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# SUSTAINABLE DEVELOPMENT IN THE COAL MINING INDUSTRY: GERMAN EXPERIENCE AND LESSONS FOR VIETNAM

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**Abstract:** Germany is listed as one of the countries that coal mining industry has completed an entire development cycle. After World War II, this industry had made a significant contribution to Germany's economy and specific development standards which are applied for a longtime, it can be easily seen that coal mining industry of Germany showcased a lot of good things. Namely, it ensured a safe working environment; warrant favorable quality of life for employees both physically and mentally, production goes along with environment protection. It also raises several funds which will be used after closing entire mines. Therefore, the German coal mining industry becomes an inevitably valuable experience for coal mining industries in emerging countries like Vietnam. The report uses some research methods, such as: Documental research method and expert method, etc. to suggest eight lessons learnt for sustainable development of Vietnamese coal mining industry.

## **Introduction**

Nowadays, mining industry in general and the coal mining industry in particular play a very important role in the development of a country. It provides mineral materials for every sector of the national economy. This industry exploits resources (coal and peat) from the earth's crust by opencast mining and underground mining technology. However, since coal is non-renewable resource, it will be depleted along with exploitation process. This industry also brings negative impacts on environment including both underground ones (geology, hydrogeology) and human habitats, although it still offers a high number of employment. Therefore, the orientation of sustainable development for this industry is very necessary, especially these countries which the economy depends a lot on coal mining like Vietnam.

Germany is considered as one of the biggest forerunners in the coal mining industry. Only RAG – the biggest hard coal mining group in Germany in its developing period achieved the exploitation productivity up to 150 tons per year. Within recent years, the annual mining output of this group is approximately 20 million of tons and the average level of mining activity now reaches -1,500 m. However, due to many different reasons including cost of production, environmental and social issues, from 2018, the German hard coal mining industry will be terminated and consume coal import from the other countries. During exploitation and production period, there are a lot of problem raising that need to be solved and Germany had found out many effective solutions.

Being considered as one of the most important industries of the economy, the requirement of sustainable development for extractive industry and the whole economy is really necessary for Vietnam. Hence, Germany can be a rational model not only for Vietnam but also many other developing countries.

## **1. Sustainable development of the coal mining industry – German experience**

### **1.1 Introduction of sustainable development**

#### **1.1.1. Definition**

The very first definition of sustainable tourism was introduced on Brundtland report of the World Commission on Environment and Development – WCED (now it called the

Brundtland Commission). After more than 30 years of researching and developing, there are so many definitions of sustainable development given out by many different scientists and organizations. Although the approach and descriptions are not the same, those definitions all show that development must meet the needs of the present without compromising the ability of future generations to meet their own needs. As a result, development should make it balance between economic, social development and environmental protection.

Accordingly, sustainable development includes:

**Economic development:** A country considered as a sustainable economic development if its surplus value exchange and offset all the damage from the economic development alone.

**Social development:** Economic development must go along with social development. Consuming economic results to solve social issues, improving and enhancing living standards for every part of society.

**Environmental protection:** Environmentally sustainable development needs to ensure that the socio-economic development does not harm to the environment, supporting the development of natural resource preservation and also prevent pollution.

### *1.1.2. Sustainable development of an industry*

The economy of each country is structured by many economic sectors. Therefore, the sustainable development of any economy needs to be derived from the sustainable development of every internal economic sector. However, each of them operates in various fields; therefore, sustainable development is also performed in different manners as well as having various solutions.

Following are some notes of sustainable development in an economic sector:

Sustainable development of each branch must respect and specify the concept of sustainable development in general. In other words, it needs to ensure the balance of economy, society and environment.

Exploiting particular features of each sector to build appropriate models and solutions which will positively contribute in the sustainable development of the whole economy.

## **1.2. Practical experiences from sustainable development of German coal mining industry**

### *1.2.1. Introduction of German coal mining industry*

The first coal mine in Germany was operated 900 years ago, but it only improved and thrived within the industrial revolution period in 19th century. In 1900, coal mining in Germany ranked the 3rd in the world after the US and the UK. Especially, it even developed more after World War II and significantly contributed to the economy recovery at that time (mining output was 150 million tons in 1957). This industry directly provided the energy for thermal power and steel industry in Germany.

However, the coal reserves have declined over the time, the mining area also became deeper that lead to decrease in mining output (it dropped from 25.6 millions of tons

to 20.7 millions of tons in 2006). To maintain this industry, the government of Germany had to subsidize approximately 2.5 billion EUR per year for nearly 10 years. Due to the reduction of comparative advantage of the coal mining industry, along with other issues such as the environment, the German government has decided to gradually shut down coal mines. Although according to the exploration of the RAG Group, the coal mining industry in Germany can still continue operating over hundreds of years more. In 2018, the last 8 coal mines will be closed. The demand for coal after the year 2018 of this country will be met by coal imported from countries with large coal mining output as Australia, Russia, and China.

However, even after mine closure, there are still a lot of social and environment issues which must be addressed.

### 1.2.2. Current situation of coal mining industry in Germany

Being considered as one of the fastest developed countries in all over the world, sustainable development is currently a big concern in Germany.

#### • Economic sector

The German coal mining industry is the unique supplier that provides mineral materials for the German economy. Products of this industry are used as production materials for the other. Therefore, the development of this sector has a great impact on the other sectors of the national economy. Particularly, this industry provided mainly coal for thermal power and steel industry of this country. Therefore, despite of the declining trend of the coal mining industries in Western Europe in recent decades, the German government is still trying to maintain the industry by large subsidies so that it does not bring negative impacts on other industries as well as the community.

However, it is the fact that natural resources is reducing fast, and particularly due to the diminishing comparative advantages, the German coal mining industry has gradually cut down domestic mining production, replaced by imported coal from other countries such as Australia, Russia, and China etc. Namely, coal output decreased from 150 millions of tons (1957) to 25.6 millions of tons (2005) and continue to went down to 20 millions of tons recent years.

Following is the financial report of RAG from 2010 to 2014

**Table 1. Financial report of RAG during 2010-2014**

BALANCE SHEET (Millions EUR)					
	31/12/2010	31/12/2011	31/12/2012	31/12/2013	31/12/2014
Non – current assets	1,610.7	1,685.2	1,779.3	3,062.9	3,571.4
Current assets	767.4	899.6	1,019.9	821.0	1,243.1
<b>Total assets</b>	<b>2,378.1</b>	<b>2,584.9</b>	<b>2,799.2</b>	<b>3,883.9</b>	<b>4,814.5</b>
Owner capital	2,219.4	2,397.2	2,595.5	3,793.6	4,148.4
Liabilities	156.7	185.7	201.7	88.3	664.1
<b>Total capital</b>	<b>2,378.1</b>	<b>2,584.9</b>	<b>2,799.2</b>	<b>3,883.9</b>	<b>4,814.5</b>
Average capital		2,481.5	2,692.05	3,341.55	4,349.2

INCOME STATEMENT (Million EUR)

Annual profit	119.2	177.1	194.7	1,190.6
Capital profit margin (%)		7.14	7.23	35.63

(Source: <http://www.rag-stiftung.de>)

Besides all of the above mentioned solutions, Germany also enhanced the work searching and exploration in order to discover and coal resources to promote the economic development. As a result of the exploration of the RAG, Germany still has enough coal more than 400 years mining.

Also, in recent years, this industry has been applying various technical measures to salvage emissions from coal mining operations. These measures not only increase the added value for the sector; but also reduce the amount of greenhouse gases released into the atmosphere, reduced bad impact on environment.

• *Social sector*

The German coal mining industry is also one of the biggest employers. However, because of the domestic mining policy, the number of employees in this sector is also decreased. In 1957, the total amount of workers in coal mining industry of Germany was 607,000. This statistics slightly increased to approximately 610,000 people in 1977, and now fall to less than 50,000 people.

Despite of the fact that the number of workers is going down; their quality of life is still ensured and even improved. Although operating under the market mechanism, the government has spent an annual large allowance for the industry. Thus, workers are paid higher salaries like a compensation for heavy and dangerous working conditions.

The safety standard of this sector is very high. Workers are equipped with enough modern work wear, from clothes, shoes to sunglasses, etc., to ensure safety. The working environment of the employees inconstantly being improved and industrial hygiene is concerned as well.

Germany also owns one of the most leading modern mining technologies in the world, going along with very high safety standard. This advanced technology not only ensures economic efficiency in resource recovery and reduce losses but also contribute significantly in reducing labor wastage and increasing safety.

Business risk management is one of the most important administrative activities for every economy. To the German sustainable development, safety is considered one extreme along with the other extreme as economy, society and environment. This reinforces noted that the health and safety of workers is always taken into concern.

Besides, the social conditions in mining areas are also important to German authorities and coal mining high-level managers. Coal mining activities are carried out with a policy to reduce to the maximum extent the negative impact on people living in mining areas. In addition, the coal mining industry and subsidiary companies have made major contributions in the construction of public facilities.

### • *Environmental protection*

The operation of the coal mine industry, from the extraction, processing and transportation to consumption are causing a huge impact on environment. Therefore, environmental protection is always one of the most concerning problems for the Government and business in this industry.

The priority to environmental management, environmental impact assessment, and establishing environmental responsibility are the first principles of the fundamentals for the mining industry in Germany. This shows the interest of the industry to environmental protection.

Coal mining operation is always carried out in the direction of minimizing the environmental impact. In May 2012, on behalf of the country's coal mines, the Association of the German coal industry signatories to the Climate Protection Agreement between the Federal Government and every industry in Germany. Accordingly, the coal mining enterprises of Germany has committed to reduce 75% of CO<sub>2</sub> emissions from coal mining activities in 2012 compared to 1990. In fact, the mining industry had cut down 90.2%, reached 120.3% of the plan. In recent years, this activity will be continued in order to constantly reduce and control the amount of greenhouse gases released into the atmosphere.

Germany as well as many other European countries are working together to form an emissions trading market in Europe. Accordingly, they will issue discharge permits and auctions for businesses. Businesses are only discharged within the discharge permits that they were acquired. The management and distribution of discharge permits are managed centrally by the European Union. In Germany, the proceeds from the sale of these licenses were submitted for the fund "Energy and Climate" to invest in the research and development of green energy sources and other activities aimed at environmental protection. Thank to this method, these countries had controlled about 45% of greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, etc.) that the participants discharged.

Besides, the work of environmental impact assessment is done very seriously, with high standards to constantly control the environmental impact from mining activities as well as active control of the project in future.

Along with very high environmental standards in Europe, the coal mining industry of Germany constantly cuts down toxic releasing into environment; improving the environment of the people.

### • *Other activities*

#### ▪ *Enhancing awareness of employees about sustainable development issues*

One of the most basic principles for the German mining industry is to encourage every employee to recognize their responsibility in environmental protection and ensure that there are sufficient resources, personnel and available training system for making environmental plan. This shows that the leaders had recognized the role of employees, the ones who directly perform activities towards sustainable development with many economic measures to raise the awareness of employees toward sustainable development issues, especially environmental protection and natural resources reservation.

- *Raising financial fund to invest for activities after closing mines - RAG Foundation*

### *Stiftung*

According to Germany government's plan there are no hard coal mine operations since 2019. However, many remain problems need to be solved, such as controlling water from close mines to make sure that it will not affect groundwater resources and water supply for local people. As a result, from 2019, every industry will have to implement the obligations in perpetuity. This requires a financial fund to sponsor such activities. From 2007, the RAG (unique hard coal producer in Germany) began raising a fund to finance operation after closing - RAG Foundation - Stiftung.

Accordingly, the fund is formed from the sale of Evonik Industries AG's share trading income, and income from other financial investment activities. This fund is expected to accumulate to EUR 18 billion in 2018. From 2019, they will continue to use this fund for finance investment. Annual income from its financial investment will also be used to finance permanent post-mining activities.

- *Using mines after closing for business activities and other activities*

Factories and mines after closure have been used for other purposes such as renovating the old power plant into an amusement park; the landfill is turned into a green park; gas tunnels become galleries; the abandoned mines become museums. This helps utilize the ruins of buildings for the purpose of economy, society and contribute to environmental protection towards sustainable development.

In summary, German hard coal mining industry has been preparing a lot for the post-mining issues. The experience, therefore, will be very useful for emerging coal mining industries like Vietnam.

## **2. Lessons learnt for the Vietnamese coal mining industry**

As a developing country, the demand for mineral materials and coal for the Vietnamese industrialization increases. Therefore, in recent years, Vietnam is pushing coal mining operations to meet that demand. Within several decades of development, coal mining operations have been operated relatively formal; create big contributions to the development of Vietnam.

- Regarding economic term, this industry provides around 40 million tons of coal per year which meet the market demand and contribute to the development of other industries like thermal power, cement, and fertilizer, also meet the demand for materials production and consumption of the society.

- In term of social issues, the Vietnamese coal mining industry has solved huge social problems by offering thousands employment with high income and contributing to economic development of mining region.

However, the growing mining production arise a lot of problems regarding environmental security, resource depletion, pollution, mining technology, and safety. Therefore, sustainable development is a crucial goal. In addition, the case of German coal mining industry would be valuable lessons for Vietnam:



*Firstly, strengthening the propaganda to workers and communities to understand the content and significance of sustainable development*

Guidelines and strategies on sustainable development planned by State agencies and senior managers of the business, however, workers are the ones who directly implement them. Therefore, it is necessary to strengthen propaganda campaigns to raise the awareness of workers and communities on the issues of sustainable development in general and in the mining industry in particular.

*Secondly, identifying resources to increase labors' incomes*

Workers of mining industry have to work in heavy, harmful and dangerous conditions. Therefore, they are paid higher incomes to ensure and improve their quality of life. This also motivates them to stay in the industry for longer time.

*Thirdly, assuring working environment and safety for workers*

It is also necessary to create a safe working environment, protecting health and life for employees. Enhancing application of modern technology in mining operations not only ensures safety and efficient but also avoids of wasting resources.

*Fourthly, strengthening environmental management to reduce the impact of environmental pollution and depletion of natural resources*

Government should strengthen the work of controlling environment, environmental impact assessment; reverting the landfill; using discharge activities (application of environmental management tools such as discharge permits; environmental tax ...).

*Fifthly, plans to use mines and waste dump after mine closure*

After more than 100 years' operating, many mines have closing plans (mainly surface mines); many landfills are already full. Therefore, it is necessary to have a plan to use these facilities for the purposes of economic and social welfare, etc. to avoid of wasting resources and to protect the environment.

*Sixthly, forming national fund to finance research activities and development of alternative energy sources; funding for activities after mine closure*

As coal will be exhausted in accordance with the mining process, research and development of alternative energy sources are crucial. In addition, even when coal mines were closed, there would be some tasks to be performed such as controlling groundwater resources. All of these activities require donor funding. Therefore, it is necessary to set up a financial fund to finance these activities. Financial funds should be set aside from revenue of coal trading activities. This may be considered a financial contribution to the future by using the resources of the current generation to ensure equitable principles generation of sustainable development.

*Seventhly, strengthening resources exploration and setting up national database*

It is needed to promote the exploration to discover new resources to meet the requirement of coal in the future. The results of this exploration must be assembled to form the national database on natural resources. This is an important facility for the process of marketization

of the minerals activities such as determining value mineral deposits and determining the amount granted mining rights.

*Eighthly, establish competitive market*

At present, coal market seemed to be the monopoly market in Vietnam under the control and management of the government. However, in order to effectively utilize coal resources, it is necessary to establish a competitive market. Then the state should build mechanisms and policies to manage and simultaneously enable this market operation under market economy principles.

### **3. Conclusion and recommendations**

Nowadays, sustainable development is the goal of many countries around the world. To achieve this goal, it requires synchronous implementation in all of the economic sectors of each country. Based on the study of sustainable development of coal mining industry in Germany, the article proposes some suggestions for sustainable development of the Vietnamese coal mining industry. To implement this solution, the article proposes some recommendations:

- Defining specific sustainable development goal for the coal mining industry and develop this objective in all aspects of the industry as well as enterprises in the sector.
- Building and completing the mechanisms and policies to ensure favorable implementation of these solutions

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