perceived benefits have a positive relationship with the acceptance of nuclear energy from the government while perceived risks have a negative though significant relationship with the acceptance of nuclear energy from the government.

Nuclear energy also has been one of the form of energy that has the capacity to enhance energy security of the country. Here the country should exploit its skills to develop nuclear energy facilities, to ensure that it is not a consumer from any other source of power. This will enhance a country's energy security. But it is also a fact that nuclear energy has some issues which were remained unsolved for the development of nuclear energy. The security and safety of the system play a key role of one of the major challenges being encountered (Tabrizchi & Kuchaki Rafsanjani, 2020; Bouma & McBratney, 2013). Project construction, particularly nuclear reactors, required safety standards that will help avoid the destruction of the environment and human life. The multilateral intergovernmental organisation of the International Framework for Nuclear Energy Cooperation increases the proliferation of nuclear energy for peaceful purposes in a safe, efficient and secure way in order to prevent the spread of nuclear weapons and enhance nuclear safety. The IFNEC Permanent Working Group helps to develop advanced nuclear energy and small modular reactors and actively discusses related seminars on the development and deployment of nuclear energy (Zhan et al., 2021). In our current work we continue and extend some aspects of the work carried in our earlier project from previous year which was focused on exploring CO2 mitigation potential of different nuclear energy growth scenarios to estimate how much more atmospheric CO2 could be avoided through nuclear power in near to medium term future or up to the year 2040. We then considered the amount of uranium resources required, and turned to consider fresh nuclear technologies which would more efficiently use uranium (Muellner et al., 2021; Gabriel et al., 2013).

Second, together with the intention to use nuclear energy as a kind of energy, the possibilities of the spread of nuclear weapons also could be increased. And so all the countries who seek to develop nuclear energy infrastructure have to be bound by regulations of the International Atomic Energy Agency (IAEA) (Canton, 2021; Perez, 1993). These are factors that

the nuclear energy policy model should incorporate economic factors In addition as well. Generally it can be noted that the setting up of nuclear energy needs large amounts of capital outlay and extremely high establishment costs. Hence, each country must ensure that the prospect for development of nuclear energy must be capable of giving the country sufficient immensity economic encouragements. The current contribution of nuclear energy to climate change mitigation is small and, according to current planning, will remain at this level in the near to medium term. A nuclear expansion strategy is not feasible due to resource constraints. New nuclear technology without such limitations will not be ready in the critical time frame of 2020 to 2050 due to the long research, licensing, planning and construction times of the nuclear industry (Muellner et al., 2021). Previous research results showed that The results showed that CI decreased in the range of 43%e53% compared to 2005 considering five economic growth conditions in 2020. Furthermore, Fujian will achieve the national goal earlier because EC is controlled and the nuclear energy ratio increases to 16.4% (the proportion of non-fossil in primary energy is 26.7%). Finally, the development of nuclear energy in China and the world is analyzed, and some policies for energy optimization and CI reduction are proposed (Peng et al., 2019).

Global warming appeared as a problem from the issue of climate change that made intellectuals to shift focus to clean energy from dirty energy sources. However the results of the use of nuclear energy to feed pollution emissions need much more research and consideration. Hence, this study seeks to extend the understanding of this relationship by examining the role of nuclear energy in explaining the bewildering relationship between economic growth and CO2 emissions in the context of a developing country, Pakistan, during 1973–2017. For environmental pollution, the auto-regressive distributive lag model concludes that nuclear energy is a negative variable because it emits carbon into the atmosphere. Moreover, the Granger causality vector error correction shows that nuclear energy and carbon emissions are reciprocally causally related (Mahmood et al., 2020). But of course nuclear energy policy is not only with reference to the set up and utilization of nuclear power and equipments but also to do with general and country energy policies. Previous research has discussed the theoretical link between nuclear energy and carbon dioxide emission in terms of territorial (or production-based) carbon dioxide emission (Ulucak & Erdogan, 2022; Wang et al., 2023).

This study aims to evaluate the potential of nuclear energy in mitigating climate change with a focus on its role in reducing greenhouse gas emissions globally. In addition, this study attempts to compare the efficiency of nuclear energy with other energy sources, such as fossil and renewable energy, and assess the safety of developing nuclear reactors in accordance with international standards. By examining the relationship between energy policy, public trust, and perceived benefits and risks, this study also aims to identify factors that influence public acceptance of nuclear energy.

This study also examines the economic impact of nuclear energy development, including the need for large investments and potential long-term benefits for national energy security. In addition, this study explores the latest nuclear technology that is more efficient in utilizing uranium, as well as the relationship between nuclear energy, economic growth, and carbon emissions in developing countries. Thus, this study provides a foundation for developing a nuclear energy policy model that not only supports economic development but also maintains environmental sustainability.

METHODS

The method employed in the research occurs in the form of a literature review with regards to the nuclear energy policy model as an option energy for supporting national defence. Thegoogle.com was used for the search by typing Nuclear energy and Nuclear energy Both the entries were critically appraised. A literature analysis shows that there are 10 literature journals that address the nuclear energy policy model as an alternative energy for supporting national defense, and all these are international and national publications.ing the phrase "nuclear energy

and nuclear energy" which was then assessed using critical appraisal analysis. There are 10 literature journals that discuss the nuclear energy policy model as an alternative energy in supporting national defense, all of these publications are international journals and national journals.

RESULTS AND DISCUSSION

Root Definition of Nuclear Energy Policy Model for Resilience

National Energy in Support of National Defense

The root definition in this study will be formulated in two questions that represent the research questions. In accordance with the SSM theory, the discussion of the root definition uses the PQR formula which is needed to answer the questions What, Why, and How. The PQR formula in question is as follows:

" Do (do) P, with (by) Q, to achieve (in order to achieve) R"

Next, the formulated root definition will be tested and refined with the analysis of Customers, Actors, Transformation, Worldview, Owners, Environment (CATWOE). Identification with this CATWOE analysis is in accordance with the steps of SSM data processing. The conceptual model that will be created later uses the basis of the results of the CATWOE identification. Then, the results of the CATWOE that have been determined will be further analyzed with the "3E" criteria from SSM to measure the performance of the activity system. The "3E" analyzed in this study basically has a "5E" structure, namely efficacy (whether the transformation process can really realize the desired results), efficiency (whether it can take place efficiently/with minimal use of resources), effectiveness (can it help achieve long-term goals in the PQR formula), elegance (can it take place elegantly), and ethicality (can it be justified morally). However, in this study, only "3E" will be measured, namely efficacy, efficiency, and effectiveness; where the effectiveness assessment here will also answer the research object:

Table 1. Nuclear Energy Policy Research: Relevant Research Questions and Systems

Root Definitions	Research Questions (in the form of statements)	Relevant System
RD1	Condition of Energy Resilience in Indonesia in Peaceful Conditions and Emergency Conditions	Deepening the nuclear energy policy model (P) by strengthening regulations, increasing investment in nuclear technology, as well as public education and infrastructure readiness (Q), to achieve national energy security that is stable, sustainable, and supports the country's future defense (R).
RD 2	Aspects of Stakeholders' Acceptability of New Energy Sources, Especially Nuclear	Conducting education and outreach to the public (P) with a transparent approach, active community participation, and media involvement in disseminating information (Q), to achieve increased public acceptance of nuclear energy as a new, safe and sustainable energy source (R).
RD 3	Nuclear Energy Policy Model for Energy Security in Support of National Defense	Developing a national nuclear energy policy (P) by integrating strict regulations, improvements in nuclear technology (Small Modular Reactors - SMR), and synergy between related institutions (Q), to achieve energy security that supports national defense and ensures stable

		and safe energy availability in times of peace and crisis (R).

Source: Processed by Researchers (2024)

As a source of alternative energy nuclear energy has recently drawn significant public attention. A large number of countries today seems ready and willing to embark on the formulation of nuclear energy policies as a part of their defense systems. However, one should also remember that the usage of nuclear energy also has its drawbacks and problems that exist. Nuclear energy is roughly defined as an energy that originates from nuclear reactions that occur within the atomic nucleus. Saying that, nuclear energy has a much greater capacity and energy density that makes it become the option compared with the already scarce fossil energy. The mentioned nuclear energy policy model consist of several components, namely regulation and supervision, radioactive waste management, and further development of enhanced security of nuclear energy. New regulation and supervision are required to prevent similar catastrophes or terrorist plots that endanger the nation's security. Nuclear power as one of the alternative energies generated to fulfil electricity demands is effort made to reduce reliance on fossil energy which is the dominant energy type used to meet electric power demands in humanity (Septiningsih et al., 2020).

The findings of the QQ estimator presented below in most of the quantiles it identified that nuclear energy has a negative impact on the environmental of US, France, Russia, South Korea, Canada, Ukraine, Germany, and Sweden. However, feedback from Spain and China indicate that Nuclear Energy Consumption (NUC) has a negative influence on the environment. Furthermore, the evidence from the causality test show that while the levels of nuclear energy and CO2 emissions were able to predict each other most quantiles of the distribution. The following could be another threat to the security, safety of Nuclear Energy in Nigeria Atributing the nature of discord, whether tribal, political or religious in nature. There are tendencies for some secret cabals to go down unlawful activities which endanger safest practices according to the International Nuclear Energy Standards to become the stronger party and/or to become rich (Ishola et al., 2019).

Different countries and states have adopted different policies towards dissemination of nuclear technology and its application. Nations have seen a certain degree hold advanced nuclear programs or have no nuclear programs at all. Most countries develop nuclear program for different reasons that including nuclear power generation, research and development on nuclear technology or nuclear weapons. Any country which wants to possess nuclear weapons must follow certain standard rules and policies of the International Atomic Energy Agency (IAEA) as well as the nuclear non-proliferation treaty which prohibits countries from getting nuclear weapons. Since the occurrence of nuclear accidents, the management of the adverse effects that may be occasioned by the use of nuclear energy is one of the most significant issues of concern for countries participating in nuclear technology. The results of previous studies indicated that empirical results proved the Fukushima nuclear affect the global nuclear energy market most, then Korea's nuclear expansion, and the smallest contagion by Nuclear phase out policies by Germany, Korea, and France. The use of nonlinear dependence test revealed more evidence of contagion than the use of linear dependence test hence identifying that asymmetry and extremity in dependence are crucial factors useful for determining contagion risk in the nuclear energy market (Hsiao et al., 2021). It is clear that nuclear science can possess enormous potential in diverse sectors, including medical, farming, and energy, but it can be very dangerous if inappropriately controlled. Consequently, it is essential for the countries to abide the stated international regulation and standard in the exploitation of nuclear technology.

Pursuant to the Government Regulation No. 14 of 2015 concerning RIPIN 2015-2035, energy deficiency has started to emerge and for the sustainability of industrial development

energy conservation and diversification policies are required besides focus on the production of renewable energy sources and cheap and safe nuclear energy (Ruslan, 2021). The strategy of nuclear energy as one of the alternative energy sources that support national defense in Indonesia must be thought through carefully when nuclear as it is a capacity that carries major risks and impact for the environment and mankind in the case of accidents or misuse. But if this policy is carried out completely and stands for safety requirements, nuclear energy would bring significant advantages for Indonesia in addressing challenges of national defense. Some of the potential benefits of nuclear energy in Indonesia are as follows: 1) Energy independence, namely nuclear energy can be an independent source of energy for Indonesia itself so that Indonesia does not need to rely on the import of energy sources from other countries which of course an insecure situation in a crisis; 2) Policy targets that affect nuclear energy mean lesser greenhouse gases emitted from the burning of fuels, the major causes of air pollution and global warming; 3) Enhancing national security, that is, nuclear energy can be used for various national matters such as in construction of nuclear weapons and can assist in fortifying the national defense system, for instance; border protection and weather and weather measurement.

Based on the research done in the past, the Republic of Indonesia has enormous potential for new RE resources such as geothermal, water, wind, bio energy (bioethanol, biodiesel, biomass), ocean current, nuclear and solar energy. All of these sources can be applied or put to use in virtually any region of the country. People's awareness of this new renewable energy is required to enhance the awareness of protect environment and bolster the development and utilization of renewable energy; the utilization of this potential on a small scale Requires enhancing people's awareness of encouragement for domestic energy (Al Hakim, 2020).

Other studies and research conducted under the PPLH Law reveal that people and companies might face criminal sanctions for environmental nuclear disaster. Other Rules are the Supreme Court of the Republic of Indonesia Number 13 of 2016 Regulation about the Process of Handling Criminal Acts by Corporations because the PPLH Law has a lack of clarity on corporate criminality. Civitas, ultimum remedium, as the last resort, was used to provide for the punishment for utilizing the nuclear weapon that impacts the environment (Tolang et al., 2020).

The development of nuclear energy policy in Indonesia requires considering several factors to be taken. Nonetheless, Indonesia has also a great challenge to guarantee that the technologies and structures necessary for controlling nuclear energy are available and in good conditions. Second, relevant authorities in Indonesia have to ensure that most of the workers in the nuclear sector are trained, informed of risks, and their responsibilities concerning the security and safety. Third, Indonesia must rely on the countries of the world to purchase the technologies and knowledge required to manage nuclear energy. Security issues together with the environment, health issues, financial aspects of Indonesia's future, as well as the overall scenario of the country's advantages have to be considered in the establishment of nuclear energy policy of Indonesia. In the same way, Indonesian government needs to convince all the people of the nation about the benefits and risks of nuclear energy policy and address them properly and clearly. Specifically for operational states, our evidence suggests that states which possess at least one nuclear warhead are more likely to continue relying on nuclear energy than to cease their reliance on it altogether. In addition to energy and environmental considerations, we discuss the less recognized political and democratic dimensions of nuclear power in the process of the public policy debate on nuclear power utilization (Neumann et al., 2020).

Russia can afford to be involved in active energy diplomacy due to its significant energy reserves that provoke interest of various foreign governments and companies (Aalto et al., 2017). To fine-tune our insight into how Russian actors envision leveraging of their large stock of advantages related to the nuclear energy industry, we leverage the structuration perspective. However, the presented study suggests that Russia's nuclear energy diplomacy has to get to the international markets of the target countries as well as serve several purposes.

Another very important aspect of nuclear energy policy is waste disposal in social studies. Due to the hazard that radioactive waste possess to the environment and the health of people, they should be managed properly. Nuclear energy strategy should also focus on increasing the reliability of using nuclear energy. This includes such as the adoption of more stable fuels and development of safer technology. National security can benefit from the process of expanding nuclear energy as another type of energy in the following ways: the reduction of the level of CO2 emissions and the degree of reliance on imports of energy resources. These are some of the challenges that faces nuclear energy development: High costs, Accidents, and issues to do with the safe disposal of radioactive waste. Since nuclear energy can produce energy in large volumes and continuously, it hold a lot of promise in the area of alternative energy source. In addition, nuclear energy is considered environmentally friendly energy because it doesn't release green house gases into the atmosphere.

The findings of previous studies indicate that the aspects of the self-management constructs are obtained as follows: (1) Accessibility and acceptability are priorities to improve the top-down and bottom-up cross-sectoral coordination management system, namely the central and regional governments in constructing nuclear power plants with involving the local communities from the planning stage; (2) The affordability of making technical designs by BATAN with SMR (Small Modular Reactor) technology in constructing commercial-scale

Prăvălie and Bandoc in Aalto et al. (2017) offers a perspective on how nuclear energy can provide energetic, climatic and environmental support in the shift to low carbon energy mix. The article strengthens the calls for the continued use of nuclear power in a number of countries and the need for safe energy generation but dwells mainly on the generation problems and dangers of nuclear waste. Possible application of nuclear energy in supporting national defense is mainly connected with using the nuclear technology for impending military application. Nuclear energy is also applied in other platforms like in portrays the generation of nuclear energy and the testing of nuclear weapons. The safety of nuclear energy is the key to the utilization of this source of energy. The nuclear energy policy model must incorporate this safety feature which must guarantee safe utilization of nuclear energy. The other unavoidable risks that are associated with nuclear energy include: Inherent risk associated with nuclear power includes the risks which nuclear energy endangers human life and poses grave dangers to human health and the environment in the case of nuclear accidents and disasters.

These risks are much of a concern to the nuclear energy policy model and the model must do all that it can to avoid a nuclear tragedy. The government plays an important role in the development and use of nuclear energy. The nuclear energy policy model must ensure that the government is responsible for supervising and regulating the use of nuclear energy. The results of previous studies show that the findings of this analysis indicate that Rosatom, with the influence and support of the Russian government, can dominate the world nuclear energy market. Rosatom is a state-owned company established by Russia with the aim of maximizing revenues from nuclear energy exports to improve the country's economy and international political power (Bukhari, 2021).

CONCLUSION

Based on the description above, it can be concluded that the development of nuclear energy as an alternative source of energy in energy security supports national defense. However, this development must be carried out carefully and pay attention to safety and security aspects, both in terms of technology and policy. In addition, there also needs to be an effort to educate the public about nuclear energy so that they understand the benefits and risks of its use. In the long term, the development of nuclear energy can make a positive contribution to national defense and also national economic development.

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