Implementation of Indonesia coal downstream policy in the trend of fossil energy transition

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Abstract. The implementation of downstream coal policies in Indonesia is regulated in Law Number 3 of 2020 to optimize coal's domestic use and value-added. The policy is also supported by the issuance of fiscal, non-fiscal, and regional incentives. In Law Number 3 of 2020, the government of Indonesia states six types of coal downstream: coal upgrading; coal briquetting; cokes making; coal liquefaction; coal gasification; and coal slurry, yet the government has not defined which downstream coal products should be prioritized. Several parameters must be considered in implementing the downstream coal policy, those are the availability of coal and its characteristics, proven technology, economic and environmental feasibility. This study examines the mineral and coal sector regulation, taxation, coal resources and reserves, technology, and economics. In addition, to implement the commitment of reducing CO2 emissions, this study also considers applying Carbon Capture and Storage (CCS) or Carbon Capture, Utilization, and Storage (CCUS) technology to implement downstream coal policy.

1. Introduction

Energy supply in Indonesia can be classified into supplies of petroleum, natural gas, coal, and renewable energy, in which coal supplies dominate the portion up to 37,15% in 2019 [1]. In 2015, the dominance of fossil energy (coal, gas, oil) in primary energy supply was still visible, approaching 90 percent [2]. Coal is the fastest-growing fuel source in Southeast Asia and the region continues to rely on coal as an essential part of its energy mix [3]. Indonesia's dependence on energy fossils in meeting the energy needs in the country is still high [4]. However, nowadays, the force of energy transition is significantly intense and every country, including Indonesia, must consider changing the use of fossil fuel into cleaner sources. On the other hand, Indonesia has relatively abundant coal resources, and in terms of coal quality distribution, they are dominated by moderate coal calories (59%) and low coal calories (31%). Indonesia takes coal as a crucial and affordable source to meet energy demands, and in fact, the majority of them are assigned as an export commodity while the rest are consumed as fuel for coal-fired power plants and as the essential substance in the industrial sector [1]. Coal-fired power plants do increase the amount of electricity at a more affordable price [5]. To optimize domestic use and value-added of coal, Law number 3 of 2020 demands the increasing added value (downstream) of coal through coal development and/or utilization, which is generally recognized as coal downstream [6].
Law Number 4 of 2009 concerning Mineral and Coal Mining (Law No. 4 of 2009) was considered still cannot provide developments, problems, and legal needs in implementing mineral and coal mining. Therefore, changes need to be made through Law Number 3 of 2020 (hereafter, it is referred to as the Minerba Law), and it is expected to become an effective, efficient, and comprehensive legal basis. The downstream of coal is one of the topics forwarded and upscaled in Law No. 3 of 2020. Replacement of regulations in the mineral and coal mining sector from Law No. 11 of 1967 into the Minerba Law has brought drastic changes in Indonesia’s mineral and coal mining regulation. This change has a consequence that the mining management system becomes pluralistic as two systems are applied, namely work contracts and mining permits. However, the Minerba Law seems to emphasize more on good mining practice and adjustments to regional autonomy [7], governance and permits [8], and guarantee of legal certainty [9].

The issuance of Law 11 of 2020 concerning Job Creation (Job Creation Law), which synchronizes issues between intersectoral law, improves the investment ecosystem and undertakes an opportunity to realize downstream coal policies. The Job Creation Law regulates the simplification of business permits and the ease of investment with sectoral fiscal and non-fiscal incentives. Based on the view of coal investors, the ease of business permit and various incentive facilities will create an investment climate that supports the development of the domestic coal downstream industry. Market players also responded positively to the ratification of the Job Creation Law because it considered that it would clear up overlapping regulations and provide investment clarity. Providing a 0% royalty incentive for coal companies that carry coal downstream will accelerate the coal downstream. Several other fiscal and non-fiscal incentives are given to business actors, among others: reduction of value-added tax (VAT) or the application of tax holidays, the certainty of the land permit, or pricing policy for downstream coal products. These incentives are very much needed because the investment in coal downstream is long-term, more than 20 years [10]. This study will discuss the implementation of downstream coal policies through Minerba Law No. 3 of 2020 and its supporting regulations in the fields of fiscal, non-fiscal, and regional incentives to meet fulfillment of future national energy.

2. Methods
The method used in this research is descriptive-analytical. Descriptive studies consist of data collection, data processing or analysis, conclusions, and suggestions. In other words, analytical descriptive research takes problems or focuses attention on the issues when the study is conducted. The results of the research were then processed and analyzed to conclude [11]. The collection of data and information in this paper is undertaken by inventorying relevant laws and regulations and examining library materials such as writings and scientific papers. The study was also conducted on other material sources, including reports and exposures related to the problems in this paper [12].

3. National coal conditions
3.1. Coal business conditions
In the 2020 and 2025 national energy mix policy, coal’s contributions still the largest as a national energy source above the contribution of new renewable energy (Energi Baru Terbarukan/EBT), natural gas, and petroleum. However, coal’s contribution is targeted to decline from 38.04% (2020) to 30% (2025), in line with entering the new carbon era. The national mix target in 2025 consists of a mix of EBT 23%, natural gas 22%, petroleum 25%, and coal 30%. Meanwhile, in 2020 the mix of EBT was 11.20%, natural gas 19.16%, petroleum 31.60%, and coal 38.04% [13]. The role of low-carbon and zero-carbon technologies has been enhanced to promote more renewable energies connected to the electricity generation system [14].

According to Article 35 of the Minerba Law, the authority of mineral and coal mining states that the mining business is conducted based on a business license from the central government. In its implementation, the said business license is conducted by granting: a) business registration number; b) standard certificate; and c) Permit. The permits in question consist of: a. Mining business permit (Izin
Usaha Pertambangan/IUP); b. Special mining business permit (Izin Usaha Pertambangan Khusus/IUPK); c. IUPK as a continuation of contract/agreement operation; d. Small-scale mining Permit (Izin Usaha Pertambangan /IPR; e. Rock mining permit (Surat Izin Penambangan Batuan/SIPB); f. assignment permit; g. Transport and sales permit; h. Mining service business permit (Izin Usaha Jasa Pertambangan/IUJP); and i. IUP for sales. The central government can delegate the authority to grant business permits to provincial governments following laws and regulations.

The Geological Agency, the Ministry of Energy and Mineral Resources in 2019 issued metallurgical coal potential in Indonesia, as in Figure 1.

Figure 1. Metallurgical coal potential in Indonesia [15]

Figure 1 shows Indonesia’s coal resources totaled 149,009.59 million tons and reserves 37,604.66 million tons [12]. Of the total resources and reserves, there is potential for metallurgical coal with resources of 8.66 billion tons and reserves of 1.73 billion tons. The location of the largest metallurgical coal found is in the islands of Sumatera dan Kalimantan. Meanwhile, the coal quality characteristics can be seen in Table 1.

Table 1. Quality of Indonesia coal resources and reserves, 2020 [16]

| Quality   | Resources (Million tons) | Reserve (million tons) |
|-----------|--------------------------|------------------------|
|           | hypothetical | inferred | indicated | measured | total | verified CP | probable | Proved | total | verified CP |
| Low Calorie | 416.53 | 15,692.40 | 15,326.18 | 16,267.55 | 47,702.65 | 22,942.93 | 7,247.44 | 6,140.09 | 13,387.53 | 8,914.00 |
| Moderate Calorie | 3,265.43 | 20,888.87 | 23,955.70 | 28,137.97 | 76,244.97 | 55,435.17 | 8,818.10 | 13,068.72 | 21,888.82 | 14,761.21 |
| High Calorie | 636.73 | 4,618.95 | 4,466.64 | 6,099.42 | 15,821.74 | 11,250.32 | 1,170.56 | 1,542.67 | 2,713.23 | 1,593.88 |
| Very High Calorie | 2.06 | 1,624.94 | 1,232.38 | 1,102.17 | 3,961.54 | 2,449.70 | 358.56 | 459.34 | 817.90 | 558.25 |
| Total     | 4,320.75 | 42,822.15 | 44,980.90 | 5,607.10 | 141,730.90 | 92,078.11 | 17,594.67 | 21,210.81 | 38,805.48 | 25,827.34 |

Note:
1. Coal quality based on caloric value class (Presidential Decree No. 13 of 2000, which is renewed with Government Regulation No. 45 of 2008)
   a. low calorie < 5100 cal/gr
   b. moderate calorie 5100 – 6100 cal/gr
   c. high calorie 6100 – 7100 cal/gr
   d. very high calorie > 7100 cal/gr
2. Coal resources class
   a. hypothetical: review survey result
   b. inferred: prospect result
   c. indicated: preliminary exploration result
   d. measured: detailed exploration result
3. Reserves class
   a. Probable
   b. Proved
Table 1 shows the quality of Indonesia's coal resources and reserves in 2020. In terms of coal quality, coal resources are dominated by moderate calorie (5100-6100 cal/gr) and low calorie (<5100 cal/gr), 55,435.17 million tonnes and 22,942.93 million tonnes, respectively. Meanwhile, the quality of Indonesian coal reserves is primarily in the form of moderate calories of 14,761.21 million tonnes, then low calorie of 8,914.00 million tonnes. Furthermore, high-calorie coal reserves (6100-7100 cal/gr) and very high (> 7100 cal/gr) are only around 2 million tons.

Data from the Directorate General of Mineral and Coal (DGMC), Ministry of Energy and Mineral Resources in June 2020 stated coal mining permits amount for total of 1,238, consisting of 67 coal contracts of works (Perjanjian Karya Pengusahaan Pertambangan Batubara/PKP2B) and 1,171 IUP foreign investment (Penanaman Modal Asing/PMA), state-owned company (Badan Usaha Milik Negara/BUMN), domestic investment (Penanaman Modal Dalam Negeri/PMDN) [17]. The central government issued several coal mining permits for 138 coal companies and by the province for 1,094 coal companies. In terms of the operation stage, 1,228 coal companies are in the production stage, which 396 of them are actively producing companies (43 coal contracts of works/PKP2B, 7 BUMN IUP, 22 IUP PMA, and 324 IUP PMDN), and the rest are preparing to initiate the production (19 PKP2B, 39 IUP PMA, and 852 IUP PMDN). There are 8 PKP2B Generation I companies that will expire before 2026 and are required to develop downstream coal projects to extend their permit in the form IUPK (specialized mining permit) [17].

The optimization of the national coal for domestic use has the following opportunities and challenges:
1) The huge number and varies in the quality of national coal resources and reserves which can be utilized for domestic coal downstream [18];
2) Coal derivative products can substitute imported oil fuel (bahan bakar minyak/bbm) and gas fuel (bahan bakar gas/bbg);
3) Reducing the environmental impact of using coal is generally inevitable;
4) The economic value of coal fluctuates, and there is a tendency to obtain lower; and
5) The conventional use of coal as a raw material gradually decreases as energy transitions global commitment.

3.2. Coal domestic market obligation policy

The policy of fulfilling the coal domestic market obligation (DMO) is regulated in Government Regulation Number 79 of 2014 concerning National Energy Policy. The policy is prioritizing coal as the national energy source through:
1) Increasing coal exploration activities for open pit and underground mining;
2) Optimizing the coal usage adjusted following the quality and spatial of coal resources availability;
3) Increasing the technical capabilities of coal mining and utilization;
4) Implementing the good principles of conservation and mining by considering the environment;
5) Ensuring the fulfillment of coal supply for domestic needs;
6) Determining the coal price reference, especially for domestic use of coal;
7) Increasing the added value of coal.

Coal DMO policy is based on the following laws and regulations:
1) Minerba Law:
   a. Article 3 letters a and c states that to support sustainable national development, the goals of mineral and coal management are: a) mining business activities in an efficient, effective, and competitive manner; c) guarantee the availability of minerals and coal as raw materials and/or as a source of energy for domestic needs.
   b. Article 5 paragraph (1) states that, for the national interest, the central government, after consulting with the House of Representatives, sets up a national policy of prioritizing mineral and/or coal for domestic interests.
2) Article 84 paragraph (1) Government Regulation Number 23 of 2010 states that holders of production operation IUP and IUPK must prioritize domestic mineral and/or coal demands.

3) Article 32 paragraph (2) Minister of Energy and Mineral Resources Regulation Number 25 of 2018 states that the Minister decides the amount and type of coal needs to meet domestic needs.

4) Minister of Energy and Mineral Resources Decree Number 255 K /30/MEM/2020 concerning the Fulfilment of Domestic Coal Needs in 2021 [17].

3.3. Investment Policy of Job Creation Law

The government's desire to boost investment, especially coal downstream through the Job Creation Law, is a way out of the downstream coal program, which requires high technology, significant investment, and feasibility that still depends on product commodity prices. The 0% royalty incentive for coal companies that carry coal downstream is stated in Article 39 of the Job Creation Law. This article changes several provisions of the Minerba Law. The article states that business actors who increase the added value of coal can be given particular treatment for state revenue obligations. Such particular treatment may be in the form of imposition of royalty at 0% (zero percent).

Further provisions regarding particular treatments are regulated in Article 3 of Government Regulation Number 25 of 2021 concerning the Implementation of the Energy and Mineral Resources Sector. Meanwhile, there is also a change on the upstream side that coal mining products are now subject to value-added tax (VAT). The Job Creation Law affirms coal as a taxable item.

In addition to these facilities, companies that carry out coal downstream will be given other incentives, including relief from import duties on capital goods, reduction of corporate income tax (Pajak Penghasilan/PPh) for several years local tax incentives to be determined by the local government. All the amenities and facilities for fiscal and non-fiscal incentives are essential for downstream coal investors. Coal downstream projects require significant investments. For example, producing dimethyl ether (DME), a substitute for liquefied petroleum gas (LPG), costs around US$ 3.5 billion. Then, to produce methanol costs around US$ 2 billion to US$ 2.5 billion. If carried out without incentives, the project is not economically feasible. The 0% royalty policy will trigger investors to enter the Indonesian mining business [10].

3.4. National coal roadmap

Several policies are recommending to optimize the opportunities of coal as the crucial national energy source [19]:

1) Optimizing national production to increase energy security;
2) Increase the added value of coal by developing coal downstream; and
3) Reduce the amount of CO2 emissions through the application of clean coal technology.

In the framework of optimizing the opportunities of national coal, it is necessary to have the following study stages:

1) Identifying potential coal resources for downstream coal;
2) Assessing the downstream technology of coal-derived products;
3) Evaluating the economics of the selected coal downstream technology for each downstream coal process;
4) Reviewing regulations and policies for downstream coal and carbon capture utilization storage (CCUS); and
5) Drawing up a coal downstream road map.

Based on data from DGMC in 2020, coal production, export, and domestic for 2020 to 2040 has been forecasted for coal utilization as shown in Table 2.
Table 2. Indonesian coal production and sales plan [16]

| Year | Production | Export | Domestic |
|------|------------|--------|----------|
| 2020 | 550        | 408    | 155      |
| 2021 | 591        | 408    | 183      |
| 2022 | 598        | 407    | 198      |
| 2023 | 605        | 411    | 215      |
| 2024 | 626        | 416    | 218      |
| 2025 | 633        | 416    | 225      |
| 2026 | 641        | 421    | 236      |
| 2027 | 651        | 420    | 247      |
| 2028 | 667        | 414    | 259      |
| 2029 | 678        | 414    | 269      |
| 2030 | 684        | 412    | 269      |
| 2031 | 682        | 412    | 269      |
| 2032 | 682        | 411    | 269      |
| 2033 | 680        | 408    | 269      |
| 2034 | 680        | 406    | 269      |
| 2035 | 678        | 405    | 269      |
| 2036 | 674        | 403    | 275      |
| 2037 | 679        | -      | 275      |
| 2038 | 678        | -      | 275      |
| 2039 | 678        | -      | 275      |
| 2040 | 678        | -      | 275      |

Table 2 shows that coal mining is still one of the leading industries of Indonesia’s non-oil and gas sector in the future, with production levels reaching more than 600 million tons/year. The utilization of Indonesian coal will be prioritized for domestic use for both electric steam power plant (Pembangkit Listrik Tenaga Uap/PLTU) coal and the coal downstream industry. In 2020, the domestic coal usage plan was 155 million tons and will gradually increase every year. The use of coal in 2030 is estimated to reach 269 million tons, and in 2040 it will be 275 million tons. National coal production is still dominant for sale for export. In 2020 it was estimated at 395 million tons, and it is predicted will continue to increase following the level of production and the absorption capacity of domestic coal use. Based on the conditions of the national coal, DGMC is compiling a roadmap for national coal downstream. Its draft is as seen in Table 3.

Table 3. Roadmap of national coal downstream (draft) [16]

Table 3 shows that during 2021-2025, 3 gasification plants and a coke plant for metallurgy with a capacity of 250 thousand tons/year must be established. The establishment of coal forecasted the following periods to substitute natural gas (SNG) factory, bio-coal briquette factory, and coal liquefaction industry to substitute imported gasoline. The government’s commitment to reducing LPG imports can also be seen by reducing LPG imports starting in 2021-2025 of 3.51 million tons. The reduction in LPG imports is by substituting DME from coal gasification, either direct coal to DME or conversion from methanol. Likewise, the commitment to meet the needs of methanol for the national industry starting in the 2021-2025 period of 3.43 million tons has increased significantly in the 2036-
2045 period of 19.81 million tons of methanol. Overall, the added value of coal in the coal downstream industry will continue to increase for each period, starting from 19.6 million tons to 40.7 million tons in 2036-2045.

The implementation of the downstream coal policy has been effective since the issuance of the amendment to the Minerba Law through Law No. 3 of 2020. For IUP and IUPK companies in the production operation stage, they "may" and "are not obliged to" carry out coal downstream. However, PKP2B (Generation I) companies that will propose the production period extension into IUPK as a continuation of contract/agreement operation are required to carry out coal downstream through coal development and/or utilization. Following the downstream coal roadmap, coal development is generally carried out using coal upgrading technology, coal briquetting, cokes making, coal liquefaction, coal gasification, including UCG, and coal slurry coal water mixture.

4. Results and discussion

4.1. Analysis of fossil energy

The transition from fossil fuel use to non-fossil fuels continues to increase [20]. The current global change is towards a transition of fossil energy into cleaner renewable energy, low in emissions. Environmental aspects are starting to get attention, and energy policies are beginning to be directed to use renewable energy that is more environmentally friendly [21]. This trend has implications for coal consumption as a global energy source. Implications for Indonesia, this energy transition trend will have significant consequences since Indonesia still takes coal as the primary national energy source and one of the mainstay commodities for generating state revenues.

The results of the Institute for Essential Services Reform (IESR) study on the thematic roadmap for Indonesia's energy transition entitled Energy Transition in the Power Sector and Its Implication for the Coal Industry formulate several things, namely: a. coal exports will be increasingly difficult in the midst of a global change to renewable energy, as well as the export destination country will meet its coal supply; b. the plan to absorb domestic coal by building a coal downstream industry, has risks from both the economic and the environmental side; c. the government realizes that exports will decrease, and to build a coal downstream is very expensive; d. contributions to the Paris Agreement would be considered 'paid off' with low emission coal downstream; and e. does not mention environmental and social considerations, coal as an asset that must be exploited, in planning it must generate income [22,23].

In response to this, government policy is guided by the fact that Indonesia has 149 billion tons of coal resources and 38 billion tons of reserve coal assets, which in the planning must generate revenue. The government's strategy is to convert coal into a product that can contribute to global consumption with cleaner and lower emissions. Indonesian coal is still potential to be relied on as a driving force for the economy. However, it cannot be denied that in the future, there is a need for innovation in the coal business world to comply with the Paris Agreement, namely reducing greenhouse gas emissions. Therefore, the government encourages the implementation of coal downstream through 6 (six) opportunities for coal downstream technology prepared by the Ministry of Energy and Mineral Resources, namely: coal upgrading; coal briquetting; cokes making; coal liquefaction; coal gasification; and coal slurry.

The downstream policy is essential to overcome the declining exports and the high investment to construct downstream coal facilities. The government provides fiscal and non-fiscal incentives policies and leeway in paying 0% royalty to encourage investors to develop downstream coal industry within the country. In addition, the policy to extend permits period up to the life of downstream coal projects will be given to permit holders who build a coal downstream industry. The added value of coal downstream will create more job opportunities and benefit domestic energy use [16,17]. Meanwhile, the Indonesian Coal Business Association (Asosiasi Pertambangan Batubara Indonesia/APBI) hopes that the coal market share is still bright in the next 20 years. However, in facing global changes, the government needs to directly lead the process towards a renewable energy transition so that the interests of all parties, including coal business actors, can be appropriately accommodated [22].
In line with the government, Alpha Research Database Indonesia research states that the downstream coal policy can be seen as the best solution for the coal mining business in adjusting to the current condition. However, it takes revolutionary and innovative thinking from coal companies, especially in processing/downstream coal. In addition, government policies need to encourage switching from fossil fuels to electricity by developing downstream minerals such as nickel for batteries [24]. Overall, it is clear that the global movement in energy transition into a lower-emission energy source is inevitable.

4.2. Analysis of regulation

In the terminology of Law No. 4 of 2009, downstream coal activities use the term "increased value-added" (Peningkatan Nilai Tambah/PNT). Meanwhile, in Law No. 3 of 2020, the term coal downstream uses the terminology 'development and/or utilization of coal'. The Minerba Law mandates that holders of IUP or IUPK at the stage of production operations may develop and/or utilize coal, as mentioned in Article 102 paragraph (2). Furthermore, according to Article 104 paragraph (2) of the Minerba Law, holders of IUP or IUPK at the stage of production operation activities may also collaborate in the development and/or utilization of coal with other IUP or IUPK holders at the stage of production operations, or other parties conducting development activities and/or utilization of coal. In the context of coal IUP and IUPK at the production operation stage as mentioned in the two articles, the holder of a production operation IUP is said to be "may", but not "shall/obligation" to develop and/or utilize coal and its cooperation.

Meanwhile, holders of contracts of works (Kontrak Karya/KK) and PKP2B, who will extend their permits to become IUPK, are regulated in Article 169A paragraph (1) of the Minerba Law. KK and PKP2B are ensured for having the production extension in the form of IUPK to continue contract/agreement operations after fulfilling the requirements. According to Article 169A paragraph (4) of the Minerba Law, the IUPK, as a continuation of contract/agreement operations for coal mining commodities, is obliged to conduct development and/or utilization of coal in the country following the provisions of the laws and regulations. In this context, activities to develop and/or utilize according to laws and regulations are "shall/obligation" to be conducted.

What includes the development and/or utilization of coal under the elucidation of Article 102 Paragraph (2) of Law No. 3 of 2020 is regulated as follows: coal development can include, among others:
1) Improving the quality of coal (coal upgrading);
2) Making coal briquettes (coal briquetting);
3) Coking;
4) Coal liquefaction;
5) Coal gasification, including underground coal gasification; and
6) Coal-water mixture (coal slurry/coal water mixture).
7) The use of coal, among others, is by building its pltu at the mouth of the mine.

The terminology of coal PNT through coal 'processing' activities has been regulated in several regulations that are ancillary to Law No. 4 of 2009: namely:
1) Elucidation of Article 94 Paragraph (1) Government Regulation Number 23 of 2010 concerning the Implementation of Mineral and Coal Mining Business Activities, as ancillary to the Minerba Law.
2) Elucidation of Article 94 Paragraph (1) Government Regulation Number 77 of 2014 concerning Third Amendment to Government Regulation No. 23 of 2010, as ancillary to the Minerba Law.
3) Article 16 paragraph (3) Regulation of the Minister of Energy and Mineral Resources Number 25 of 2018 concerning Mineral and Coal Mining Business, as ancillary to the Government Regulation Number 23 of 2010.

National energy policy (Kebijakan Energi Nasional/KEN), formulated by the National Energy Council, is the basis for the national energy general plan (Rencana Umum Energi Nasional/RUEN). Presidential Regulation Number 22 of 2017 concerning RUEN targets 23% renewable energy by 2025 for the primary energy mix dominated by fossil fuels. Coal at 30%, followed by oil (diesel) and natural
gas at 25% and 22%, respectively. The electricity sector is still very dependent on coal as coal-fired power plants producing 60% to 65% of the total energy supplied [6].

In terms of regulation aspect, it can be concluded that the Government of Indonesia has been encouraging the mining business community to develop coal downstream industry since the issuance of Law Number 4 of 2009. Developing coal downstream is escalated to be mandatory for some coal mining companies in Law Number 3 of 2020.

4.3. Ease of investment facility/incentive analysis

Coal utilization technology has been successfully proven and implemented in various countries [25,26], yet it has not been successfully implemented in Indonesia until now. One of the main factors that became an obstacle was economic viability. Since the downstream coal program to increase domestic added value is considered strategic, the government is continuously attempting to create a favorable investment climate for investment in coal downstream through publishing the regulation in both fiscal and non-fiscal incentives. The objective of providing those incentives is that the downstream coal project can be economical and competitive to be increasingly developed. According to Article 128A paragraph (2) of Law Number 11 of 2020 concerning Job Creation, the government provides a facility to charge a royalty of 0% for coal PNT activities. This is further regulated in Article 3 paragraph (1) and (2) of Government Regulation Number 25 of 2021. Particular treatment in the form of imposition of a royalty of 0% is given by considering energy independence and meeting the needs for industrial raw materials.

In addition to these facilities, UCG coal development as a pioneer industry will receive sectoral/fiscal incentive facilities in the form of tax holidays, tax allowances, VAT, import duties, and others. Moreover, if the area is in the form of special economic zones (12 Kawasan Ekonomi Khusus/KEK), industrial zones/bonded zones, bonded logistics centers, and free trade zones, tenants in the area will receive regional incentive facilities.

Meanwhile, the ease of doing business in the form of non-fiscal incentives consists of:

1) Special coal price regulation to increase added value implemented at the mouth of the mine;
2) Regulation of a particular period for coal iup / iupk specifically used as coal supply for pnt, given according to the economic age of the project and/or the age of the reserves; and
3) Regulations on prices for processing products that can guarantee sustainable benefits for the state, society, and business entities, including the potential for more LPG subsidies [17].

4.4. Coal downstream analysis results

To provide input to the government regarding the policy of coal downstream, the Research and Development Agency for Energy and Mineral Resources conducted a study based on several aspects, namely: availability of coal and its characteristics, technology, economy, and the environment from the aspect of coal utilization related to CO2 emissions. Coal characteristic parameters are needed to determine the choice of downstream technology, such as coal gasification, coal upgrading, coking coal, bracketing, coal liquefaction, and coal-water mixture. Aspects of technology, economic feasibility, and the environment are the following factors to be considered, including the market for downstream products. From the analysis and measurement of each of these parameters, finally, it can be seen the downstream technology and its products that can be implemented into a downstream coal program to be carried out.

Based on this study, it can be classified as currently feasible downstream coal technologies are: [27]

1) Coal gasification includes underground coal gasification (UCG): products of methanol, ammonia, hydrogen, BBM, and dimethyl ether (DME);
2) Coal upgrading: higher calorie coal products;
3) Coke-making - semi coke - carbon raiser (cokes making): semi coke product (metallurgical smelter) and carbon raiser.

Based on the analysis results on technological and economic aspects, priorities for the development of coal downstream can be arranged. According to development priorities, the downstream coal is
sequentially conducted: gasification of DME and methanol products, semi-coke/carbon raiser, gasification of urea and ammonia products, UCG, upgrading, coal to fuel, hydrogen, and advanced materials as mentioned in Table 4.

**Table 4. Coal downstream development priority policy [27]**

| No. | Downstream Products               | Challenge                                                                 | Policy Proposals                                                                 |
|-----|----------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| 1   | Gasification of DME and Methanol | - Big investment                                                           | - Providing subsidies for DME, if intended for household needs                   |
|     |                                  | - The price of DME must be able to compete with subsidized LPG             |                                                                                  |
| 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                                            | - Share risks between BUMN and the private sector                                |
|     |                                  | - Domestic technology has not been proven                                  | - Government guarantees are required regarding the continuation of UCG investment |
| 5   | Upgrading                        | - Upgrading technology has not been commercially proven                    | - The government encourages PLTU to use upgrading technology                     |
|     |                                  | - It is necessary to integrate upgrading technology with PLTU or other technologies to make it commercially viable |                                                                                  |
| 6   | Coal to Fuel                     | - The market is already oversupply                                         |                                                                                  |
|     |                                  | - compete with biofuel development                                         |                                                                                  |
| 7   | Hydrogen                         | - The market is not formed yet                                             | - Encouragement/incentives for the use of hydrogen fuel                          |
|     |                                  | - There is no infrastructure                                               |                                                                                  |
| 8   | Advanced Materials               | - Not yet commercial, still in research and development stage.             | - Needs research collaboration                                                  |
|     |                                  |                                                                          | - Funding support (government and private)                                       |

Table 4 shows that each type of technology and downstream coal product has challenges and requires its policies, the challenges, and policy proposal for each of the downstream technologies and products. Coal gasification technology (including UCG) that produces DME and methanol or urea and ammonia products requires a significant investment. The product must be able to compete with the price of LPG. In contrast to upgrading technology which has challenges in technology that needs to be adapted to the PLTU, semi-coking/carbon raiser technology has challenges in product marketing. Meanwhile, coal to fuel which was previously developed in Indonesia, challenges remain, namely the market is oversupply and competes with the biofuel development.

The advanced carbon material production technology from coal tar products has a broad prospect and market share globally. Coal tar can be further processed to produce derivative products in coal tar pitch (CTP) and carbon precursors. Both products can be used as raw materials for energy storage which is the main component for new and renewable energy. The environmental aspects studied show that CO2 emissions from power plants can be utilized through the route of utilizing CO2 for methanol production, utilization of CO2 for algae production, and utilization of CO2 for enhanced oil recovery (EOR). These three things are technologies that can be integrated into CCUS technology.

Within the framework of priority implementation of coal downstream, a business model and development scheme can be drawn up based on aspects of coal downstream technology utilization and economic feasibility. Development priorities for small and medium enterprises (Usaha Kecil
Menengah/UKM) are formulated regarding technological factors and economic feasibility. From the study result, only the downstream carbon raiser can be implemented on a UKM scale at this time.

Several things from the results of the downstream coal study can be used as input in the implementation of the national coal downstream policy through the development and/or utilization of coal. The decision-making strategy on the condition of the national coal becomes the database for implementing the downstream coal policy. The assessment parameters are the choice of downstream technology, economic feasibility, infrastructure, product market, and diversification/national energy demand.

5. Conclusions and Suggestions

5.1. Conclusion

1) In facing global changes in the transition trend of fossil energy to clean and renewable energy, it is considered that Indonesia's implementation of downstream coal policies is the best solution for reducing emissions.

2) The downstream coal policy is based on national coal conditions by considering several parameters: availability of coal and its characteristics, technology, economy, and environment. Coal downstream technologies that are currently feasible to implement are:
   a. Coal gasification, including methanol, DME, hydrogen, ammonia + urea underground coal gasification products.
   b. Coal Upgrading: higher calorie coal products through the CDB process; and
   c. Making Semi Coke - Carbon Raiser (Cokes Making): semi coke products and carbon raisers.

3) The recommended sequence of the priority for the development of downstream coal product are as follows:
   a. Production of DME, methanol by gasification,
   b. Semi coke-carbon raiser through carbonization,
   c. Ammonia + urea through gasification,
   d. Syngas through UCG,
   e. High-quality coal through coal drying and briquetting (CDB),
   f. BBM through gasification and Fischer-Tropsch Process (indirect liquefaction),
   g. Hydrogen through gasification, and
   h. Advanced carbon materials through coal tar processing.

4) The implementation of downstream coal technology of UKM scale can be applied to coal carbonization technology to produce fuels commodity (char). The empowerment of UKM in the use of coal can increase the amount of domestic use of coal and substitute BBG and BBM.

5) With the implementation scheme of coal downstream technology to produce viable coal derivative products, 55 million tons of coal are needed. The coal downstream technology implemented is on the islands of Sumatra and Kalimantan, because almost 90% of the coal resources are in the two islands.

5.2. Suggestions

1) Coal downstream technology that has not been studied can be considered, such as coal briquetting technology, which can be implemented on a small scale whose product can substitute BBM and BBG.

2) In implementing coal downstream, related to determining the plant’s location, it is necessary to pay more specific attention to the characteristics of the coal.

3) This study is expected to be an input in the implementation of the downstream coal policy.
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