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The Political Economy of Energy Alteration in Indonesia: The Role of Coal and Mineral in New and Renewable Energy Alteration

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Abstract

The world's energy sources have seen various transformations, with the majority first relying on biomass such as firewood to satisfy their energy demands, before transitioning to fossils such as coal, oil, and natural gas as a result of the industrial revolution. Indonesia faces issues in satisfying its domestic energy demand. Dependence on fossil energy sources presents its own challenges. The purpose of this paper is to address three questions: first, to reiterate the importance of developing more comprehensive energy transition strategies in Indonesia. This is accomplished by comparing data on the availability of energy sources to data on Indonesia's expanding energy demands. Second, how to establish an energy transfer policy that takes into consideration Indonesia's conditions and potentials, as well as the problems that must be solved. Third, how to position the mining and coal sector as a key component of the energy transformation process, especially given the long-term character of the transformation process, while reaching energy sufficiency is a problem that demands immediate attention. Using qualitative methods with case studies, It showed that a number of prerequisites need to be met to make coal and nickel a transitional element, namely: infrastructure, resources, economic aspects, and national energy policies. To increase the contribution of New and Renewable Energy in the National Energy Mix, there are still a number of problems and challenges, both from the policy and regulatory aspects to support the development of NRE, the aspect of providing accurate data, the financial aspect for developing NRE for private investors, and the aspect of providing technology and infrastructure to support private investment in the NRE sector.

Key Words: Political Economy, Energy Alteration, Coal, Nickel, Indonesia.

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INTRODUCTION

In recent years, the notion of "sustainable development" has grown in popularity. Unlike past development conceptions, this one has begun to be addressed with a greater emphasis on environmental considerations (Rozali, R., Mostavan, A., & Albright, S., 1993: p. 173). In contrast, one of the most critical components in attaining sustainable development is energy (Khan, H., Khan, I., & Binh, T. T., 2020: p. 859). The world's energy sources have seen various transformations, with the majority first relying on biomass such as firewood to satisfy their energy demands, before transitioning to fossils such as coal, oil, and natural gas as a result of the industrial revolution in the 1900s (Pertamina, 2020). Industrial activities and utilization of natural resources that occur continuously will cause negative externalities to the environment in the form of pollution and environmental damage. Externalities occur when a person carries out an activity that has an impact on others, both in the form of benefits and external costs that do not require an obligation to receive or pay for it. One of the negative externalities for the environment due to economic growth is climate change which has become a world issue (Astuti, 2015: p. 50).

According to preliminary assessments, Indonesia, like other rising market nations, faces issues in satisfying its domestic energy demand (Winanti, et. al: 2019). Indonesia's energy demands are fast growing as growth and industrialization proceed, and this trend is expected to continue. According to the most recent data from Sritrisniawati, et. al (2022), the percentage of Indonesia's energy consumption increased by an average of 3% per year from around 99 Mtoe in 1990 to 237 Mtoe in 2019. Indonesia's primary energy consumption per capita grew by 1.5 percent each year, from 0.71 Tonnes Oil Equivalent (toe)/capita in year 2010 to 0.76 toe/capita in year 2015. So far, fossil energy sources such as oil, natural gas, and coal have fulfilled 91.45 percent of the rise in energy consumption demands (National Energy Council, 2019: p. 7).

Indonesia, on the other hand, has pledged to reduce greenhouse gas emissions by 26-41 percent (26 percent by self-funding and 41 percent with aid from foreign/donor nations). It was established during the presidency of President Susilo Bambang Yudhoyono by Presidential Regulation No. 6 of 2011 addressing the National Action Plan for Reducing Greenhouse Gas Emissions. Then, President Joko Widodo reaffirmed his goal to decrease emissions by 29-41 percent by 2030. The commitment to 2030 was confirmed with the passage of Law No. 16 of 2016 on the Ratification of the Paris Agreement to the United Nations Framework Convention on Climate Change (Paris Agreement on the United Nations

Framework on Climate Change). Indonesia is the world's sixth largest emitter nationally (Andersen et al, 2016: p. 31).

Dependence on fossil energy sources presents its own challenges. First, considering that the availability of petroleum is no longer reliable, the fulfillment of the energy demand for oil is met through imports, thereby contributing to Indonesia's trade balance deficit. Second, Indonesia is rich in renewable energy resources such as geothermal, biodiesel, diesel, wind, and hydro. However, the potential of renewable energy resources has not been optimized to meet national energy needs. Third, the fulfillment of national energy needs must be placed in the context of the energy alteration process or the transition from fossil energy to renewable energy.

In order to achieve sustainable development, we must address the issues of economic growth and reliance on fossil fuels. The purpose of this paper is to address three questions: first, to reiterate the importance of developing more comprehensive energy transition strategies in Indonesia. This is accomplished by comparing data on the availability of energy sources to data on Indonesia's expanding energy demands. Second, how to establish an energy transfer policy that takes into consideration Indonesia's conditions and potentials, as well as the problems that must be solved. Third, how to position the mining and coal sector as a key component of the energy transformation process, especially given the long-term character of the transformation process, while reaching energy sufficiency is a problem that demands immediate attention.

METHOD

The author built a research design using qualitative methods with case studies. Qualitative writing methods present a form of data collection and analysis that focuses on emphasizing and understanding meaning. The data collected comes from official documents and other supporting documents. The author in this method makes interpretations of what he sees, hears, and understands (Edmonds and Kennedy, 2017: p. 141), based on research questions, conceptual framework and research design. The author then examined the collected data to identify patterns and themes. Through this qualitative study, readers are expected to gain valuable insights into this case.

THEORETICAL FRAMEWORK

Energy Alteration

There is no firm or universal definition of what is meant by an energy alteration. One of the most basic definitions of energy alteration is "... a shift in an energy system, generally to a specific fuel source, technology, or primary mover.." (Sovacool, 2016: p. 203). However, the energy alteration can also be interpreted in a broader sense, which "...includes technological shifts as well as the resulting "constellation of energy inputs and outputs involving suppliers, distributors, and end users, as well as institutions of regulation, conversion, and trade.... or structural changes in the way energy services are delivered" (Sovacool, 2016: p. 203). The word energy alteration is also frequently used to refer to energy transformation or energy revolution, both technologically and socially, which focuses on increasing access to energy. The term alteration energy is also often associated with energy transformation or energy revolution, both technologically and socially, which focuses on expanding access to energy that is sometimes scarce. (Sovacool, 2016: p. 203).

The literature review on energy alteration can be divided into two main perspectives, namely energy alteration as a 'socio-technical alteration' (Kern & Markard, 2016) and energy alteration in the perspective of 'energy democracy' (Burke and Stephens, 2017; 2018). As a 'socio-technical alteration', energy alteration does not only require broader technological innovation (Kern & Markard, 2016) but also considers the socio-economic impact of the alteration process. This perspective, also known as the 'Socio-Technical Energy Alteration' (STEA) model, appears to criticize the energy alteration model which tends to ignore social factors and socio-political dynamics and the involvement of these aspects in the alteration process (Li, Francis. GN, Trutnevyte, E. and Strachan, N. (2015).

Furthermore, this model argues that energy alteration is not only about how to improve technological capabilities and capacities but also requires a more comprehensive understanding of changes in the economic, political, institutional and cultural aspects of the alteration process (Berkhout, F., Marcotullio, P. ., and Hanaoka, T. (2012). In other words, this model also emphasizes the importance of adopting a wider system in the energy alteration process which includes not only technological aspects but also social and institutional elements (Li, Francis. GN, Trutnevyte, E. and Strachan, N., 2015) Based on this STEA model, there are at least three main elements that can support the success of the energy transition, namely: policy interventions based on scientific evidence, conceptualization of the behaviour of individuals and dominant actors in policy making, and assessment on the normative goals to be achieved by me through the adoption of new technologies and the dynamics that accompany them (Li, Francis. G. N., Trutnevyte, E. and Strachan, N., 2015: p. 7).

A number of scholars have created the model to supplement the current STEA Model by incorporating larger societal movements in the energy transition process. To be effective, the energy transformation process necessitates what is known as 'energy democracy.' Born from social movements in developed countries fighting for issues related to climate change and the environment, 'energy democracy' is a new concept that attempts to integrate policies related to social justice and economic equality in the transition to renewable energy (Burke and Stephens, 2017: p.35). According to Burke and Stephens (2017: p. 37), in the context of 'energy democracy,' the transition to 100 percent renewable energy is also an effort to combat the dominance of fossil energy sources.

According to Burke and Stephens (2017: p. 37), the transition to 100 percent renewable energy is also an endeavour to combat the dominance of fossil energy sources and to reclaim control of the energy sector by the wider community and the public. Energy sector restructuring may also be seen as an endeavour to encourage a more democratic process, justice, and social inclusion, as well as a more sustainable environment. In essence, democratic energy highlights the critical role of communities and social movements in achieving community-based sustainable energy (Burke and Stephens, 2018). Proponents of 'energy democracy' claim that without a broader societal reorganization of power relations that is now taking place, the energy transition would merely prolong an unjust system, reinforce dominating players, and continue to marginalize those who have been marginalized in society. Managing the Energy Sector (Burke and Stephen, 2018: pp. 79-80). As a result, the energy transition to new and renewable energy is viewed as a political process and struggle with two key goals: achieving renewable energy while enhancing democracy.

This study adopts a view of energy transition that differs from the two traditions; nonetheless, numerous changes must be made in light of Indonesia's socio-political dynamics. As a result, in order to comprehend Indonesia's energy transition, this study will also employ an international political economy (IPE) approach. As previously said, the energy transition is a process driven by the interplay of political and economic elements that cannot be divorced from the context of global events.

International Political Economy Approach on Energy Alterations

According to Van de Graaf et. al (eds), (2016), the International Political Economy (EPI) approach will be useful in understanding the energy alteration process in Indonesia for at least the following three main reasons:

1) In understanding energy alteration, the EPI approach emphasizes the importance of political aspects and the role of dominant actors in the energy industry. These actors are not only multinational companies and various international organizations (established by both state and non-state) but also the so-called epistemic communities engaged in environmental issues. These actors control key resources and therefore have the ability to advance their interests at national and international levels.
2) The EPI approach underscores the interests of domestic actors which are not only diverse but also competing with each other. Therefore, in formulating its national policy on energy alteration, the government of a country is influenced by considerations and calculations of various interests of dominant domestic actors. The interests of these actors influence the decisions taken, for example related to targets and priorities in the alteration process, the development of appropriate technology, as well as the institutional design that is formed.
3) In the EPI approach, energy alteration is also concerned with the question of who benefits and loses in the process or what is known as the "distributional consequences of transitions". In this context, to a certain degree, energy alteration in the EPI approach is close to the idea of "energy democracy" which also emphasizes the importance of energy alteration as a change in configuration and energy management that is more equitable or "just transition".

Using the EPI approach, energy alteration is defined in the Indonesian context as the transition of energy from fossil sources, including associated technologies, to cleaner, renewable, and more sustainable energy. The primary goal of this change is to ensure national energy security, which involves ensuring the availability, ease of access, and affordability of energy sources for the general public. With this interpretation, it is clear that the transition from fossil energy to new and renewable energy is a long-term political process. Several conditions are required for this process. First, political will, which is represented in a country's skill and resilience in devising and executing policies, as well as the presence of institutions to supervise the change process. Second, the ability of the state related to mastery of technology, financial capacity and its ability to develop innovation. Third, it’s not only the availability and capacity of the country's non-renewable energy sources, but also its ability to manage and process sources into usable energy. Fourth, which is no less important, energy alteration requires social acceptance or strong support from the wider community.

In the energy alteration process, several strategies are needed that are adapted to the conditions of each country. The most ideal strategy is that the energy alteration process is carried out by making a direct transition from fossil energy sources to new and renewable energy sources. This strategy not only requires a strong political will from the government and a large amount of social support and acceptance from the community. However, this strategy is only possible if all the previously mentioned requirements are met. Considering the existing conditions, it is almost impossible for this kind of process to be carried out. Even if a country has all the requirements it has, there are obstacles related to the characteristics of (New and Renewable energy) NRE that make the alteration process difficult. For example, NRE production is still very volatile depending on natural conditions, while electricity demand tends to be stable and even continues to increase, thus requiring a more stable energy supply guarantee.

Furthermore, the majority of NRE manufacturing is currently small-scale and can only service local demands. To expand the use of NRE, it is required to develop it in large-scale manufacturing, which, of course, necessitates infrastructure, not only in the production process but also in distribution so that it can be utilized broadly. Furthermore, the features of some NRE sources that must be used promptly necessitate the need of equipment that can transform or at least store them. Another issue confronting NRE manufacturing is societal acceptability. In certain regions, they are still rejected by the community, whether for concerns of security, myths, or the rise of land conflicts.

As a result, before entirely transitioning to NRE, a more viable option to execute is to optimize the most accessible and ecologically benign fossil energy sources as part of the energy mix. The plan in this context is aimed to secure sufficient supply to full-fill energy demands before NRE can be employed as a vast, economical, large-scale, and inexpensive energy source. In terms of availability, given that Indonesia can no longer rely on the supply of petroleum energy sources, coal and nickel for batteries from our abundant deposit has the potential to become energy alteration.

RESULTS AND DISCUSSIONS

The Role of Coal in New and Renewable Energy Alteration

Indonesia is one of the top coal producers with an export amount of 80 percent of total coal output and the level of domestic coal consumption in power plants (PLTU) is about 95 million tons in 2020. Coal's potential in Indonesia is still quite big, thus it is still reasonable to rely on it as a driving factor in the economy. However, in the future, the coal industry must innovate in order to comply with the Paris Agreement, which calls for a reduction in greenhouse gas emissions. The challenge is to grow the downstream coal sector, which includes coal gasification, coal liquefaction, and coal quality improvement. The government also through Omnibus law will provide non-fiscal incentives for coal development such as granting mining permits, and fiscal with royalties of up to 0 percent to boost the economy of coal downstreaming, with these efforts the coal market share is still bright in the next 20 years (Yasin, C. M., Yunianto, B., Sugiarti, S., & Hudaya, G. K., 2021: p. 2).

No.	Downstream Products	Challenge	Policy Proposals
1	Gasification of DME and Methanol	- Big investment - The price of DME must be able to compete with subsidized LPG	- Providing subsidies for DME, if intended for household needs
2	Semi Coke/ Carbon Raiser	- The market is limited to users in the smelter technology RKEF (Rotary Kiln Electronic Furnace)	- There is a government policy that smelters use domestic semi-coke
3	Urea and Ammonia	- Big investment	- Government intervention is required for the off-taker (assigning BUMN)
4	UCG	- Negative environmental image - Domestic technology has not been proven	- Share risks between BUMN and the private sector - Government guarantees are required regarding the continuation of UCG investment
5	Upgrading	- Upgrading technology has not been commercially proven - It is necessary to integrate upgrading technology with PLTU or other technologies to make it commercially viable	- The government encourages PLTU to use upgrading technology
6	Coal to Fuel	- The market is already oversupply - compete with biofuel development	
7	Hydrogen	- The market is not formed yet - There is no infrastructure	- Encouragement/incentives for the use of hydrogen fuel
8	Advanced Materials	- Not yet commercial, still in research and development stage.	- Needs research collaboration - Funding support (government and private)

Figure 1. Coal Downstream Development Priority Policy
(Handoko et. al, 2020)

However, from the figure above, the author agrees that if the government immediately leads the process towards renewable energy alteration so that the interests of all parties, including coal business actors, can be accommodated properly. Of course, to prepare for energy alteration, Indonesia also needs to map the affected industries, regions and communities so that they do not cause a significant economic contraction. I would like to recommend the government to adopt three strategies to reduce the impact of energy alteration. First, conduct a moratorium on the construction of electric steam power plant to reduce the potential for abandoned assets and also to increase the space for the renewable energy mix. Second, electric steam power plants that are still operating and economical need to retrofit, namely to make development more relevant, and more flexible for renewable energy. Third, evaluate the efficiency and preparedness of the electrical system, as well as renewable energy replacement technologies, while planning the acceleration of electric steam power plant shutdown (coal-phase out). For the coal industry, of course, business diversification to a more sustainable and sunrise industry is needed to maintain and improve the company's competitiveness in the medium and long term.

The Role of Minerals (Nickel) in New and Renewable Energy Alteration

Nickel is now a hot topic of conversation around the world. Being an important component in the production of electric vehicle batteries, nickel is a driver of change in energy use. It is estimated that there were 3,269,671 electric vehicles in the global electric vehicle market in 2019 and the number will reach 26,951,318 units by 2030. The higher demand for electric vehicles will automatically make the electric vehicle industry one of the most popular. Therefore, nickel as an important component will be the target of countries in the world (Indonesian Investment Coordinating Board, 2022).

Indonesia will participate in welcoming the electric vehicle trend by promoting energy-efficient cars and accelerating the production of electric vehicle batteries. Presidential Regulation Number 55 of 2019 concerning the Acceleration of the Battery Electric Vehicle Program (Battery Electric Vehicle) for Road Transportation supports the acceleration of production. Based on data compiled by Investor Daily, the Ministry of Industry's website mentions the target number of electric cars in Indonesia. The number of electric cars is targeted to reach 400,000 units by 2025, then increase to 5.7 million units by 2035 (Mailinda Eka Yuniza & I Wayan Bhayu Eka Pratama & Rahmah Candrika Ramadhaniati, 2021: p. 435).

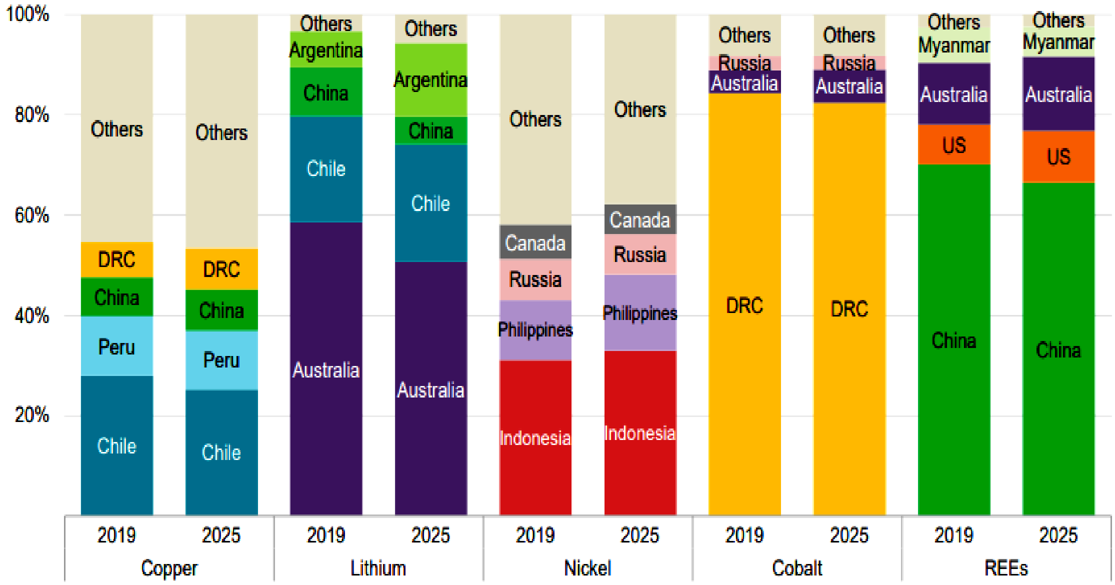

Figure 2. Major Producing Countries of Selected Minerals, 2019 and 2025 (International Energy Agency, 2021: p. 145)

From the figure above, Indonesia has tremendous local resource potential to be at the forefront of the development of the rechargeable battery industry with the strength of local resources. Almost all the main materials for the development of the rechargeable battery industry, except lithium, to support electric cars and new and renewable energy (EBT) are in our country. Synergy between the Ministry of Energy and Mineral Resources (MEMR), and the Ministry of Industry is a necessary thing to do. These two ministries have the power to determine policy directions as well as direct access to the regulation of natural resources and the industrialization of local natural resources for the benefit of the state. Whether we realize it or not, the successful development of the rechargeable battery industry with the power of local resources will have a significant chain effect. Some of these chain effects include the growing growth of interrelated industries, the creation of added value for minerals, as well as cutting imports of fuel oil so that the trillions of rupiah of saved state funds can be used for more urgent matters (World Economic Forum, 2019: p. 16).

In addition, the creation of new jobs, and several other effects related to the independence and sovereignty of the nation. It is time for the Ministry of Energy and Mineral Resources to create a more holistic management of the exploitation and processing of nickel resources. Downstream nickel resources are not solely focused on processing with pyrometallurgical technology which produces ferronickel and NPI (nickel pig iron) as well as nickel matte. Ferronickel and NPI are basic materials for the stainless steel industry, while nickel matte is further processed for other derivative products. This technology tends to only process saprolite nickel ore which has a smaller portion than limonite (Tian, H., Pan, J., Zhu, D., Yang, C., Guo, Z., & Xue, Y., 2020: p. 2579).

Another type of technology, namely hydrometallurgical technology, can be used to process limonite and produce relevant products to support the battery industry. In contrast to pyrometallurgical technology, hydrometallurgical technology can produce cobalt as a by-product of higher value in addition to nickel in various variants as the main product. Ministry of Energy and Mineral Resources needs to create a new governance in the form of limiting the downstreaming of saprolite as well as encouraging the downstreaming of limonite (International Energy Agency, 2021: p. 145).

In fact, almost all smelters in Indonesia produce ferronickel, NPI and nickel matte from saprolite. There is not a single limonite downstream that is running commercially. Saprolite nickel ore is exploited in massive quantities (71.2 million WMT/year in 2021), while limonite nickel ore is only used as cover for ex-mining areas. Whereas the cobalt element which is also needed for raw material for rechargeable batteries is mostly found in limonite (International Energy Agency, 2021: p. 146).

Pyrometallurgical technology has limitations in extracting cobalt in ores. Meanwhile, hydrometallurgical technology has the advantage of extracting almost all precious metals in ores, especially nickel and cobalt. The hydrometallurgical technology has also resulted in adjustable product variants in the form of sulfate or hydroxide compounds of nickel and cobalt. These two types of compounds are indispensable as raw materials for the rechargeable battery industry. The application of hydrometallurgical technology has a direct correlation with the development of the rechargeable battery industry. Another thing that is more strategic is the conservation of nickel ore reserves. However, the massive exploitation of the saprolite nickel ore will one day come to a close. Moreover, nickel ore is a natural resource that cannot be renewed (Tian, H., Pan, J., Zhu, D., Yang, C., Guo, Z., & Xue, Y., 2020: p. 2578).

The policy of relaxing nickel ore exports from the Ministry of Energy and Mineral Resources for several companies building smelters must be limited and ended until January 2021 only. After that the export of nickel ore in any form must be stopped. The Ministry of Energy and Mineral Resources should review a policy in the form of incentives for companies that will develop and process limonite ore with hydrometallurgical technology to be submitted to the relevant ministries and agencies. This does not mean that the application of pyrometallurgical technology is not important, but the population and capacity of smelters that use this technology are already very massive. It is considered more than enough and it is time to limit it because it is almost close to saturation point (Gunawan, A., & Nadir, N., 2022: p. 409).

In addition, pyrometallurgical technology does not have a direct correlation with the development of the rechargeable battery industry which has more strategic value. This rechargeable battery industry will support the nation's independence for the development of electric cars, electronics industry, EBT as well as encourage energy sovereignty in the future. The synergy between the Ministry of Energy and Mineral Resources and the Ministry of Industry and other relevant ministries needs to be improved. The exploration, exploitation and processing of nickel ore into semi-finished products is the domain of the Ministry of Energy and Mineral Resources. Meanwhile, further processing into other downstream products, including for the rechargeable battery industry, is the domain of the Ministry of Industry (National Energy Council, 2019: p. 16).

This includes the used battery recycling industry, because if the battery life cycle has been exceeded, the battery will become a serious waste. Such concerns can be dismissed because the battery can be recycled. As stated in the automotive industry roadmap compiled by the Ministry of Industry, the electric car industry is planned to be realized in 2022. But beforehand, other related industries must be prepared earlier. These industries include the battery industry, PCU (Power Control Unit), electric motors and other similar industries (Mahalana, Aditya, Zifei Yang, and Francisco Posada, 2021: p. 3).

Document	Relevance to EVs
General Plan for Energy (2017)	Uptake targets of 2,200 EVs and hybrid cars (no specification regarding type of hybrid) and 2.1 million electric two-wheeler by 2025.[1]
Presidential Regulation (PR) 55/2019 on Battery Electric Vehicles (BEVs)	Launched in 2019 with the goal of accelerating the uptake of BEVs, but with no quantified target.[2,3]
Ministry of Industry (MoI) automotive production target	• Low Carbon Emission Vehicle (LCEV), which includes hybrid vehicles, PHEV, BEV, and FCEV to cover 20% of annual vehicle production by 2025 and 30% in 2035. • Electric two-wheelers production target of 7,700,000 units in 2025.[4]
National Energy Grand Strategy, Ministry of Energy and Mineral Resources (MEMR)[5]	The timeline of this strategy is 2020-2040. It includes plans to reduce oil imports and promote electric vehiscle development. EV uptake targets in the strategy are as follow: • 2,195,000 of EVs by 2030 (cumulative number)[6] • 13,002,000 of electric two-wheelers by 2030 (cumulative number)

Notes:
[1] Presidential Regulation, Republic of Indonesia No. 22/2017 on General Energy Plan, 2017, https://www.esdm.go.id/assets/media/content/content-rencana-umum-energi-nasional-ruen.pdf. The General Energy Plan is currently under review and new or revised targets may be included.
[2] Presidential Regulation Republic of Indonesia No. 55/2019 on Battery Electric Vehicle, 2019, 2021, https://peraturan.bpk.go.id/Home/Details/116973/perpres-no-55-tahun-2019.
[3] Although the presidential Regulations does not provide quantified targets, it covers the acceleration policy guidance for the uptake of Batter Electric Vehicle that includes two- and three-wheelers, and four-wheelers. For Indonesia, the share of two-wheelers is significantly higher compared to four-wheelers.
[4] The Ministry of Industry, Presentation on Promoting Electric Vehicles in Indonesia, presented in Strategy Development Workshop, 29 September 2020.
[5] The Ministry of Energy and Mineral Resources, Press Release National Energy Grand Strategy to Ensure Energy Availability, October 2020, https://www.esdm.go.id/en/media-center/news-archives/national-energy-grand-strategy-to-ensure-energy-availability.
[6] Presentation by Mr. Hariyanto, Director of Energy Conservation, MEMR, at the virtual workshop "Economic Benefits of Emission Control," organized by Komite Penghapusan Bensin Bertimbel (KPBB), 2 February 2021.

Figure 3. National Electric Vehicle Targets Relevant to Two- and Four-Wheelers (Mahalana, Aditya, Zifei Yang, and Francisco Posada, 2021: p. 3)

From the figure above, especially for the battery industry, it is closely related to the policies of the Ministry of Energy and Mineral Resources, especially in terms of governance for the use of local natural resources. The battery industry also has a direct correlation with one of the flagship programs of the Ministry of Energy and Mineral Resources in terms of the planned portion of 23% NRE in the national energy mix by 2025. The roadmap at the same time provides its own challenges for investors to get involved. The involvement can be from various related fields according to their respective strategic plans. However, in terms of the process path, the battery and battery material industry presents its own challenges that must be answered. The involvement of investors can start from the development of the hydrometallurgical industry to process limonite nickel ore into a mixture of nickel and cobalt compounds. Then proceed with the refining of these compounds to produce pure nickel and cobalt compounds (usually in the form of sulfate and hydroxide compounds) (Mahalana, Aditya, Zifei Yang, and Francisco Posada, 2021: p. 7).

It does not stop there, the involvement of investors can be continued with the battery material industry with the raw materials for the two core compounds plus several other compounds, including lithium compounds, so that battery material (cathode active material) is produced. This material will be the most important material to be packaged with other materials so as to eventually produce a rechargeable battery with the capacity and specifications as needed. The involvement of investors is a necessity so that the roadmap can be realized. For more than 50 years the management of nickel resources has only focused on the export of nickel ore and semi-finished products. There is no continuation of added value creation. It is time for all stakeholders to think creatively and move forward. It is also time for all components of the nation to work together to maintain the dignity of the nation's sovereignty in the fields of empowering natural resources, technology, energy and creating added value. Otherwise, this nation will forever only be the object of the market. They will only be spectators, not actors.

CONCLUSIONS

In general, a number of prerequisites need to be met to make coal and nickel a transitional element, namely: infrastructure, resources, economic aspects, and national energy policies. To increase the contribution of New and Renewable Energy in the National Energy Mix, there are still a number of problems and challenges, both from the policy and regulatory aspects to support the development of NRE, the aspect of providing accurate data, the financial aspect for developing NRE for private investors, and the aspect of providing technology and infrastructure to support private investment in the NRE sector.

1) Aspects of policy and regulation, cross-sectoral policy coordination has not optimally supported the achievement of the target for the contribution of New and Renewable Energy in the National Energy Mix, including those related to the determination of the selling price of renewable energy, licensing issues, and the division of authority between the centre and the regions;
2) Aspects of NRE data accuracy, NRE potential data which is generally a reference source for investors is not yet fully up-to-date and accurate so that it is not optimal to support efforts to increase private investment in the NRE sector;
3) Incentives and funding aspects, the existing incentive schemes have not been effective in increasing investment in the NRE sector, and the existing funding instruments are not yet effective enough to overcome the difficulties of investors in obtaining access to funding to develop NRE;
4) Aspects of research and development, the government's commitment in providing budgetary and non-budgetary support for increasing research and development of investment in the NRE sector still needs to be improved.

To overcome these problems, there are several suggestions for improvement as follows:

1) There is a need for proactive and intensive coordination both cross-sectorally with Ministries/Agencies, and a division of authority between the Centre and the Regions regarding the preparation of a strong legal umbrella and policy framework for the development of New and Renewable Energy while still paying attention to the fairness of energy development between regions;
2) Reviewing and coordinating the updating of NRE potential data by relevant stakeholders to produce accurate and reliable data, as well as presenting comprehensive initial potential data and limitations to investors through an online platform;
3) The government needs to develop new incentive schemes that encourage increased investment and development of NRE infrastructure, such as the provision of interest subsidies, exemption from a *value-added tax* (VAT) on construction services, ease of licensing, and so on;
4) Strengthen monitoring and monitoring and evaluation of various NRE development programs which are clarified through implementation rules so that their implementation can run effectively and the results of the monitoring and evaluation can be used as suggestions for continuous improvement

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