ICESE
Interaction, Community Engagement, and Social Environment
ICESE 1(1): 27–39
ISSN 3025-0293

# Social impact analysis on environmental conflict dynamics at coal fired steam power plant

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Received Date: April 21, 2023 Revised Date: June 28, 2023 Accepted Date: July 23, 2023

Cite This Article:
Ishardanti, R. (2023). Social impact analysis on environmental conflict dynamics at coal fired steam power plant. *Interaction, Community Engagement, and Social Environment, 1*(1), 27-39. https://doi.org/10.61511/icese.v1i1.2023.187



**Abstract**
This article examines the dynamics of environmental conflict to the community around the Batang Coal Fired Steam Power Plant as a case study. Rejection of it appears in the early stage of the construction because of its thread to the environment and economic resources, mostly to farmers and fishers. Batang Coal Fired Steam Power Plant has track records of conflict turmoil from behalf of the Ujungnegoro, Kandeman District, Central Java. This study used a qualitative approach with in-depth interviews and FGD methods to affected districts and related government agencies, as well as analyzing environmental pollution. Social impact assessments (SIA) are a framework to investigate the causes, dynamics, and resolution of social-environmental conflicts. This study found out that the root cause of environmental conflict starts with ecological degradation. The dynamics of social and economic will accumulate until a form of conflict. This study offers conflict management models in resolving social-environmental conflict.

**Keywords:** Coal Fired Steam Power Plant; conflict management; degradation; economic resources; pollution; resolution models; social-environmental

## 1. Introduction

Conflicts over resources and the environment have increased over the past decade (Hess & Fenrich, 2017). One of the most debated causes of environmental conflict is ecological damage or deterioration (Libiszewski, 1992). Ecological degradation results in the conflict being questions because it is considered as a driving force and justification of political interests (Barnett, 2000). However, ecological change causes social impacts that can lead to environmental conflict (Mackay, 1981). The dynamics of increased conflict escalation are socio-environmental factors that emphasize the biophysical dimension, the natural cycle, humans, social structures, and the dynamics of interdependent relationships between these dimensions (Hess & Fenrich, 2017; Little, 2001). The link between socio-economic, political, and cultural is possible to bring about environmental changes that lead to conflict (Libiszewski, 1992).

This series of conflict cause-dynamics manifest different conflicts in each region or community because the social context greatly influences the forms of conflict that arise. Social conflicts are seizing, using, and marking different areas, which continue to develop until they feel threatened by a group of undesirable impacts through impacts on land, water, or living systems, as a result of activities resulting from the actions of other groups (Hess & Fenrich, 2017). Therefore, sustainable development requires a balance of three aspects namely economic, social, and environment. Unfortunately, economic development gives impacts on the environment.

Economic development requires the availability of natural resources and supporting infrastructure. One of the most fundamental one is energy infrastructure. The total installed capacity of plants in Indonesia is 54,577.9 MW, most of which still depends on Coal Fired Steam Power Plants by 45.1% (PLN, 2019). Additional generating capacity over the next ten years (period 2018-2027) for the whole Indonesia is 56.0 GW or still dominated by Coal Fired Steam Power Plants which reach 26.8 GW or 47.8% (PLN, 2019).

Coal Fired Steam Power Plants create polemics because they are considered being one of the most significant contributors to air pollution after motor vehicles (Walhi, 2019; Tempo, 2019). Meanwhile, solid waste from coal combustion such as bottom and fly ash (FABA) could contaminate groundwater plumes by surface water bodies. Past study shows that fly ash did not impact residential wells near the site. However, they consider potential damage case on site groundwater contamination (U.S. EPA, 2015). This accumulation of environmental problems enables environmental change.

The construction of Batang Coal Fired Steam Power Plant has become one of the projects experiencing conflict. Around 7,0000 residents in 3 villages around the location expressed rejection because of fear of losing livelihoods and environmental damage, precisely two agricultural communities and one fishing village (Noorden, 2013). Various NGOs and environmental activists accompanied residents who insisted on refusing development. Multiple actions were carried out starting from Batang, Jakarta, even to Japan (Abidin, 2018). The rejection of the community around the power plant is known as Ujungnegoro, Karanggeneng, Ponowereng, Wonokerso, and Roban (UKPWR). Community lawsuits including land acquisition and environmental pollution disturb the livelihoods of fishers and agriculture. Although the confrontation is currently fading, the operation of Batang Coal Fired Steam Power Plant may trigger another conflict in the next phase, where the service of Batang Coal Fired Steam Power Plant is planning to begin in 2020.

The construction of the power plant considered as unsustainable because it does not meet three main aspects such as environmental, economic, and social issues. These three aspects must go together. However, in the context of coal plant development, it appears that economic elements are prioritized, and tend to forget the environmental and social aspects. Therefore, the main question of this research is to explain the dynamics of environmental conflict and how to manage the application of environmental conflict at Batang Coal Fired Steam Power Plant. This study would contribute to Social Impact Assessment (SIA) tools in the conflicted area. Moreover, the practical benefits of this research can help as material for further consideration in government programs, especially electricity programs related to coal-fired power plants and their environmental management, to realize sustainable development and in formulating policies and making decisions.

This section explains the concept of environmental conflict which is analyzed through a social impact assessment. The principal concern of this study is to understand causes, impacts, and potential conflict solutions of environmental problems to the field of a coal-fired steam power plant. Based on this assessment, critical factors would be found and could be applied as a basis for conflict management consideration.

Sustainable Development Principles. Economic growth cannot occur in the long term and is continuously unlimited (Meadows et al., 1972). Based on simulations of economic growth and its limits, it triggers the emergence of limits in economic development. This encourages the creation of ideas to maintain environmental conditions for the long term. The concept of sustainable development was first known in Brudlant Report. Sustainable development is defined as development that fulfils our current needs without compromising future generation's ability to meet theirs need (Common & Stagl, 2005; Keeble, 1988).

The aims of sustainable development require an increase in the life quality for the world by considering the carrying capacity of the earth and the use of natural resources. The synergy between three aspects, precisely economic, social, and ecological elements, is a must to achieve this (Common & Stagl, 2005). Sustainable development then gives rise to the concept of Social Development Goals (SDGs), which aims to prosper the community and

preserves the environment. There are some sustainable development targets. In this research, energy projects are goal number seven. The energy here is not only an affordable and clean energy, but also related to other SDGs goals. Researchers assess that the development of electricity infrastructure with coal-fired power plants is not sustainable development. The 10,000 MW and 35,000 MW electricity programs do not attach importance to sustainable rules. Only the economic aspect is the primary consideration.

Ecological Degradation, Social Dynamics, and Environmental Conflict. The environmental context in this article is related to the concept of ecosystems and fundamental environmental changes, compared to the issue of resources (Libiszewski, 1992). Environmental changes caused by humans have positive and negative impacts. Nevertheless, in this context, environmental changes have adverse effects. Environmental change can mean ecological degradation and loss of life quality (Gaan, 2015; Libiszewski, 1992).

Ecological degradation is human-caused environmental changes that harm society, which shows more precisely the causes of environmental conflict (Libiszewski, 1992). The concept of environmental change is often distinguished based on renewable and non-renewable natural resources. Conflicts related to struggles over access to resources cannot be categorized as environmental conflicts, because basically, the case is a socio-economic conflict. Ecological degradation leads to another problem like the scarcity of resources. Resource scarcity divides into four types of scarcity namely physical, geopolitical, socio-economic, and environmental (Rees, 1992).

The definition of environmental conflict can be understood as a conflict caused by environmental scarcity from resources, which occur due to human interference to the ability to regenerate the environment (Libiszewski, 1992). The shortage of the environment can be triggered by the overuse of renewable resources and pressure from excessive ecosystem capacity (pollution). Both of these can cause damage to the environment (Libiszewski, 1992).

Environmental conflicts are disputes or discrepancies that arise due to environmental problems, and the rapid development that causes pollution, land use, security, and comfort (Setiawan, 2003). Sources of disputes that lead to environmental conflicts are resource competition, relative valuation differences, insufficient knowledge of costs, benefits, and risks (Westman, 1985). Environmental conflicts are disputes or discrepancies that arise due to environmental problems and the rapid development that causes pollution, land use, security, and comfort. Sources of disputes that lead to environmental conflicts are resource competition, relative valuation differences, insufficient knowledge of costs, benefits, and risks. Conflicts do not occur suddenly. There are always initial indications. Conflict stages seen as a social process that have three steps, i.e., cause, dynamics, and resolution (Prayogo, 2010).

Environmental conflict and traditional conflict have different meanings. Traditional conflicts are more focused on geopolitical issues, scarcity of physical and socio-economic resources (Gaan, 2015; Libiszewski, 1992). Therefore, the definition of environmental conflict has two crucial implications. These exclude non-renewable resources and focus on renewable resources, which in this context, ecological degradation, results in scarcity of renewable resources (Libiszewski, 1992).

Conflicts are becoming more complex due to various causes in the modern era (Vanclay, 2020). Environmental conflicts occur as a result of ecological destruction. However, it does not necessarily and directly lead to conflict. It becomes different from ethnic or religious conflicts, where several resource competition variables involve political contexts and differences in values owned by the community. This context caused environmental conflicts in each region to be different.

Table 1. Cause and dynamics of conflict

| *Indicating Conflict* | *Possible causes of Conflict* |
|---|---|
| Overuse of resources | Environmental change |
| Access to resources | Ethno-political differences |
| Damage to environmental quality (pollution, overexploitation) | Center-periphery relationship |
| Differences in ethical and religious beliefs | Migration/displacement |
| Simple scarcity | |
| Problem due to group identity | Demographic pressure |
| Friction caused through deprivation of lower status group | Shared resources |

Source: Barrow, 2010

The definition of the conflict itself has stages from which only in the form of argumentation and contention both at the individual level and against the state (Libiszewski, 1992). Therefore, there are several stages in the level of conflict that can predict future environmental conflicts (Pfetsch, 1991; Libiszewski, 1992). Discussions related to the relationship between ecological degradation and the occurrence of serious conflicts are still much debated. Environmental problems require an analysis of multidisciplinary science, namely chemical and biological processes, and also see the side of social phenomena that occur (Esteves et al., 2012; Libiszewski, 1992). It assumes that ecological degradation does not have a direct relationship to conflict, but there are stages of analysis of environmental impacts, social impacts, and conflicts (Libiszewski, 1992; Prayogo, 2010).

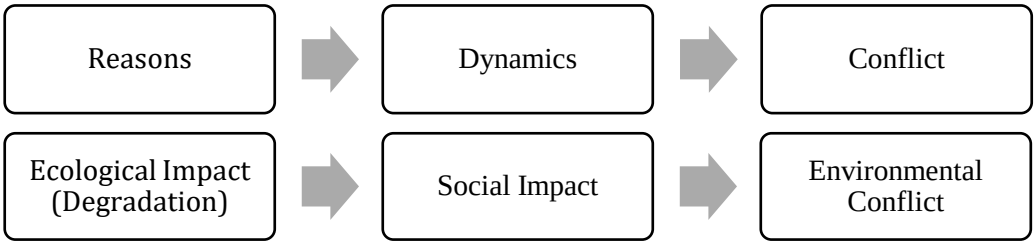


Figure 1. Environmental conflict stages
*Source: modified by author*

The conflict does not appear suddenly; there is a series of causes and dynamics. The relationship between socio-economic, political, and cultural is possible to bring about environmental changes that lead to conflict. The socio-political context is the most influential. The range of these factors includes beliefs, social structures such as family and community, religious and ethnic group, socio-economic factors, including political institutions. This context determines the vulnerability and the ability of community adaptation to environmental pressures (Libiszewski, 1992).

Conflict studies that have been conducted related to energy sources or natural resources mostly raise issues of social conflict (Julianti et al., 2018; Niskanen et al., 2020; Prayogo, 2010). The background of political policy, community culture, and economic interests make the dynamics of environmental conflict very complicated (Barnett, 2000; Niskanen et al., 2020). Discussions related to the relationship between ecological degradation and the occurrence of conflict are still much debated. Environmental problems require an analysis of multidisciplinary science, namely chemical and biological processes to see the side of social phenomena that occur (Esteves et al., 2012; Libiszewski, 1992). The current conclusion confirms that ecological degradation does not have a direct relationship to conflict, but there are stages of analysis of environmental impacts, social impacts, and conflicts (Libiszewski, 1992).

Another argument states that ecological degradation as the leading cause of the conflict is being questioned because it is just a driving force and justification of political interests (Barnett, 2000). Despite this, studies on the consequence of coal-fired power plants have resulted in the pollution explaining that the construction and operation of power plants produce waste can pollute the environment such as air pollution, solid waste, and water pollution (Dandautiya et al., 2018; Islam & Al-Amin 2019; Mulya, 2015).

Based on the understanding of environmental conflicts, it is a challenge for this study to discover how ecological degradation caused by the construction of a power plant will have socio-economic impacts that create conflict in the community. The environmental conflict itself manifests in the context of politics, social, cultural economy, religion, and the interests of natural resources, all triggered by ecological degradation. Hence, it becomes essential to know the cause of conflict, in this case must be in the form of ecological degradation and how the dynamics of the conflict develop due to social factors.

Environmental and Social Impact Assessment (SIA) Approach to Conflict Management. The concept of Environment and Social Impact Assessment (ESIA) was introduced in the USA by the National Environmental Policy Act (NEPA) in 1969, including Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) (Götzmann, 2017; Momtaz & Kabir, 2018). ESIA has been developing since 1970 and new SIA guidelines were formed in 2014 and created a report of SIA in 1994 (Burdge et al., 2003).

SIA is a tool for assessments or forecasts of social impacts that will occur from the application of specific policies (including programs and adoption of new systems). Also, implementation of government policies (such as physical construction of buildings, large projects, or extraction of natural resources) in the framework of 1969 USA NEPA (Burdge, et al., 2003; Finlayson et al., 2018). International Association for Impact Assessment (Esteves et al., 2012) released guidelines to understanding SIA "the processes of analyzing, monitoring, and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, program, plans, project) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment" (Vanclay, 2003).

Table 2. Three Aspects of Environmental and Social Assessment

| *Characteristic* | *Outline* |
|---|---|
| Physical Aspect | Surface water, sedimentation, groundwater, water quality, noise, land, and land use. |
| Biological Aspect | Biodiversity |
| Socio-Economic Aspect | Demographics, health, welfare (employment status), humanity (Human right) |

Source: Kabir & Momtaz, 2013

Based on this perception, environmental and social impact assessments measure physical, biological, and socio-economic aspects. Physical aspects include air, water, soil, and noise pollution. Meanwhile, biological aspects are assessed in terms of biodiversity, and socio-economic scopes involving population, health, welfare, and humanity (Kabir & Momtaz, 2013).

SIA process based on the definition of IAIA consists of the stages of analysis, monitoring, and management of social consequences in its development (Mahmoudi et al., 2015; Vanclay, 2003). More detail, managing intentional or unintended social outcomes, positive or negative impacts, from designed interventions (policies, programs, plans) and social transformations as a result of these interventions (Finlayson et al., 2018; Vanclay, 2003; Wolflin et al., 2007). This approach aims to create a more sustainable human and biophysical environment. SIA is more enhanced than just steps for assessing and identifying social impacts. However, it is a mechanism to promote social sustainability (Kabir & Momtaz, 2013) and tools for positive social change (Esteves et al., 2012). SIA baseline study should cover all aspects of the environment: physical, biological, and socio-economic issues.

SIA is functioned internationally as an assessed study that forms part of the regulative approval process toward infrastructure projects or resource extraction (Kabir & Momtaz, 2013). Thus, SIA is a method and tool that often applies natural resource management (Dale et al., 2001; Fenton et al., 2003; Cooper et al., 2006) and also during initiating conflict reconciliation (International Alert, 2005).

Recent studies (Abidin, 2018; Hanna et al., 2016; Hess & Fenrich, 2017; Rincón et al., 2019) applied the socio-environmental conflict approach to describe conflict models in energy development. Environmental and social assessment analysis are often used in energy security projects in developed countries but separately does a social assessment (Khan, 2020).

Coal Fired Steam Power Plant construction in Indonesia considers not required three main aspects of environmental, economic, and social issues. These three aspects must go together, none left behind. The analysis of social impact assessment on environmental conflicts at Batang Coal Fired Steam Power Plant has not been raised much. This paper describes and analyzes the social impact assessment of the environmental conflict that occur and can create a model of resolution and environmental conflict management in the construction of the power plant.

The application of SIA is often within the EIA and ESIA application tools. SIA measurement is more focused on environmental impact and social issues (Aucamp & Woodborne, 2020; Esteves et al., 2012). Social Issues in the 21st century have become very complicated and wide, often criticized by SIA tools because they are considered inefficient (Aucamp & Woodborne, 2020; Vanclay, 2020). Thus, some studies suggest that SIA measurement limits are applied to focus on a particular level of analysis at the community, policy, or stakeholder level.

SIA's derivative dimension illustrates the complexity of social problems and their dynamics. Due to this complexity, scoping is adjusted to the purpose of the study. The limitation of this study applied to the issue of environmental conflict in the community. It has the potential to identify and clarify the causes of conflict, furthermore the possibility to understand and provides conflict mitigation and also the management (Barrow, 2010).

## 2. Methods

This study's primary instrument was a locally modified version of Social Impact Assessment (SIA) framework. SIA was developed by IAIA for measuring social impacts over the dynamics of conflict at the community level around Batang Coal-Fired Steam Power Plant. SIA has been implemented in the study of socio-environmental conflict approach to describe conflict models in energy development (Abidin, 2018; Hanna et al., 2016; Hess & Fenrich, 2017; Rincón et al., 2019). To make SIA relevant to this study, the critical parameters of socio-economic aspects are the main variables measured in this study. The main location of the study was Ujungnegoro Village, Kandeman, Central Java. Data collection of this study was literature study.

This research used qualitative study, content analysis, and secondary literature of books, journal articles, and newspaper articles. The content analysis included credible journal articles, books, newspaper articles, and internet documents. Content analysis was significant because there was a large body of literature, including journal articles, newspaper articles, and Internet documents, on the controversy.

In brief, this research assessed the social impact of environmental conflicts around Batang Coal Fired Steam Power Plant. This research employed a qualitative approach with Social Impact Assessment (SIA) framework in analyzing which social factors influence dynamics the most and forms of conflict. Compared to previous research, the most fundamental difference from this study was the assessment of environmental strife not only in environmental assessment but also in its social impact (Khan, 2020). Due to a wide range of social issues, scoping of this research emphasized on social capital at the community level.

Table 3. Secondary Data

| Institution | Type | Year | Scope of Data |
|---|---|---|---|
| PT. Bhimasena Power Indonesia | Report | 2016 | Environmental Impacts |
| Greenpeace | Report | 2016 | Social, health, and environmental impacts |
| Wahana Lingkungan Hidup (Living Environment Facility) | Pers Release | 2017 | Social impacts |

Source: Author Elaboration

## 3. Results and Discussion

### *3.1 Ecological Degradation as a Trigger*

Environmental changes in the context of this study are divided into two, namely changes in demographics and changes in the physical environment. These two factors are crucial to analyze and describe changes in the carrying capacity of the environment with the presence of a power plant. Demographic changes include population factors and population density. The main environmental problem is related to population explosion and technological development (Salim, 1986). Both are directly related to humans, population dynamics, exploitation of natural resources which harm the environment. The increasing population of humans is often closely associated with an increase of air emissions and other environmental damage.

The process of construction and operational power plant causes changes in the physical environment (Aryani, 2020). It is often controversial because its presence is not apart from the presence of liquid waste, solid waste (fly ash and bottom ash), and air pollution, which is claimed to have a negative impact on the environment. Air pollution comes from fly ash and combustion residues through the PLTU chimney. Air pollution components contained include Carbon Monoxide (CO), Nitrogen Oxide (NOX), Hydrocarbon (HC), Sulfur Oxide (SOX) and Particulates (Darmayasa, 2013). Side effects from toxic release will be very detrimental to the environment and humans, such as respiratory organ disorders to acute respiratory infections.

Meanwhile, based on the Government Regulation of the Republic of Indonesia Number 101 of 2014 concerning the management of hazardous and toxic waste, it states that solid waste in the form of fly ash and bottom ash is classified into hazardous and toxic material group. Thus, the treatment of its waste disposal and treatment is slightly different and quite difficult compared to other waste. The impact on the environment based on the results of research from the literature review shows that this waste has a high level of contamination in water (Dandautiya et al., 2018). Even with notes, this can be different in each location because it depends on the waste management system and the existing environmental conditions.

Batang power plant is planned to be using desulfurization and de-NOx technology. Projection of emissions from factories which are taken from environmental impact analysis and the plant is assumed operating with an average annual load factor of 80% (Greenpeace Indonesia, 2015). Environmental impacts occur at Batang Coal-Fired Steam Power Plant (Table 4) both in the pre-construction stage and operational stage in physical aspects and biodiversity. The physical dimensions of environmental changes arise due to waste generated by the power plant in the form of liquid and solid waste, which affects water, air, and soil quality. Water pollution has long-lasting derivative impacts ranging from damage

to marine life to coral reefs. Meanwhile, the impact of noise emissions and soil quality directly affects people's lives (Bhimasena Power Indonesia, 2016).

Table 4. Projection of Environmental Impacts at Batang Coal Fired Steam Power Plant

| Waste | Description |
|---|---|
| Liquid Waste | Liquid waste discharge areas will include solid waste, surface runoff, coal storage yard, floor and drainage yard, laboratory waste. |
| Unloading Heat from processing plants | Heated seawater is dumped back into the sea. The plant will be designed to use intake seawater with a maximum temperature of 32°C. Indonesian regulations prohibit water discharge significantly more than 40 ° C. |
| Coal storage and solid waste storage on soil quality | Coal storage yards may affect groundwater quality because the ash processor can affect water. |
| Ash treatment | It can cause soil and groundwater pollution. |
| Noise Emission | The primary noise source is during the construction phase of traffic vehicles and construction equipment, while the operational phase is on the machine. |
| Disruption of Marine Biota | Impact of derivatives on the decline in seawater quality |
| The impact of heat on the Coral Reef Ecosystem | Temperature changes that affect coral ecosystems must not exceed 2°C following Decree No. 51/2004 concerning Sea Water Quality Standards. Temperature changes have the potential to cause a significant impact. The Maeso coral ecosystem shows the following weaknesses: it is close to the mainland and Muara (Sambong River and Sono River) so that the sediment threat is more dangerous. However, its proximity to the mainland facilitates monitoring. |
| Disturbances from dredging | Dredging can cause high turbidity and biota disturbance including plankton, benthos, and fish (not recognized as endangered or protected) |
| Disruption of disposal | Disturbance to marine biota originates from the decline in the quality of seawater as a result of the disposal of 1,526,000 m3 from scrapings to the disposal area, which is about 16 km from the coast. Fish found around protected reefs are not recognized as endangered or protected. |

Source: Bhimasena Power Indonesia, 2016

Several studies show that there is no direct relationship between PLTU waste and the declining quality of renewable resources around PLTU. This assumption brings debate that environmental degradation did not occur because of the power plant and was only a political issue to be used as a justification for maintaining security and military legitimacy (Barnett, 2000). However, environmental degradation cannot be measured in the short

term. Rather, it must be done in a long period of time and periodically (Dandautiya et al., 2018; Islam & Al-Amin, 2019). The variable of environmental change becomes an important factor in seeing physical and population changes in measuring the quality of community life. It becomes the basis for the position of environmental degradation in the context of environmental conflict analysis and conflict management itself.

### *3.2. Health and Social Problems in Community*

Social dynamics is an aspect that makes conflict a very complicated thing because it includes many factors influencing the situation and unusual conditions in an area that is different from other regions. It becomes a challenge to research and to detect conflicts in situations that are still developing. The study of natural resources and the environment related to the social conflict has been raised by the review of environmental conflict studies, both by experts in the fields of psychology, economics, anthropology, sociology, political economy, and so on. There are efforts to develop conflict models (Barrow, 2010). SIA can be said to focus on social capital factors, which can be a supporting factor for conflict resolution or provide a picture of reconciliation from resistant groups (Barrow, 2010).

In the social context of Batang PLTU case, the community worries that PLTU presence will give bad impact to the health until causing death. The worst air quality effects will occur in Batang and Pekalongan, where the risk to individual health threats due to coal-fired power plants is the highest.

PLTU Batang air pollutant emissions are projected to cause 780 premature deaths per year (95% confidence interval: 470-1090). This included 340 deaths from stroke, 300 deaths from systemic heart disease, 40 deaths from lung cancer, 70 deaths from chronic respiratory disease, and 10 deaths from young children due to acute respiratory illness (Greenpeace Indonesia, 2015).

Table 5. Projection of Early Death Due to Air Pollutant Emissions from Coal Fired Power Plant Batang, Case Per Year

| Diseases | Estimates | Confidence Interval |
|---|---|---|
| Stroke | 340 | 210-480 |
| Systemic heart disease | 300 | 190-410 |
| Chronic Obstructive Pulmonary Disease | 50 | 30-68 |
| Lung cancer | 40 | 17-66 |
| Other Chronic Heart and Respiratory Diseases | 20 | 14-32 |
| Lower Respiratory Infections in Children Under 5 Years Old | 10 | 4-34 |
| Total | 780 | 470-1090 |

Source: Greenpeace Indonesia, 2015

Concerns about the health impacts cause public to demand more attention from the government. Concerns about health impacts cause public to demand more attention from the government. The Ministry of Environment should manage an environmental impact analysis for coal power plants. Any assessment of the impact on health and the environment or greenhouse gas emissions in AMDAL must be strengthened. The Ministry of Environment and Forestry needs to play a strong role in assessing the sustainable environmental impact of the Coal-Fired Power Plant project and conducting a thorough inspection of the damage caused by this PLTU. Each power plant should be required to carry out an epidemiological survey of health impacts on residents and environmental pollution near the power plant, then publish the results transparently, and come up with clear long-term measures to reduce damage.

The relation of political, community, and social actors who have influence, authority, and power will determine resolution management and the pattern of conflicts that will be formed. The presence of interest groups is also a distinguishing factor in developing strategies in conflict resolution. Interest groups in this context can be groups created by the

community or groups outside community such as environmental activists or NGOs. These social factors are important variables in determining appropriate conflict management and following the community's socio-cultural context. Policies taken based on the condition of the environment (community-based) have a higher chance of being implemented optimally.

### *3.3. Economic Drive to the conflict*

Economic conditions are a variable that is very sensitive and can encourage conflict to the most extreme level. Welfare perception for the community becomes the essential measurement of the expected economic needs. There will be social reactions and turmoil because of this condition. In this research, the existence of a power plant has a direct impact on fishers and farmers in their economic income. Fears of environmental damage will influence agricultural land, and fish catches to make a wave of rejection which have been carried out at the PLTU even though the PLTU has not yet operated.

The land in Karanggeneng and Ujungnegoro Villages used for the construction of PLTU Batang is a productive agricultural land in the form of 125.5 hectares of technical irrigated rice fields. Based on the data collected, 69.2% of household heads worked in agriculture, followed by 11.1T in trade and 16.8% in services. About 2.9% are unemployed. Most of them were farmers with their land; sharecroppers working on land owned by other people or agricultural workers (Bhimasena Power Indonesia, 2016).

Many people in Batang Regency depend their lives on farm products on the area, so there is an assumption that the conversion of the function of paddy fields to the construction of the PLTU Batang can eliminate the livelihood of the community as farmers which has an impact on decreasing population.

Another livelihood that will be affected is fisherman. The power plant builds at the Ujungnegoro-Roban Marine Conservation Area, an area rich of fish and coral reefs, and a catchment area for fishermen from various regions in the North Coast of Java. Their activities will be affected by dredging and disposal because dredging operations from input pipes, drainpipes, and docks impact fishing activities and production. Similar effects happen at the waste disposal site.

Analysis of changes in economic income is essential to see changes in community life patterns and work patterns in Kandeman. This analysis can determine which marginal groups are the most disadvantaged or have the most significant negative impact of a power plant presence.

## 4. Conclusions

Environmental conflicts around the power plant are due to an imbalance in the aspects of environmental sustainability. Environmental damage is the first issue that has sparked debate and community concerns about the impact on their lives. The effect of ecological damage responds differently according to the social characteristics of the community. Social dynamics play a crucial role in maintaining the balance of the conflict process itself.

Political and social actors who have authority and power own an essential role in negotiating and controlling conflict dynamics. Unfortunately, the economic dimension becomes a central issue that determines the manifestations of conflict form. The case study that took place in Kandeman District was concerned about reduced income on farmers and fishermen due to the quality of agriculture and fish catches. The community demands material compensation mainly for economic losses.

The settlement of environmental conflicts in people's perception is in the interest of their survival, but not by thinking about environmental sustainability. The essential thing that needs to be built is the awareness and commitment to protecting the environment. The government must have a responsibility to implement waste management and supervision rules and reduce the use of coal fuel in power plants. The government needs commitment because it is a long-term investment. Meanwhile, environmental awareness at the individual and community level will help the system realize ecological degradation that continues to occur every year.

**Acknowledgement**
The author appreciates comments and suggestions from Irma Novalia as a mentor throughout the writing of this article. Acknowledges to all reviewers include Wikan Indrianingdyah Budiharto and Poerborini Damayanti, help authors with the GFA format. This research was supported by Publikasi Terindeks Internasional Sosial Humaniora (PUTI SOSHUM)- Direktorat Riset dan Pengembangan Universitas Indonesia 2020 with contract number NKB-2568/UN2.RST/HKP.05.00/2020.

**Author Contribution**
Conceptualization, Ishardanti, R.; Methodology, Ishardanti, R.; Software, Ishardanti, R.; Validation, Ishardanti, R.; Formal Analysis, Ishardanti, R.; Data Curation, Ishardanti, R.; Writing – Original Draft Preparation, Ishardanti, R.; Writing – Review & Editing, Ishardanti, R.

**Funding**
This research received no external funding.

**Ethical Review Board Statement**
Ethical review and approval were waived for this study due to no personal data was collected in this study.

**Informed Consent Statement**
Not applicable.

**Data Availability Statement**
The data is available upon request.

**Conflicts of Interest**
The authors declare no conflict of interest.

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