Politik Indonesia: Indonesian Political Science Review, 9 (3), December 2024, pp. 187-207
ISSN 2477-8060 (print), ISSN 2503-4456 (online)

DOI: 10.15294/ipsr.v9i3.11900 © 2024 Politik Indonesia: Indonesian Political Science Review

The Socio-Material Power of Coal: the Downstreamization of Coal and the Energy Transition Challenge

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Abstract
Under the Paris Agreement in 2015, many countries are adaptive to the issue of climate change, especially the energy transition agenda through coal phasing out. However, the issue of coal phasing out has not received enough attention from energy issue researchers. Although as one of the largest coal producing countries in the world, Indonesia faces major challenges for the purpose of mitigating climate change. Under Joko Widodo's government, the situation was responded to with the coal downstream policy. Departing from the formulation of the research problem, the research question of this study: how does downstreamization of coal answer the challenge of low carbon in the middle of coal dominance? The purpose of this study is to test the relevance of coal in answering the challenges of energy transition. This study is an explanatory-qualitative research by using a case study approach strategy with the Jokowi administration's coal phasing out agenda case with a documentation study technique. The results of the research show the increasing importance of coal in driving the energy transition. The relevance is made possible because coal is the country's main support to encourage energy transition with the downstreamization of coal. In this case, the materiality of the biophysical character of the resource allows coal to create a new space in the form of a link in the supply chain of the national energy system in the context of a low carbon economy. The coal material ultimately contains the socio-material power that determines the energy transition.

Keywords:
Energy transition; Coal phase-out; Downstreamization policy; Materialit.

INTRODUCTION

Indonesia's coal industry is a well-established and critical material that underpins and consolidates the country's economy both legally and illegally. The structure and infrastructure of the coal industry has been integrated into the national economic system ensuring the supply of energy to industries and millions of households in Indonesia. This statement is based on the following arguments: first, control over energy, which relies on coal, makes an important contribution to the state being able to convert resources into sources of prosperity through industrialization, development, and even encouraging the birth of new economic sources. Energy is not just a commodity but a resource critical to the metabolic viability of social systems where social forms depend on energy flows (Smil, 2010; Tyfield, 2014). In short, energy ensures that the state has control over economic production where

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the economy has a profound effect on social and political life.

As one of the world's largest coal producers, coal dependency is very high in Indonesia. Indonesia's energy supply is still dependent on coal. Until 2023, the fossil fuel-based electricity energy mix is still around 86% (Kementerian ESDM Republik Indonesia, 2024). Indonesia has 38.84 billion tons of coal reserves which are estimated to last for the next 65 years (Setiawan, 2021). Coal is also one of the main elements in the processing of basic industries such as steel, cement, fertilizer, textiles, paper, and glass. In addition, the coal sector absorbs hundreds of thousands of workers, which absorbs around 150 thousand workers in coal mining plus PLTU operational labor reaching 310 thousand workers (Rah, 2022). Coal also contributes to state revenue through non-tax state revenue (PNBP) (Sandria, 2023).

Second, what energy processes have created a legitimizing base for the state in ensuring public acceptance of state power. There is an important link between the energy regime and certain socio-historical formations that are specific and concrete, not just abstract (Tyfield, 2014). Energy has shaped the state into an engine of freedom through industrial policies that lift people out of poverty and into freedom. The existence of the state is accepted because the state can create welfare which is a source of state legitimacy in the form of citizen compliance. Without control and control of energy sources, it would not be possible to turn resources into the welfare needed to build state legitimacy.

However, the relationship between the socio-technical system of energy, including coal, and the dominant power regime always creates paradoxes (Tyfield, 2014). How coal power has created paradoxes: productive regimes and exclusion on the other hand. Coal was instrumental in the emergence of industrial societies, which produced increasingly powerful dynamics of political and economic advantage based on cities and big manufacturing and new freedoms with social mobility. At the same time, however, coal also created elitism through processes of exclusion: it fostered racism, oppression and reinforced colonialism.

In such a paradox, coal has also created a concentration of political economic power in a few domestic elites in Indonesia. Coal is generally extracted from shallow, soft rock that does not require complex technology and is therefore cheaper and more accessible than other mineral materials. With such characteristics, coal is easy to mine and move, which makes Indonesian tycoons compete fiercely with each other to profit from an industry that at the turn of the century became much more accessible to domestic capital (Warburton, 2017). Unsurprisingly, the composition of coal control in Indonesia is largely dominated by domestic corporations. They are affiliated to political parties and influential actors in the government. There are several names of big coal entrepreneurs who have strong relations in conglomerate networks and the government.

In its development, Indonesia has faced the pressure of a global agenda in

the form of climate change issues in the last two decades. Under the Paris Agreement in 2015, the Government of Indonesia adapted the energy transition agenda with the target of reducing greenhouse gas (GHG) emissions. In the energy sector, the climate change discourse creates pressure with an energy transition agenda that encourages the transition from fossil energy to New Renewable Energy. The biggest challenge of the energy transition process is the agenda of phasing out fossil energy, in this case coal. The energy source that has been supporting countries like Indonesia, namely coal, is starting to be questioned because it is considered dirty energy.

Indonesia is one of the countries with the largest planned coal power capacity additions in the world, posing a major challenge to global climate change mitigation goals (Ordonez et al., 2021). The strong influence of coal conglomerates in political and government circles has hampered a number of coal phasing out policies in the Joko Widodo era (Singgih, 2022). This further confirms the political challenge that dependence on fossil fuels has created a symbiosis between the political class and the interests of the coal cartel (Guild, 2020).

In the midst of the climate change discourse through energy transition, the Jokowi administration is faced with demands to save the coal industry, which is clearly threatened by the energy transition agenda. The high dependence on coal that impacts the national economy, coupled with the control of resources within Joko Widodo's circle of power, makes it difficult for his government to make decisions in achieving the vision of the energy transition. This necessitates that the reconsolidation of the energy transition through the coal phasing out agenda and commitment to climate change must address how the coal sector is managed politically.

The Joko Widodo administration is addressing this by setting up an energy transition framework while at the same time not disrupting economic growth. The transition agenda includes a policy reorganization that strikes a balance between structural consolidation and the demands of climate change mitigation and adaptation. The plan is realized in a scenario to ensure that coal-fired power plants can operate for a decade while gradually switching from fossil fuels to renewable energy over the next 20 years.

One of the efforts to phase out coal undertaken by the Joko Widodo administration is to downstream coal. The Jokowi administration's step towards downstreaming is a policy option to reduce carbon emissions while still processing abundant coal reserves in various downstream coal products. Under the Jokowi administration there have been efforts to extend the coal industry chain by exploring the materiality of coal as a derivative commodity which is claimed to be low carbon

Departing from this formulation, this study aims to raise research issues regarding coal downstream policies which are claimed to be a breakthrough to get out of the dilemma of eliminating

coal in the energy transition corridor. The question that can be asked is: how relevant is coal downstreaming to answer the challenges of the energy transition towards low carbon? The aim of this study is to examine how far coal has strong relevance in answering the challenges of the energy transition. In summary, this study actually starts from the assumption that coal is increasingly relevant in the energy transition process.

Literature Review

Unfortunately, studies on coal phasing out have not shed much light on how resource materiality affects coal phasing out policies. A number of studies that attempt to explain the links between coal phasing out, energy transition and climate change recognize that coal is likely to remain a difficult question in relation to climate action and development for a long time to come (Edwards, 2019). This is reinforced by the conclusion of Blondeel et.al's (2018) comparative study that the norm for keeping coal in the ground is fundamentally contested. This complex relationship is also contributed by the limited literature and research tools that directly focus on coal and climate change mitigation (Bi et al., 2023; Edwards, 2019).

Nevertheless, a number of scholars have attempted to propose explanatory frameworks for the links between coal, energy transition and climate action. The first is an actor-centered political economy perspective as proposed by Jakob et al. (2020).This perspective proposes an AOC (Actor, Objective, Context) political economy framework that enables how economic structures, political institutions and the political environment shape policy outcomes. The framework believes political economy is key to explaining why countries are expanding their coal capacity which helps identify entry points for politically feasible policies to phase out coal (Ohlendorf et al., 2022). A number of studies with the AOC tool include those of Ordonez et.al. (2021) in Indonesia, Dorband et.al (2020) on coal development in Vietnam, Walk et.al (2022) on climate policy links and coal phase-out in the UK.

Similar to the AOC framework, Brauer et.al (2020) offer the Triple Embeddedness Framework. The approach centers on identifying influential actors, the most discussed aspects, and the relative power of actors in coal phase-out. Within this perspective are Montrone et.al's (2021) study on India's dependence on coal in the power sector, and Haas et.al (Haas et al., 2022) offers a conflictual approach to coal phase-out by showing the linkages and tensions between democratic capitalism, and its sustainability in Germany.

Other studies explain coal phase-out using a discursive model. This model emphasizes narrative as a key strategy to manage the challenges of coal removal. This model claims to reveal the power relations of an issue and helps reveal the characteristics and strategies of coal politics through its narrative. As Curran's (2021) study in Australia shows how the social-context dimension is increasingly used narratively by the ruling energy regime, Trencher et.al

(2019) on coal use in Japan by examining the narratives used by actors in government and industry, and Markard et.al (2021) reveal the key to the victory of the anti-coal coalition in Germany due to the coalition's consistency in using climate change as the dominant narrative line to delegitimize coal.

There is also a new ecological political framework offered by the few scholars who have taken up the theme of anti-coal struggles. This approach draws attention to the changing relationship between economic, environmental and social advocacy while showing how coal's impacts exacerbate and perpetuate inequalities. Brown et.al. (2017) in their study of coal resistance in the UK and Indonesia offer an analysis of contested spaces and practices due to the presence of coal extraction, Toumbourou et.al's study (2020) shows how discursive power works in contestation over the meanings, rules and practices of coal mine reclamation in East Kalimantan, the main coal producing province in Indonesia.

The study of coal removal also offers an institutional perspective by examining the institutionalization of global norms on energy transition, focusing on the ethical dimensions of institutionalizing a just transition, and the formation and role of transition institutions. Blondeel et.al (2020) and Jewell et.al (2019) highlight the effectiveness of institutions such as the Power Past Coal Alliance (PPCA) that push the coal phase-out agenda. Meanwhile, Gürtler et.al (2021) offer a comparison of the effectiveness of coal phase-out commissions in Germany and Canada in building legitimacy about a just transition. Lahiri et.al. (2017) for example raises 'moral questions' when the state relates the iconic status of stone in India, which is dominated by indigenous coal mining communities. Meanwhile, Blondeel et.al (2018) show that the failure to institutionalize global norms on energy transition is even caused by non-climate reasons such as industrialization and fiscal justice.

The study of coal removal in the context of transition is also getting richer with a structural approach that dissects the dynamics of agrarian, labor, and capital/market. This approach also opens up new debates on issues of colonialism, climate change as a cross-cutting issue that includes racial, gender, and economic justice issues by engaging with cultural politics around coal and energy transition (Brown et.al, 2019). Shah's study (2022) reveals that changes in the agrarian context of rural India in mining-affected communities shape the motivations for local anti-coal struggles. Kumar's (2022) study also shows how market forces of what he calls "fossil neoliberalism" have turned the state into an agent of fossil fuel extraction.

A relatively new framework on coal phase-out in transitional contexts is contributed by the Science-Tecno-Society (STS) approach and its combination with other approaches. This approach attempts to embrace the two great traditions of science and social science. These studies mainly encourage the importance of engaging and finding relationships between both technical and non-technical aspects to model the energy transition by releasing coal and

technically operationalizing it in explaining and solving energy transition problems. In this vein, for example, Clark et.al's (2020) study on the future growth of coal power generation in Southeast Asia and its ability to limit emissions shows the status quo trend of coal power generation significantly hampers the region's ability to contribute to global efforts to limit global warming. Similarly, Kuchler et.al's (2018) study on socio-technical aspects appears to shape the imagery of coal as a national resource that provides support for coal's future. While Cherp et.al (2018) for example offers an integrative framework of 3 approaches. Economic development, technological innovation and policy change are important factors shaping the energy transition.

Reinforcing existing studies, there are also those that offer the importance of reading the materiality aspect of resources to explain the phenomenon of phasing out coal. In this tradition, developing works are directed at the various ways resources and the environment become objects and interests of the state (Bridge, 2014). Erensü's (2018) study, for example, looks at the role of energy in enabling authoritarian regime power, which gives the state a new role as an intermediary as well as new legal instruments and authorities due to the increasing growth of the energy market in Turkey. Similarly, Lahiri-dutt (2014) looks at the supremacy of coal in post-colonial India, reflecting how 'coal nationalism' has replaced 'coal colonialism' in the country. Meanwhile, from the limited literature, most of the literature in the materiality approach on energy still focuses on the impact of energy infrastructure (such as oil pipelines) and its materiality on international energy relations (Barry, 2013). One analysis that relies on the materiality approach is Mitchell's (2011) study on comparing the impact of the oil-based economy with the early 20th century 'first oil' transition era on labor, which provides important insights.

Socio Material Power as an Explanatory Concept

In the discipline of political science, Balmaceda (2018) detects that political literature has not contributed much in looking at the materiality of energy and its influence in shaping social relations including the coal phasing out agenda. Like Balmaceda (2018), this study offers an analysis of energy power starting from a more fundamental starting point: the materiality of energy resources themselves in relation to their production and transformation into energy services and their impacts. The challenge shows that the materiality of energy is decisive in the issue of change including the material characteristics of a commodity affecting the constitutive power relations at work in the phasing out agenda through coal downstreaming.

This study offers a new materialism approach as a framework. The materiality perspective places the materiality of resources challenging the position of human agency (anthropocentrism) in shaping various social relations (including political economy). In Choat's (2018) language, new materialism helps us understand

social reality (including politics) as a phenomenon that is not separated from nature, as a network between non-human and human elements in reshaping the definition of power and agency.

Materiality, in this case geological and biophysical characteristics, extend the coal industry chain resulting from the production process of natural resources. Therefore, this article uses the *New Materialism* approach. The new materialism approach was chosen as a post-human approach that criticizes the central position of humans as deterministic agencies in economic relations (anthropocentric). In this line of thought, materiality focuses on the chain of production decisions along with political relations, as well as the socio-cultural values attached to material objects (Bakker & Bridge, 2006), including also taking into account the elements of temporality and spatiality associated with material objects (Rogers, 2015). Therefore, this approach was also chosen as an attempt by this study to explore the phenomenon of coal removal - through bringing back to the scientific discussion that Choat (2018) calls 'a reappraisal of science' in understanding socio-political phenomena by not separating them from natural phenomena. The argument builds on the finding that coal's materiality - its biophysical and geological characteristics - shapes perceptions and practices about energy transition.

Bakker and Bridge (2006) formulate materiality studies as a radical approach to re-understanding the agency, spatiality and biophysical diversity of natural materials that impact on the 'econatural network' that mediates the transformation of natural materials into various features, from resources to assets to commodities, including the emergence of various conditions of production. Placing materiality as a point of departure implies a way of thinking that explores the dimension of relations. This kind of relational thinking, which takes into account socio-material power, falls within the post-structuralist family of theories.

This approach takes into account the influence of materiality in networks by situating the human and the non-human, and linking the 'social' and the 'material' equally (Bennett, 2010). The theoretical consequence of this perspective is that it recognizes the 'capacity' of natural resource materiality within socio-material formations to shape orders that have ideas, mechanisms and practices (Choat, 2018; Devellennes & Dillet, 2018). Bunker (2003) explains that one of the 'capacities' that emerge from this socio-material configuration is the capacity to form a spatial configuration called 'materio-spatial' that is closely associated with economic, political and cultural activities. This distinctive space can be recognized through the extractivist production chain, which is the activity of extracting natural materials and turning them into trade commodities by involving the capacities of capital, land, labor, and science and technology (Castree, 2003). Within this 'materialospatial' configuration of space, the materiality of natural resources has

the capacity to inspire networks of actors.

A number of studies have used 'materio-spatial' formations as an analytical framework to understand the operation of socio-material power in natural resource commodification decision chains (Barry, 2013; Rogers, 2015; Watts, 2004). Watts (2004) calls this 'materio-spatial' formation a governable space or "territorialization of governmental thought and practices". In other words, materiality within socio-material associational networks forms strong definitions and expectations regarding commodities produced from extractive production: regarding who can manage them and how to manage them. The more connected natural resource commodities are to the world commodity trade supply chain, such as petroleum, the more solid socio-material power networks need to manage natural resources.

Starting from the formulation of such a position, this study aims to raise research issues about the coal downstreaming policy, which is claimed to be a breakthrough to get out of the dilemma of coal elimination in the energy transition corridor. Under the Jokowi administration, there are efforts to extend the coal industry chain by exploring the materiality of coal for various derivative commodities that are claimed to be low-carbon. The purpose of this study is to examine how far coal has a very strong relevance in answering the challenges of energy transition. In short, this study departs from the assumption that coal is increasingly relevant in the energy transition process.

RESEARCH METHOD

This study is an explanatory-qualitative research using a case study strategy as its method. Case study is chosen as the method in this study because this method is believed to be superior in achieving the purpose of this research, namely specificity in the sense of depth and complexity of a social phenomenon (Stake, 2005; Yin, 1996). In this study, the coal phase-out agenda with the coal downstreaming policy in the context of energy transition during the Jokowi administration was chosen as the case. The timeframe is based on the consideration that during the Jokowi administration, the global agenda on energy transition in the context of climate change was strongly pushed. The strengthening of the climate change discourse in response to the energy transition has changed the agenda and policies not only in the energy sector but also the development agenda in many countries, including Indonesia.

The data in the research study fully uses data in the form of documents and other written information obtained through desk study with documentation techniques. There are several considerations with the use of this technique. Firstly, it is not limited to time and space so it gives researchers the opportunity to find out things that happened in the past. Second, most social facts and data are stored in the form of documented materials. Researchers access documentary data sources depending on the type of documentary data both in printed and digital form through internet media searches. The data and information

extracted in this method cover the themes of climate change, energy transition, and coal phase-out sourced in the form of, research results, policy papers, regulatory products, official government publications, media articles relevant to this study.

After the data is collected, procedurally the data analysis technique in the case study starts from the stages of data reduction, data display, and conclusion/verification. The mechanism of data analysis work steps carried out by researchers here is that after all the data has been collected, the first step is to sort or select (data reduction) the data needed and focused in accordance with the focus of the research formulation. After the data is selected, the results of data analysis are presented in the form of quoted statements, tables, and pictures. After the first and second stages are complete, the researcher draws conclusions (conclusion/verification) on the data that has been successfully organized as the final stage of the analysis. In this study, researchers tested the validity of the data on the results of the above research using triangulation techniques. Triangulation is done by cross checking the data by juxtaposing various data sources to the time span. With these data validity test steps, this study has a high level of credibility and can be accounted for by the researcher.

RESULTS AND DISCUSSION

This section presents the results that include an overview of Indonesia's coal resources along with an overview of new industrial policies that have been and will be developed in the coming years. This section concludes with a discussion on coal downstreaming policy in the context of energy transition.

Sketch of Coal Resources and Reserves in Indonesia

Coal is one of the fossil fuels that makes an important contribution to meeting energy needs, supplying 27% of the world's primary energy needs (Kementerian Energi dan Sumber Daya Mineral, 2021a). There are a number of reasons why the use of coal in the world is in demand. First, the biophysical character of coal in the form of solids is relatively more stable. This makes coal easier to store and move compared to other fuels such as natural gas and petroleum. Secondly, coal is easier to access with uncomplicated methods because it is located in the surface layer of the earth compared to petroleum or natural gas which are located in the bowels of the earth. Furthermore, the existence of coal is spread in almost all regions of the world, making it more accessible to many countries. Third, the price of coal per unit of energy is relatively lower and more stable than the price of other fuels. The lower and stable price is influenced by the ease of extracting this soft rock.

In 2020, the Geological Agency of the Ministry of Energy and Mineral Resources noted that Indonesia's total coal resources amounted to 143.7 billion tons. Meanwhile, coal reserves amounted to 38.8 billion tons or around 3.6% of the world's total coal reserves. With this amount, the BP Statistical Review of World Energy in 2020 noted that Indonesia is the country with the

sixth largest coal reserves in the world (Kementerian Energi dan Sumber Daya Mineral, 2021a). These reserves also make coal the largest energy resource owned by Indonesia when compared to other fossil fuels, such as petroleum and natural gas as presented in Table 1.

Table 1. Indonesia's 2020 Fossil Fuel Reserves and Production (in Tonne of Oil Equivalent/TOE)

Type	Reserve	Production
Coal	27,16 Billion	396 Millian
Natural Gas	1,5 Billion	75,3 Millian
Petroleum	0,57 Billion	59,9 Millian

Source: Ministry of Energy and Mineral Resources, 2021a

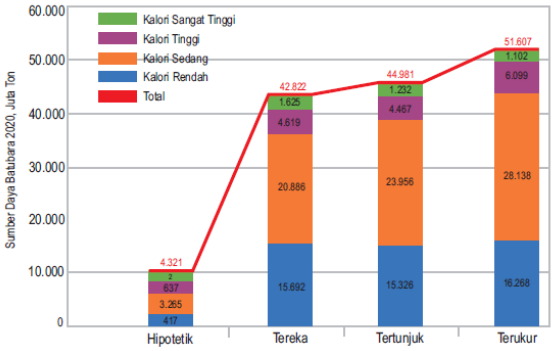
With these reserves, the life of Indonesia's fossil fuel reserves is estimated to last for the next 69 years for coal and only 20 years and 10 years for natural gas and oil, respectively. The life of Indonesia's coal reserves could be extended to 250 years if annual production levels remain at the current level of domestic market demand.

These conditions make the government reconsider that the use of coal is optimized as a substitute for oil and natural gas to meet energy needs and the needs of the domestic basic chemical industry. This means that coal is not only prepared to supply electricity, but is prepared as a substitute for LPG and oil for use in transportation and household needs such as cooking fuel.

Understanding the characteristics of coal as resources and reserves is a key requirement for optimizing the utilization and increasing the use value of coal. Based on the level of confidence on an investigation basis, mineral resources including coal are classified into 4 categories, namely hypothetical, inferred, indicated and measured. Meanwhile, coal based on calorific value is classified into 4 groups, namely very high calorific (>7,100 cal/g), high calorific (6,100-7,100 cal/g), medium calorific (5,100-6,100 cal/g), and low calorific (<5,100 cal/g).

Based on this standard classification, the characteristics of coal resources in Indonesia are dominated by coal with a measured confidence level, followed by indicated, inferred and hypothetical. Meanwhile, based on the calorific value, most coal is medium calorific, followed by low calorific, hi gh calorific, and very high as presented in Figure 1.

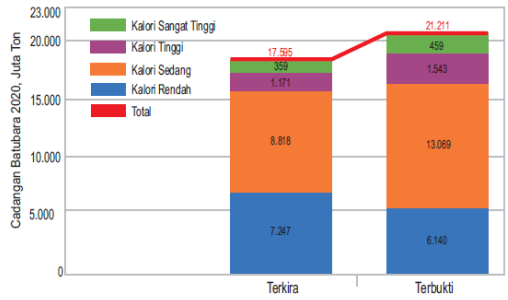
Figure 1. Distribution of Indonesia's coal resources in 2020 based on calorific value at each confidence level



Source: Kementerian Energi dan Sumber Daya Mineral (2021a)

As for coal reserves, the classification is divided into 2 categories, namely estimated and proven. In general, medium and low calorie coal reserves dominate all categories as presented in Figure 2 below.

Figure 2. Distribution of Indonesia's coal reserves in 2020 by calorific value at each confidence level



Source: Kementerian Energi dan Sumber Daya Mineral (2021a)

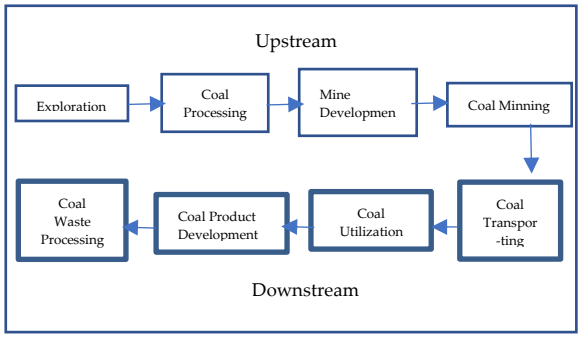
Indonesia's largest coal reserves are in East Kalimantan Province with total reserves of 10.9 billion tons followed by South Sumatra with total reserves of 8.5 billion tons. Medium calorific coal reserves dominate reserves in East Kalimantan at 71%, while 29% is low calorific coal. While coal reserves in South Sumatra Province, the proportion of medium and low calorific coal is almost balanced, namely 57% for low calorific and 43% for medium calorific respectively.

With total coal reserves of 38.8 billion tons in 2020, the age of coal reserves is projected to last for the next 69 years, which will run out in 2089. Such a long reserve life is calculated based on the assumption that all coal production and use, especially low calorie coal, is managed economically. Based on this assumption, the government sees the need to optimize the value of coal resources and reserves from the exploration stage, extraction (mining) stage, processing stage to the conversion stage.

Direction of Coal Industry Development: Coal Downstreaming

The coal industry forms a supply chain from upstream to downstream. The upstream and downstream map of the coal industry provides a comprehensive overview of the supply chain and activities involved in coal production and utilization. Understanding this map is important to optimize efficiency, reduce environmental impacts and ensure the sustainability of the coal industry. In the upstreams, the coal industry chain includes exploration, mine development, coal mining and coal processing activities. Meanwhile, the downstream chain covers post-coal mining activities, namely transporting, utilization, and waste management as presented in Figure 3 below.

Figure 3. Coal Industry Chain



The upstream chain begins with exploration. Exploration is the activity of finding and evaluating new coal reserves through geological surveys, drilling, and data analysis including testing the quality and geological characteristics of coal. Mine development activities include the construction of infrastructure and supporting facilities for mining, such as roads, waste disposal and water treatment.

Mining activities are the extraction of coal from the ground using surface mining or underground mining methods. Meanwhile, the processing chain is carried out by sorting based on the quality and characteristics of each layer, preparation including washing if necessary and the blending stage. Such processing is necessary in order to obtain coal in accordance with the quality that meets market needs.

The downstream chain of the coal industry begins with transporting, which is the activity of transporting coal from mine sites to utilization facilities or ports via trains, trucks, or ships. Meanwhile, utilization is the use of coal for various purposes, such as power generation and reductant (heating) for industrial and household commodities. The largest utilization of coal today is still for PLTU as fuel to produce electricity. Coal is also used as a heat source (reductor) in various basic industries, such as cement, metallurgy, fertilizer, paper, glass, and textile industries. Especially for the metallurgical industry, the coal used is special coal, namely coking coal for making steel (iron). Therefore, a coal drying plant is needed to reduce the moisture content in coal so that the calorific value of coal can increase to improve the quality of coal (coal upgrading).

Meanwhile, coal product development is the activity of processing and producing more raw products such as upstream petrochemical raw materials such as methanol, DME, olefins (ethylene and propylene) or derivative products processed through gasification (in the form of synthesis gas or syngas) and liquefaction. The development of coal through gasification also leads to the development and gasification of liquid or gaseous fuels. This kind of product development is starting to be developed in a number of coal-producing countries such as China and India. This is done to reduce dependence on imports of upstream chemical products which are the raw materials for many strategic industries. Meanwhile, waste management is the activity of handling and waste generated during the process of mining and utilizing coal in a safe and environmentally friendly manner such as Carbon Capture Storage (CCS).

In Indonesia, the existence of the downstream coal industry is still relatively small compared to the production of the upstream industry. The downstream coal industry is directed at the utilization and development industry. Downstream coal industry products can be processed into solids, gases, and liquids (Kementerian Energi dan Sumber Daya Mineral, 2021b). Solid forms of coal include upgraded coal, coal briquettes, coke, semi-coke, and activated carbon, which are in the form of solids. While the gas form is syngas and the liquid form is coal slurry and diesel oil. Of all these products, the conversion of syngas to methanol has the best economic opportunities, with the potential for a very wide range of derivative products, such as the production of DME and olefins. Olefins have a wide range of applications, including the pharmaceutical, textile, food, lubricants and plastics industries. So far, the need

for these products has been met through imports. This condition is quite interesting because Indonesia has coal reserves, which are not only a source of energy, but also a source of carbon that can be converted and processed into these products.

So far, there are only a number of companies engaged in the downstream industry in the form of coal solids products. Companies that have sought the utilization and development of coal solids include coke making plants, namely PT Krakatau Steel, PT Krakatau Posco, and PT Dexin Steel Indonesia where the coke produced is consumed by the factory for the needs of the steel production process. As for semicoke plants, there are two companies, namely PT Megah Energi Khatulistiwa (MEK) and PT Primal Coal Chemical. There is also a coal briquetting plant, namely PT Bukit Asam and PT Thriveni (Kementerian Energi dan Sumber Daya Mineral, 2021b).

Yet, no company has developed liquid or gaseous coal conversion products using gasification or liquefaction methods that operate commercially (Kementerian Energi dan Sumber Daya Mineral, 2021b). As a result, Indonesia still has to import several commodities with considerable value, namely methanol (USD 213 million) which can be obtained through syngas conversion from gasification; ethylene (USD 584 million), the result of the methanol to olefins process, ammonium sulfate (USD 115 million) which is a fertilizer raw material, and coke (USD 186 million) which is a coal carbonization product.

The imbalance in the coal industry tree creates opportunities for the downstream industry to be able to supply the needs in the supply chain of the basic chemical industry and the steel industry. Therefore, the government through the coal downstreaming program initiates and encourages the upstream industry to build a coal development and utilization plant which is targeted to be built starting in 2025.

Law No. 3/2020 directs the utilization and development of coal with a number of technological options, including: coal upgrading; coal briquetting; coke and semi-coke making; coal liquefaction; surface and underground coal gasification; and coal slurry/coal water mixture. Among the available technology options, coal gasification is the option that has the greatest market opportunity because the market is already available.

Coal Downstreaming: Challenge or Answer to Energy Transition?

The climate change discourse puts pressure on various countries to rethink energy sources and how to manage them, including Indonesia. The country then sees the energy transition as a new dilemma. There are a number of reasons why the energy transition poses a dilemma. First, the energy transition is an important part of being able to reconsolidate the country's position in the global ecological system but at the same time has the potential to create political risks. The experience of a number of countries shows that the rapid energy transition process has created a crisis where energy prices have become

more expensive and unreliable. The experience of a number of EU countries shows that the process of rapid energy transition has created an energy crisis triggered by the Russia-Ukraine war. As a result of the war, Russia stopped gas supplies to the EU. According to Eurostat, Russia is the main gas supplier to the EU, accounting for 40%. Each country has a different level of dependence on Russian gas supplies, with Germany being the country with the highest dependence, reaching 55% (Riyandanu, 2022). At the same time, renewable energy has not been able to meet the needs of the European Union. To overcome the crisis, a number of EU countries reactivated power plants. This increased the global demand for coal.

It also increases risks and generates political problems at least during the transition period. Stopping coal abruptly is tantamount to shutting down the country's economic resources, stopping rent-seeking by economic actors, and changing established infrastructure. There are social costs to be borne that will have a political impact on the public. Not only does it threaten the rent-seeking of coal by the political economy elite, but economic production and the industrialization process are threatened with disruption because they are strongly influenced by energy production while threatening the existence of the state.

Second, there is a paradox when there is an imbalance in the energy transition road map between developed and developing countries (Sulistyo, 2022). Developing countries are forced to adopt capital-intensive new renewable energy utilization. However, the utilization of new energy requires considerable new investment. New renewable energy has a problem of unreliability, requiring a device such as a battery to store the energy produced. Not to mention the use of new renewable energy requires a grid that is different from the coal-fired power plant grid. Meanwhile, developed countries, including European countries, actually open opportunities to increase the utilization of coal to deal with the energy crisis they are experiencing. Britain, for example, is opening new coal mines under the pretext of supplying the British steel industry (Fajrian, 2022). Beyond the funding aspect, Joko Widodo's administration also carried out a transition strategy through: First, decarbonization technical intervention. This intervention is in the form of electricity production efficiency. The efficiency of electricity production is carried out by rejuvenating the PLTU engine for coal consumption efficiency and transmission equipment to reduce electricity loss. Another technical intervention is co-firing of coal-fired power plants. The co-firing strategy claimed by the Ministry of Energy and Mineral Resources can reduce carbon emissions and is more efficient because it does not require new plants.

Second, downstreaming is carried out by encouraging the form of derivative products, both coal bed methane and liquid coal (liquifaction coal) through gasification technology which is claimed to be low in emissions. Jokowi's administration even realized coal downstreaming by offering joint

investment in Dimethyl Ether (DME) plants in Muara Enim, South Sumatra with PT Bukit Asam and in East Kalimantan PT Kaltim Prima Coal with American energy corporation Air Products Chemicals Inc (APCI). The Rp 34.04 trillion investment project was later canceled by Air Products' withdrawal from its commitment in 2022. Air Products' withdrawal was due to a change in the company's business direction to hydrogen development triggered by the US Government's policy of developing renewable energy (Riyandanu, 2023). Now the government, through Pertamina, is exploring the possibility of cooperation with 12 parties to replace Air Product.

Downstreaming of coal also extends to the context of energy transition. Instead of reducing production, coal consumption has increased significantly in the last 5 years. The Ministry of Energy and Mineral Resources estimates that in 2024 domestic consumption will reach 187 million tons, up 35.5% compared to the realization of absorption in 2019 of 138 million tons (Umah, 2020). This is happening amidst efforts to fulfill the ambition of the energy transition to reduce GHG emissions with a phasing out agenda. The increase in coal consumption occurred due to efforts to build the renewable energy industry by downstreaming materials such as nickel, bauxite, copper and manganese as the basis for batteries by building a number of smelters. The Ministry of Energy and Mineral Resources is targeting the construction of 53 smelters by 2024, which requires 5.6 GW of electricity or the equivalent of 6 large capacity power plants (Setiawan, 2022). In addition to energy needs, coal material is also used as a reductant for various minerals in processing.

Still within the downstream framework, the government is also working on the knowledge sector by examining the use of coal other than thermal coal. The Ministry of Energy and Mineral Resources is studying the potential of rare earth element minerals in domestic coal such as synthetic graphene and germanium while considering how to increase the value of these commodities beyond their use as raw materials for power plants (Karyza, 2023).

The country's effort towards downstreaming is an alternative policy to reduce carbon emissions while still processing abundant coal reserves. The strategy attaches commodities in the context of resource making to coal by exploring coal's biophysical characteristics into new resources. Coal is generally extracted from soft rock, requires less complex methods, and therefore has low costs and lower barriers to entry (Warburton, 2017). With such characteristics, coal is easy to mine and move, which allows the sector to be more inclusive for domestic businesses than other minerals.

The state's efforts to extend the life of coal show that resource materiality is one of the key aspects to keep coal relevant in the global energy supply chain and industry despite the pressures of the energy transition. By extending the commodity chain while providing evidence that coal's externalities can be

managed to make it less environmentally problematic, the state seeks to retain control over national energy resources. The materiality of coal determines the state's efforts to reshape the resource.

Instead, such materiality provides an opportunity structure for the state to reconsolidate its political power through coal. Coal is considered a key energy source in driving the national economy as it drives business, industry and innovation. The presence of the state becomes relevant by utilizing and revitalizing coal where the state becomes an important player in the revival of industrial policy. The materiality of coal determines the state's efforts to reshape the resources that enable the state to reconsolidate itself, which in turn provides sources of prosperity and foundations for state legitimacy. In summary, the state is reimagining coal as a strategic resource where coal is projected to continue to play an important role in the energy roadmap for the next 20 years (Theodora, 2021).

This configuration puts the state in a paradox. In the midst of demands for decarbonization through phasing out coal, coal is increasingly relevant in the context of energy transition. Energy transition is an important part that can reconsolidate the state's position in the global ecological system, but at the same time the state's response creates a paradox. Coal material in this case plays an important role in the processing of various other minerals (such as nickel, manganese, cobalt). In the context of energy transition, the use of coal for smelter power plants, transporting mineral processing products, including as a mineral mixture material. Whereas the processed minerals are oriented for green technology (battery industry) whose initial idea is decarbonization. The case of Indonesia shows that coal is increasingly relevant in the energy transition agenda.

CONCLUSION

Coal materiality is key in downstream policy. Resource materiality, namely the biophysical character of resources, allows coal to be processed into a new form of energy that can be managed in terms of externalities in the form of energy commodities that are claimed to be lower in carbon. Apart from that, coal supports the needs of the energy transition by providing large-scale and affordable electricity and as an element in the mineral mixture needed for batteries for renewable energy industrial technology. Coal material ultimately contains the socio-material power that determines the energy transition. The materiality of coal in turn creates new spaces in the form of new links in the national energy system supply chain in the context of a low carbon economy.

This narrative increasingly emphasizes that coal is an important material that is sufficient for the energy transition. This is reinforced by the Tyfield Study (2014) which actually shows the increasing important role of fossil fuels in driving the transition to a low-carbon society. This means that coal actually has a very strong relevance in answering the needs of the energy transition. This relevance is actually possible because coal is the main support

for the country's efforts to encourage the energy transition through coal downstream policies.

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