



Sustainable landscape management study on coal post-mining land in forest area with forest area loan for use agreement (IPPKH) in Indonesia

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Abstract. The rising mining activity caused rising environment degradating impact which influence environment quality with serious consequence not only locally but also globally. Environmental damage can be minimized if environmental protection is prioritized in coal mining development strategy. The assessment accomplishment of environmental management in coal post-mining forest area can be observed from how a coal mining company manages post-mining land that supports sustainable development of forest area. Most environmental disturbances influence the landscape and thus, prerequisite of area reclamation until the end of mining was designed. Model schemes in raising sustainable development indicator of coal post-mining landscape consist of: (1) environment (ecology); (2) social economy (public welfare and acceptance); (3) quantified assessment of sustainable mining. Ecological benefit ensures preservation of natural resources and environment. Social economy benefit ensures economical development of the area to reach planned sustainable long-term production. Coal mining is a promising investment project as state revenue while also poses high risk on the environment. To protect the sustainability of post-mining land, a balance must be achieved by supporting conducive investment condition and continued supervision by mining management and related stakeholders such as the government.

Key Words: coal, landscape, environment, post-mining.

Introduction. Coal mining is an entire phase of activity in managing and exploiting coal which encompasses general investigation, exploration, feasibility study, construction, mining, processing and purification, transport and marketing, and post-mining activity (UURI No. 4 year 2009). Coal mining gives fast and sustainable assurance to economy and cultural development of the community surrounding the area. However, the rising exploitation of coal caused massive damage to soil and environment surrounding the mining site. Area around coal mining site also gives serious impact to environmental destruction, causing more rapid damage which is exacerbated by the lack of law that control a development of environmentally friendly mining (Ming-yin et al 2009; Yang et al 2011). In the last several years, over exploitation caused massive change to ecological environment around mining sites, making direct and indirect changes to physical and biological properties of the environment. This rendered the environment to be unfit or no longer function as a support of sustainable life. Natural varieties of environmental elements suffered from different degree of damage, which has negative impact on ecosystem balance surrounding the mining sites and massively influence sustainable development on the region surrounding the coal mines (Yang et al 2011).

Mining activity in Indonesia forest area requires special permit, which is the forest area loan for use permit (Izin Pinjam Pakai Kawasan Hutan - IPPKH). The purpose of this permit is to limit and control the use of part of forest area for strategic interest and limited public interest outside of forestry sector without changing the status, function, and allocation of the forest area while also avoid enclaving in forest area (UURI No. 41

Year 1999). Coal mining potency contained in forest area may be present in various type of forest area, however the loan use of forest area for development purposes outside of forestry activity (mining) can only be given to production forest and forest reserve area (Ministry Decree Ministry of Environment and Forestry Republic of Indonesia No. P. 50 Year 2016). According to data obtained from Ministry of Environment and Forestry, in 2010 the number of forest area land use through IPPKH for mining has been approved for 176 units with total area of 238.068 ha and for non-mining for 158 units with total area of 20.044 ha. Until 2015, the use of forest area by using IPPKH status according to Ministry of Environment and Forestry, has reached 562 units with total area 457.614 ha for mining and 269 units with total area 46.685 ha for non-mining (Dirjen PKTL 2016). The rising of mining activity means the rising of environmental damage, on which the activity impacts environmental quality and poses serious consequences not only for surrounding area but also globally.

Law on environment protection in Indonesia mostly implement laws derived from other country. Coal mining must fulfill related environmental requirement that has been decided by relevant agreement and administration permit. In European Union, environmental protection is a primary priority. Thus, crucial problem concerning coal mining followed the requirement needed for coal production. Environmental protection is among the priorities of coal mining strategy. Negative impact from coal mining activity can be minimized by obtaining only desired amount of production (Burchart-Korol et al 2014). However, such condition is different in Indonesia. The strategy of policy implementation in environmental management of coal mining area should show its result. Conceptual framework in solving environmental problem concerning mining is suggested and then restoration process and repair steps are designed to overcome environmental pollution. Restoration steps are suggested to solve post-mining landscape changes (Bian et al 2010). Thus, the achievement assessment of environmental management in coal mining area can be observed in how successful a coal mining company is in managing the environment in its post-mining land to support sustainable development of forest area.

Concerning the importance of sustainable utilization of post-mining land, Indonesian government has released several constitutional laws on mining activity. Peraturan Pemerintah Republik Indonesia Nomor 78 Tahun 2010 (Republic of Indonesia Government Decree Number 78 Year 2010) on reclamation and post mining stated that one of the principles is mining environment protection and management. This indicates that the usage of post-mining land is better to be adjusted with the purpose of its utilization. The purpose of this research is to study several environment management policy concepts in post-mining forest landscape. It is hoped that the result of this study can be used as a recommendation to be implemented in coal mining industry in Indonesia, so that post-mining land management can be conducted effectively and rationally, sustainable for the future generation.

Coal mining sustainable development. Environmental damage issue on 1960 was a focus on attention and received responses from local government and world institution, generally to strengthen constitutional law on environmental pollution which is still weak and inappropriately enforced. After years, debates on environmental protection turned to focus in the dwindling and degradation of natural resources such as water, air, and unrenewable natural resources (Bangian et al 2012). The word sustainable development has been designed to reflect this urgency, which grows with the interaction of economy growth and long-term environmental quality. Sustainable development is a development which fulfills the present need without decreasing future generation's possibility in attaining theirs (United Nations 1987; Kemp et al 2016). Development must support the harmony between human and nature, live within the biosphere tolerance level, and ensure equality in asset distribution or as alternative to fulfillment of other creature's needs (Demo et al 1999).

Coal mining is among the sources of economy development in Indonesia. It plays an important role in ensuring revenue and energy for Indonesia. Thus, in order to implement sustainable development plan, it is hoped that exploitation and production can be in accordance with measured needs and demand and not excessively. It is possible

than within the next 20 years coal will be the main source of energy and primary ingredients used for electricity in Indonesia. According to International Energy Agency (2012) in Burchart-Korol et al (2014) Indonesia is one of the largest producer of coal in the world, being 4th and producing 5.7% of total world production. From that information, the implementation of sustainable development must be enforced. It would not only control ecology, economy, and social condition but also provide large opportunity for future generation to fulfill their own needs, especially in the management and utilization of coal resources (Figures 1 and 2).



Figure 1. Coal mining activities.



Figure 2. Revegetation on coal post-mining land.

Coal mining activity has caused serious environmental problems but almost 30% of global primary energy demand is fulfilled by coal and thus it is difficult to be replaced within a short period of time (Xu et al 2018). In this condition, since it is impossible to completely stop coal mining, investment in cleaner production technique is needed to reduce environmental damage. The condition of coal reserves and producer demand should consider global dynamics and trend of main ingredient economy. The importance of coal resources in world economy development is related to the importance of mineral resources for economy development. This is assumed to be related with sustainable development in mining sector which significantly shape mining development in the future (Dubin'ski 2013). Thus, sustainable development is evaluated from various points of view. According to Vrablikova et al (2016), sustainable development in mining sector is evaluated from three points of views, modified by other experts into:

1. Ecological point of view: ecology is strongly related with ecosystem structure and mechanism as a basic functional unit of nature, from ecosystem diversity, ecosystem health, ecosystem management, and ecosystem fertility. Ecological approach in maintaining a region for sustainable development must protect:

- ecology quality suitable with the condition of the said area (stability, capacity, balance, endurance, etc.) by adequate protection of soil surface for open vegetation, forest, plain, pasture, and surface water;
- protection and reasonable usage of natural resources, especially soil, water, and wood resources;
- direct protection of human environment. This encompasses management of anthropic, semi-natural, and natural elements to ensure that hygiene, health, and psyche are the main requirements of human safety in a healthy environment;
- progressive rehabilitation to keep disturbance damages in its minimum and to ensure ecological and agricultural land use production can be restored as soon as possible with preferences on waiting until the closing of the mine (Lechner et al 2016).

2. Biophysical and socioeconomical point of view: socioeconomy is an important part of sustainable development to supervise the process in giving social, economy, and environmental balance in the world. This created a structure which is related to one another for its decision making, basing itself in community to enable people to coordinate their movement in ways that do not destroy their natural resources. Sustainable moral compass explores difficult problems such as the values for future generation or

aesthetics. Important biophysical and socioeconomical factor for the fulfilment of permanent sustainability on earth are:

- total recycling of materials;
- transition of energy system permanently to sustainable resources;
- stabilization or decrease of human population;
- closing gap between developing and developed nation;
- creating community-based decision-making structure that enables wide improvement and coordination;
- change in the relationship between economy and ecology system.

3. Political point of view: sustainable development problem should be handled not only by environmentalists but also by politicians. Sociologists, philosophers, politicians, researches and economists should cooperate in finding politic, economy and law mechanisms that can solve the rising ecological problem. Sustainability requires a more complex law making involving the protection to present environment and especially wider commitment in environmental management policy. This requires cooperation between politicians and experts in the field, unlike sly conventional policy that approves natural resources exploitation. New ecological policy should be based on a different principle that concentrates on controlling living cultural ecosystem. It is possible that most of the sovereign countries did not feel the need of effective intervention to global threat. First and foremost is the impact of climate change, ozone layer disturbance, and the problem of drinking water availability in various sides of the world. Demo et al (1999) states that a country that is unable to protect its people from global ecological problem may lose its dignity while throwing the doubt of legitimate accuse to its people. A nation's activity should be more robust in promoting environmental restoration and avoid further damage in environment.

Life Cycle Management (LCM) is an indicator of sustainable development, which combines environmental assessment, social assessment, and the cost of life cycle. Burchart-Korol (2011) provides a complex assessment method for sustainable development and applied the potency of Life Cycle Sustainability Assessment (LCSA) and Socio-Eco-Efficiency Analysis (SEEbalance). Implementing Life Cycle Perspective (LCP) as main basic foundation of sustainable development enables the fuse of sustainable development issue into decision-making process. LCP considered product related aspects (environment, economy, and social) thorough the entire life cycle (from main material excavation up to material processing, production, distribution, exploitation, renovation and maintenance, usage and recycling) in a chain of value (Burchart-Korol et al 2014).

Indicator of sustainable development is a basic measuring device that enables visualization of concept essences in measurable forms. In the last several years the importance of sustainable development keeps growing, especially after considering environmental issue related to global warming. Sustainable development issues also appeared in the strategy and action plan of coal mining industry (Yu 2017) and these issues play an important role in determining the purpose and priority related to sustainable development of a country, especially Indonesia, and its ability in following the rule of sustainable development.

Mining activity has always been connected to its negative impact on the environment and thus, preventing significant environmental impact is important for coal mine. According to Burchart-Korol et al (2014), coal mines better implement environment management system and develop environment protection strategy to main environmental aspect of coal mines such as: mine waters, mining waste, and methane emission to the atmosphere.

Landscape management post-coal mining. Most of coal mines in Indonesia adopt open mining method which still presently occurs by damaging the land (Maryati 2013). This method is a mining and digging effort in the surface which is directly in contact with open air. Coal mining done on forest land becomes a serious disturbance to tropical ecosystem which drastically lead to land damage and forest areal degradation, exploiting vegetation, soil, and stone. Several studies state that mining impacts the surrounding

environments, influencing land potency and productivity. It causes landscape change, changes and loss of vegetation, increasing greenhouse gasses, erosions, sedimentation, flood, and lowering soil productivity from changes of soil physics, chemistry, biology, stability, and overall properties (Awuah-Offei & Adekpedjou 2011; Makineci et al 2011; Burchart-Korol et al 2014). This soil degradation worsened with the lack of research, bad management, weak regulation, and rehabilitation failure on post-mining land. Considering mining impact on forest environment is very dangerous, post mining land should be rehabilitated by reclamation and revegetation. Forest reclamation is an effort to restore or revitalize damaged land and vegetation so as to function optimally according to their purpose. Reclamation is required to achieve post-mining land that is safe, stable, and productive. Thus, usage of post-mining land should be managed well (Lechner et al 2016). Revegetation is an effort to restore damaged vegetation through planting and maintenance activity on used forest soil.

Method of managing landscape post coal mining is done according to post-mining activity plan which begin by determining the use of post-mining land. This should be done carefully by considering soil physical properties, topography, micro climate, and risk assessment to reach a productive and sustainable usage. This is possible by fulfilling a harmonious governance around coal mine area. Steps that should be considered are:

- coal excavation should be adjusted to soil capacity. For example, exploitation on mining lands with critical status such as swamps should be done by soil reclamation, ensurement of water flow, and avoidance of water accumulation which will improve land use efficiency (Yang et al 2011; Zhou & Zhao 2011; Jonek-Kowalska & Turek 2013);
- tree replanting and effective efforts in avoiding direct fire of coal remnants should be done to improve environmental condition on mining sites;
- building power plants from the remnants of coal to use the remnants of coal, fly ash, and other solid wastes (Wang & Guo 2007);
- reshaping ecological system through soil restoration and building food chain from the ecology to obtain higher economical and environmental benefits (Liu et al 2010; Jonek-Kowalska 2014; Michalak & Nawrocki 2015; Sierpińska & Bąk 2012; Sierpińska & Bąk 2013).

Landscape exploitation by mines exists in different extents, influenced by the difference of coal potency in the field. This exploitation increased in second last term of 20th century, when mining is concentrated in larger region, creating gigantic hole in open air caused by mining activity (Vrablikova et al 2016).

Most of environmental disturbance impact the landscape (Figure 3), signified by the contamination of soil, water, and air, worsening of water table and drinking water sources, decreasing plant and animal diversity, and other impacts. The requirements of area reclamation until the end of mining are planned while mining is on progress (Figure 4). Reclamation does not indicate the end of mining but is a structured part of the process. This provides guide for nature subsystem (environment with stone, soil, water, atmosphere and climate, flora, fauna, and ecosystem) and restoration of components desired by people (garden, playing ground, sport center, plantation, suburbs recreation zone, lake, and water surfaces).



Figure 3. The process of opening a landscape for mining activities.



Figure 4. Mine pit closure process.

Theoretical point of view of landscape reclamation is related to the steps of environmental function restoration as written in Republic of Indonesia Constitution Number 32 Year 2009 (UURI No. 32 Year 2009) on the protection and management of environment, completed with results of Vrablokova et al (2016) study on restoring post-coal mining land, which are:

1. Land reclamation:

- human activity is focused on restoring nature and land values changed by humans;
- reprocessing land main materials (such as main materials after mineral-mining) into agricultural land or forest.

2. Land restoration:

- restoring desired features of degraded land;
- controlling the treatment of various vegetation to focus on modifying nature to provide better effect.

3. Land rehabilitation:

- returning ecology stability and improving aesthetic quality;
- returning to initial state, for example the landscape.

4. Land optimization:

- finding socially optimum condition after destabilization compared to its natural state;
- the nation has fulfill all need without sacrificing regulation and landscape regeneration process;
- finding the best possible option to be managed, agreed, and implemented.

5. Reconstruction:

- reconstruction of nature geobiocoenosis;
- returning nature condition to its initial state.

6. Remediation:

- to renew nature condition on soil polluted by mining activity.

7. Regeneration:

- the ability of an organism to rejuvenate cell, organ, or whole body, or even part of landscape;
- this generally means restoring something to initial state, such as in soil.

8. Rebuilding:

- cleaning, restoring poor situation related to mining activity. These are used to better adapt with slope stability, overlapping layers of coal or lower level of excavation site.

For replanting called revegetation, interpretation given is related to land use on abandoned or damaged land for reforestation purposes or as agricultural land. More general meaning of replantation is given as a chain of steps and maintenance for reclamation of degraded and damaged land caused by mining activity, giving contribution on the restoration of landscape productivity and overall natural features of all nature components. Replantation process should respect forest ecosystem value with stronger emphasis on ensuring restoration of land and forest and the appropriate function of ecosystem on reclaimed post-mining land (Burger 2011). Forest reclamation approach replaces plain reclamation where forest is a logical land use post-mining activity. Restoring forest land, endemic species, and the protection of river area is a positive result of post-mining reclamation activity (Figures 5 and 6).

As an example the largest restoration in North Bohemia, Czechs Republic is a post-mining land, which include open mining and underground mining, waste disposal and stacks, tailing pond, mined peat swamp, post mining region of stone, gravel, brick, and ceramic materials. This is crucial in restoring environmental function by developing landscape reclamation stages on the area. Restoration of anthropogenic activity consists of post-mining rejuvenation of eco-technical stage and on later restoration stage focusing on resocialization which is the return of people to previously damaged land (Vrablokova et al 2016).



Figure 5. The process of reclamation and revegetation of landscapes on coal post-mining land.



Figure 6. Landscapes that have been improved after coal mining.

According to Vrablikova et al (2016) landscape restoration method by revegetation on post-coal mining land classically is divided into four main methods:

- replanting of agricultural vegetation, resulting in fertile agricultural land, permanent plain, bushes, parks and garden of grapes;
- the most used replantation method is by making productive forest (local vegetation or fast growing trees in terms of energy usage), forest with particular purposes (land conservation, hydrology, agricultural land restoration, climate, vegetation spread, etc) (Fields-Johnson et al 2012);
- hydrology restoration including stagnant water, flowing water, and wet land. The most effective method is repairing holes left after coal mining;
- developing new frontiers, tree pathings, and also places for recreation activity, parks, garden colony, sport center, etc.

Stages of replanting process in coal post mining land can be divided into four steps (Figure 7):

- preparation process to optimize whole process. In this stage documentation of planned territory is processed and discussion begins from mining method which involves: mining technicalities, land governance, technicality of environmental impact analysis (AMDAL), and the method of minimizing and tidying damage post-mining such as planting techniques (silviculture), soil/land condition analysis, and preparation of suitable plant seed (Yang et al 2011; Burchart-Korol et al 2014; Vrablikova et al 2016);
- reclamation stage which consists of mining technicalities with preventive characteristics, taking care of technical and economical suitability if the condition can be tolerated for next revegetation, for example in waste landfill location, piles of excavated soil, working system in excavating soil low layer for mine chambers, etc. (Yang et al 2011; Vrablikova et al 2016);
- biological technique stage which consists of technical and biological procedures to eliminate negative impact of mining. Technical work includes creating contour formation and reliefs, refilling fertile or potentially fertile land composition (Yang et al 2011; Maryati 2013), modifying flooded land and runoffs in the location, stabilizing slopes and erosion control measurement system, continuing road construction to make the area accessible, and so on. Biological effort is a group of forestry and agricultural technical effort, especially those related to building and maintaining green area where target and plant type for revegetation depends on local needs (agriculture, forest, plantation, natural species, etc.);
- post-revegetation stage is related to handover process of land subjected to revegetation so that it is productive in the future for user and land owner through revitalization and intensive monitoring from the government (Vrablikova et al 2016).

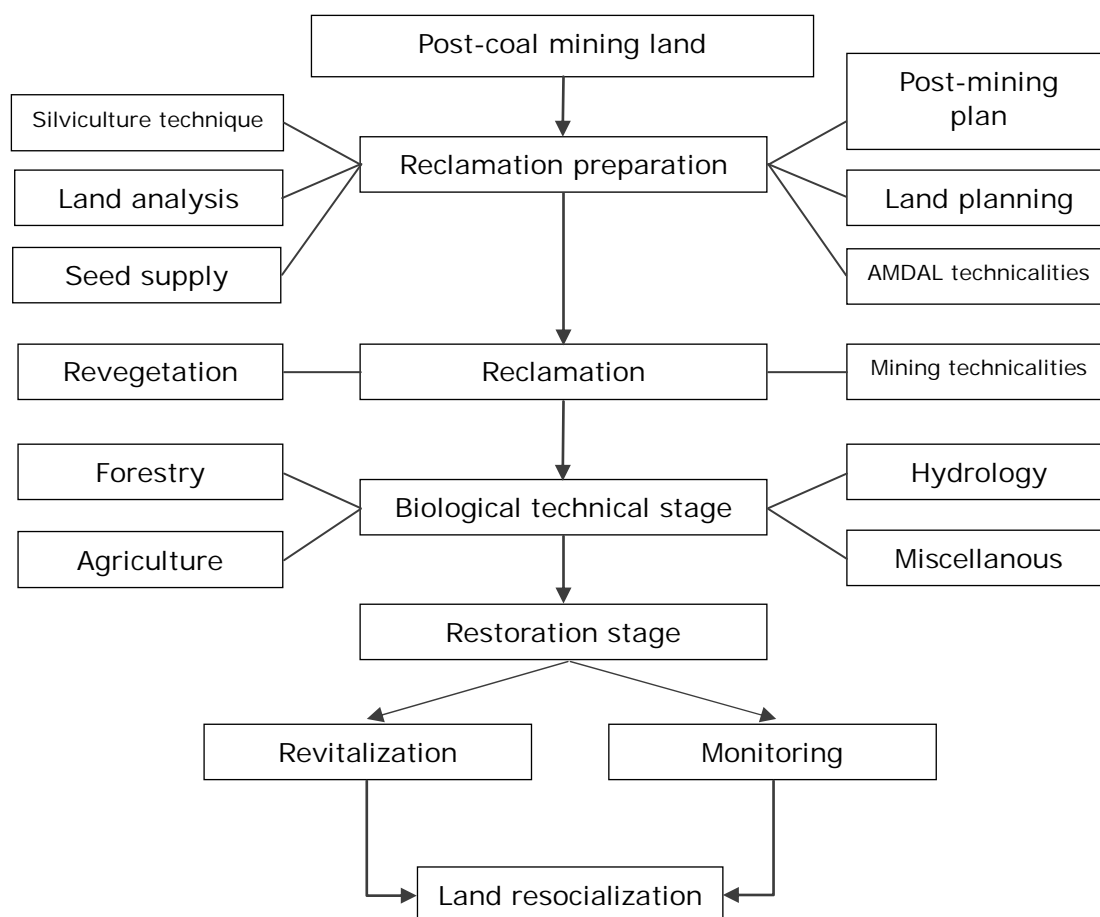


Figure 7. Modified post coal mining land reclamation procedure (Vrablikova et al 2016).

The concept of restoration and landscape revitalization has been a much discussed problems recently (Burchart-Korol et al 2016; Vrablikova et al 2016). In general terms, this concept refers to every effort including socioeconomic effort related to environmental quality improvement on regions damaged by mining activity. To solve the condition, coordination with complex integration around the landscape is required. All problems of environmental and individual component relation should be entirely taken care of, for example a given location should be able to fulfill its ecological function separately. Revitalization steps suggested must be appropriate and the effect should be acceptable by the community. Other than landscape ecological integration, it is important to focus on the need of the community and obey integration management principle of the region.

Sustainable coal mine landscape assessment. Coal mining landscape assessment refers to assessment of environmental efficiency and cost efficiency during production process up to its landscape rehabilitation stage. This research allows it to be done in complex pathway so all aspects of sustainable development (environment, economy, and social) become main indicators. Model scheme in measuring sustainable development indicator in coal mine landscape is divided into three stages (Vrablikova et al 2016): environment assessment; socioeconomic analysis; quantification assessment of sustainable coal mine.

Environmental assessment in coal mine sites. Life Cycle Assessment (LCA) is chosen to be used during coal mine land environmental assessment. LCA in environmental assessment includes factors that affect environment directly such as waste management, mine water usage, and methane emission, while also consider indirect environmental impact concerning main ingredient production and main source of energy used in coal

mine (Awuah-Offei & Adekpedjou 2011; Burchart-Korol 2011; Burchart-Korol et al 2014, 2016).

- Based on standard requirement of ISO 14040: 2006, LCA is conducted in 4 steps:
- determining the purpose and scope of analysis;
 - collecting and analyzing input and output data;
 - measuring environmental impact according to designated categories;
 - results interpretation.

LCA implementation makes possible to obtain several environmental indicators. ReCiPe 2008, the most complex method in environmental assessment, allows damage assessment in three categories: the health of human, ecosystem and resources, while assessing the impact in 18 categories of environmental impact (Burchart-Korol et al 2014, 2016): climate change, ozone depletion, soil acidification, fresh water eutrofication, sea eutrofication, photochemical oxidant formation, particulate formation, human toxicity, terrestrial environmental poison, sea ecotoxicity, fresh water ecotoxicity, ionizing radiation, agricultural land occupation, urban land occupation, natural soil transformation, water depletion, mineral resources depletion, fossil depletion.

Coal mine socioeconomical analysis. Coal mine socioeconomy analysis used Cost Benefit Analysis (CBA) method, which compares and assesses all costs and benefits for community and ecosystem which are related to certain activity while considering the tangible and untangible costs and their benefits. CBA method is used to assess the contribution of coal mine in improving economy welfare of the region and the nation. Developed schemes must have its assessment to be made from community perspective (of a region or nation), while cost analysis only assumes the perspective of coal mine owner. The assessment methodology for coal mine socioeconomy analysis consists of the following stages (European Commission 2008 in Burchart-Korol et al (2014):

- adjusting the effect of tax, subsidy, or other transfer;
- adjusting external effects;
- transforming market price into accounting price, which allows cost and social benefit assessment (building conversion factor).

Social expenses of mining activity show that to reach balance of external costs and benefits obtained from coal mines, the following costs should be considered (Kaszowska & Nowak 2013; Krawczyk et al 2014):

- work related accidents cost;
- work related disease cost;
- mining damage and loss of degraded land by mining activity cost (decrease of utility and aesthetic of an area);
- environmental cost caused by emission pollution (mining waste especially unmanaged waste, mine acid water, methane).

While obtained benefits are:

- benefit from opening new workplace;
- benefit from the cooperation between mining industry and other business organizations, especially village business organizations or farmer unions from surrounding area;
- regional and national benefit from tax payment from mining company;
- infrastructure benefit around mining sites build by mining company.

Sustainable development aspects assessment for coal mine. Sustainable development indicators allow coal mine to be compared. Method suggested to assess sustainable development indicator is for it to be based on LCA and CBA at the same time. This is the reason why special care should be given on the input of every environmental aspect that will be analyzed. To avoid faults related to the same factor between LCA and CBA, external effect (especially environment) verified during CBA should be checked if it is also included in certain environmental impact category in Life Cycle Impact Assessment (LCIA). LCIA is used to determine the category of damage on health of human, ecosystem, and resources (Burchart-Korol et al 2014, 2016).

The scheme designed to assess sustainable development on coal mine landscape was made to allow complex use that consider social, economical, and environmental aspects. The result can be used to support coal company management in making decisions related to analysis and assessment of various functional aspects of coal mining. It also supports multi-aspect efficiency strategic analysis of mining industry during transformation simulation in coal mine production and its impact to environmental, economical, and social efficiency. A research by Cardoso (2015) showed that economy value of socio-environmental obligation per ton of coal extracted and exported to be higher than the market price of coal. Socio-environmental liability especially arises from pollution, local community's decreasing health, depletion of surface water, loss of soil and ecosystem service, damage caused by transportation and distribution, and the loss of coal reserves. Compared to research in China and United States, it appeared that values increase when other health impact and climate change on global scale are considered (Wang et al 2016).

Benefit of sustainable landscape management. General definition of sustainable development concept is included in 27 Principles of Sustainable Development contained in documents signed during Earth Summit in Rio de Janeiro on 1992 which was related to issues on world future, environment, and global resources towards sustainable development. It also stressed out the need of cooperation in creating sustainable economy in industry which used mineral resources and creating new technology to be used by them. Implementation of sustainable development means integration of three main activities of post coal mining environment management, which are (Dubinski 2013):

- economy, mining activity can improve economy growth and achieve long term sustainability benefits by fulfilling desired production and consumer demand. By doing so, economy efficiency can be achieved through the sales of mining products;
- ecology, ensuring the protection of natural resources and environments. Its benefit is on giving awareness to leave and protect resources within rational acquisition, indicated by dwindling reserves. This should be done by taking steps that minimize negative impact from processes related to mineral resources extraction in various geological forms and natural landscape;
- social, its benefit is granting safety and protection to employees in their workplace and development of communities around mining sites. Social responsibility is considering the characteristic of mining environment, not only that the safety of every working condition should be ensured but also includes social aspects of mining, family of miners, mining environment, etc..

Every IPPKH holder will be imposed Penerimaan Negara Bukan Pajak (PNBP—Non-tax National Revenue) tariff. PNBP is central government revenue that does not come from taxation. PNBP from general mining field through IPPKH holders give relatively significant contribution to national revenue in Indonesia. Thus, every issue in the implementation of IPPKH and other problems that happen around coal mining in forest area will automatically disturb the investment itself. This condition is not linear with world coal mining condition which tends to fluctuate, such as erratic coal price and the issue of green house gasses and the resulting environmental impact. Coal mining investment as promising investment project for national revenue yet at the same time poses high risk to the environment, should be supported with conducive investment climate and continual monitoring between mining management and related stakeholders to protect post coal mining landscape sustainability.

Integrated and sustainable post coal mining land planning can be implemented on various businesses in the field of cultivation such as: forest vegetation, agricultural vegetation, aquaculture, and cow farms. Profitable potency until the closing of mine can be up to USD 91,295,530 (1 USD = Rp 13,329) (Kodir et al 2017). Other than environment restoration through conservation and protection, post coal mining land also has the potency of economical development and may give social benefit for the community. With this condition, once the mining end, social condition and environmental sustainability can be maintained.

Conclusions. Sustainable development is an important concept in managing the nation and developing community resources, especially in regions damaged by coal mining with restoration by revegetation and revitalization to ensure landscape development that is permanently sustainable to provide suitable condition for future generation.

The concept of restoration and revitalization of post coal mining land is a concept that refers to every activity, including socioeconomy activity related to quality improvement of the environment in damaged area. After conducting complex coordination for integration surrounding the land, a certain location should be able to fulfill separate ecological function and thus proposed revitalization steps should be appropriate and its effect should be acceptable by the community. Other than landscape ecology integration, focusing on the needs of the community is important, as well as to follow integrated management principles of the area.

IPPKH becomes one of the media that bridge national investment interest with the interest of protecting nature sustainability and environment, which allows investment in coal mining sector to be allowed in forest area with strict prerequisite and requirements to protect forest sustainability. Other than that, national government and related stakeholders are the main factors of the issue for they are the determinant and the subject of forest sustainability protection policies in Indonesia.

Nation has the role of determining a good environment by intervening community in a given environment with activities related to their own everyday health and safety, such as determining the presence of mining and its post mining condition. However, these interventions are mostly negative where communities face emission, waste water, various waste products, forest clearing, land robbing, and so on. These negative impacts can be minimized by strict policy from the nation to respect the boundaries of living space with appropriate management.

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