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TOPIC:A STUDY OF PROCESS OF EXPLOITATION OF NATURAL GAS IN RWANDA

<<CASE OF METHANE GAS IN LAKE KIVU 2000-2012>>

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TOPIC: **A STUDY OF PROCESS OF EXPLOITATION OF NATURAL ENERGY RESSOURCES IN RWANDA**

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TABLE OF CONTENT

ABSTRACT

ACKNOWLEDGEMENT

INTRODUCTION

CHAP 1: HISTORICAL BACKGROUND OF METHANE GAS IN LAKE KIVU.

1.1 DEFINING THE KEY CONCEPTS
1.1.1. DEFINITION OF METHANE GAS
1.1.2. MEANING OF EXPLOITATION

1.2 EVOLUTION OF METHANE GAS
1.3 UNDERSTANDING THEORITICALLY METHANE GAS PROCESS OF EXPLOITATION
1.4 THE DOMAIN OF EXPLOITING METHANE GAS
1.4.1 GEOGRAPHICAL DOMAIN
1.4.2 COMMERCIAL DOMAIN

CHAP 2: DESCRIPTION OF PROCESS OF EXPLOITATION OF METHANE GAS

2.1 CAUSES AND FACTORS OF EXPLOITING METHANE GAS

2.1.1 ADVANTAGES OF PROCESS OF EXPLOITATION OF METHANE GAS

2.1.1.1 DOMESTIC USES

2.1.1.2 INDUSTRIAL USES

2.1.1.3 PUBLIC INTEREST

2.1.2 DISADVANTAGES OF PROCESS OF EXPLOITING METHANE GAS

2.1.2.1 ENVIRONMENTAL DEGRADATION

2.1.2.2 COMMERCIAL EFFECTS

2.2 BARRIERS THAT AFFECT THE PROCESS OF EXPLOITATION OF METHANE GAS

2.2.1 GEOGRAPHICAL BARRIERS ……..

2.2.1 ECONOMICAL BARRIERS

CHAP 3: STRATEGIES TO OVERCOME THESE CHALLENGES AND WEAKNESS DURING THE PROCESS OF EXPLOITATION

3.1 GOVERNMENTAL POLICIES TO HANDLE THIS CHALLENGEs

3.1.1 ECONOMICAL SOLUTION

3.1.2 USE OF SKILLED LABOUR UNDER CONDITION

-CONCLUSION AND RECOMENDATION

ABSTRACT

Our country has set up the strategies of exploiting natural methane gas found in lake Kivu as a part of solving the problem that are still arising in the domain of energy resources uses and its development which is still all the way through different strategies in order to accomplish the goal.

Long ago, this project were setting but it's too hard to say that it has achieved on the level that was planned because the methane gas is like a blessing to our country, once we exploit it effectively and efficiently, this will make our country to move from under developed country to developing country so that it will preserve its dignity without acquiring again those funds from outside.

In addition, it's a good time since we have good governance that are courageous to while exploiting this manna from God, it will empower the source of energy resources over 20 times to the existing power supply and because of its potential, it has to serve the whole country and after this, it also possible to export it to the neighboring countries by limiting the energy crisis that arise in this region ,and also the transport that always occur for solving fuel means.

CHAP 0 INTRODUCTION

Lake kivu which was taken as a poisonous water body for the surrounding population many years ago because of methane gas which bed at the bottom of and feared many people ,and there are other that are always saying that this will cause saturation of gas and finally cause explosion as occurred in lake Nyos in Cameroun.

But this time a lot of researches has been carried out and show that these expected disasters should be solved through the modern extractions method basing on all equipments that are required. Truly, this is one of the proposed solutions to limit that rate of exploding and the damages of ecosystem in general.

Consequently, it is starting to be taken as the country primary source of power means through its exploitation process so that it can add its higher potential to the other sources of energy that are used in Rwanda.

Additionally, Methane gas pilot plant is one of the project that our country is emphasizing on ,in order to accelerate its speed so that it can supplement the country's energy needs which will be used to handle some of the population basic activities and other different concerns. Extraction of methane gas from lake kivu is going to contribute enough in the national domain of power supply development at a desirable level of taking care for our environmental resources through the use of this natural gas and make the shortage need of using wood for house work such as cooking and so many others that will be discussed in the following chapters.

CHAP 1: HISTORICAL BACKGROUND OF METHANE GAS IN LAKE KIVU

1.1 DEFINITION OF KEY CONCEPTS

1.1.1 what is methane gas

Methane is an organic compound which is the simplest alkane and the main constituent of natural gas. It is odorless, colorless, flammable gas that is the simplest hydrocarbon.

Gas is a fluid in the gaseous states having neither independent shape nor volume and being able to expand indefinitely.

Thus, **methane gas** is defined as an odorless, colorless, flammable gas and which is released during the decomposition of plant or other organic compounds.

Pilot plant is defined as place where the extraction of methane gas occurs.

1.1.2 Definition of process of exploitation

Exploitation is defined as the act of making some area of land or water more profitable or productive or useful. Then the process of exploitation gas on this field means the action of making the dissolved methane gas from Lake Kivu to be more profitable or productive for the country's energy supply.

1.2 evolution of methane gas in lake kivu

The Lake Kivu makes boarder to Rwanda and democratic republic of congo, the scientist in water bodies published that this lake has been living over 5billion of years. As concern it constitute highly concentration the methane gas that was discovered for the first time in 1937, even though our past generation said that before it was there.

The process leading to the formation and accumulation of methane and carbon dioxide
In the deeper waters of Lake Kivu's is not fully known. Few hypotheses have been advanced on the processes leading to the formation and the enrichment of the deep
water in methane gas and carbon dioxide. Methane gas is believed to form in the Lake
From a combination of geological and biological processes. Carbon dioxide of volcanic
origin is reduced to methane by the anaerobic bacteria, which proliferate in the stagnant
deep waters of the Lake. The same bacteria cause also the decomposition and fermentation of the organic material accumulating in the bottom sediment, leading to the formation of carbon dioxide and methane. The latter is similar to the process leading to
the formation of oil and gas in sedimentary rocks. Two thirds of the methane generated
is believed to come from the reduction of volcanic carbon dioxide and the remaining
fraction is from the fermentation of organic material. It is estimated also that some 100 to

150 million cubic meters of methane are generated annually in the lake.[1]

Lake Kivu has been found to contain approximately 55 billion cubic meters (72 billion cubic yards) of dissolved methane gas at a depth of 300 meters. Twenty years after the gas deposit discovery in 1937, the first extraction and purification pilot plant was established at Rubona situated nearby Gisenyi town in 1963.

With reference to the governmental action plan, there is an installation pilot plant build for the second time which turn two generators as an expansion of the Rubona cap and another which called Kibuye pilot plant which will produce 3.6 megawatts.

Briefly, the formation of kivu's methane seems to be the result of two simultaneous actions: the first due to the fermentation of biogenic sediments on 30%, and the second is due to the reduction in magmatic co2 by bacteria on 70%.

1.3 understanding theoretically the process of exploitation of methane gas in lake kivu at Rubona cap

A small pilot plant was installed in 1963 to supply some 8000 cubic meters of methane gas per day to the Bralirwa Brewery and has make changes in that sector as a new source of energy supply.

The gas production and process facilities installed at Rubona cap plant are relatively simple. Water from the methane rich zone is brought to the surface through two large pipes, "*the water production string*". As the water rises in the production string, its pressure decreases causing progressive liberation of the gas in solution in the water. The increasing proportions of free gas bubbles as the water nears the surface in the pipe induce a process of "*gas-lift"* giving rise to a naturally continuous eruptive production of water from the deeper parts of the Lake to the surface. The liberated gas and the partially degassed water are passed through a water-gas separator, operating

[1]Formation of methane gas in lake kivu, available at http://www.upegaz.gov.rw/Feasibilityreport.pdf, visited on 17th,September,2012

at a pressure slightly higher than the atmospheric pressure, where more gas is liberated and separated from the water.

The gas separated from the water, "*crude gas"*, is essentially a mixture of about 70% carbon dioxide (CO2) and 30% methane (CH4). This crude gas is then put through a series of gas washing "*scrubbing*" tanks where water from shallow depth in the Lake, having relatively little amount of gas in solution, is circulated. Coming in contact with the crude gas, the circulating water dissolves and removes the major part of the carbon.[2]

1.4 The domain of process of exploiting methane gas

1.4.1 geographical domain

A number of 65 billion meter cubes of methane gas are lying at the bottom of the lake at a depth under 250m. It is dissolved before extraction but there are some processes that are in place when it is being extracted from the lake to the deserved shore and they are mainly used to separate the gas from water.

Density of gas is more dense than water and that what makes the gas to stay at the bottom, which is the major reason that limit that gas from explosion and also because the volume of water is doubled the volume of gas.

In fact, after extraction and give it the quality of getting ready to be used, its transmission is done by the pipelines that take it to the work place reserved.

1.4.2 commercial domain

Normally, this process of exploiting our natural gas known as methane gas meet our commercial goal when it is transformed into a power source of energy that can replace that can replace the high rate of using traditional resource of energy which cause deforestation.

Its natural potentiality would generates 100MW per year which will make the amount of electricity which can reduce the normal cost .as result, many houses and other infrastructures will have access to power within the distribution of that power by energy and water sanitation authority(EWSA) as national utility.

[2] The process of exploiting methane gas theoretically, available at : http://www.upegaz.gov.rw/Feasibilityreport.pdf, visited on 20th/September/2012

So about the completion of the project ,the world bank estimate that the power cost in Rwanda will be reduced by 60% and reduce the amount of money spent on heavy diesel from outside.(kigalitodaynews,12nd December,2011)

Chap 2: DESCRIPTION OF PROCESS OF EXPLOITING METHANE GAS

2.1 causes and factors of exploiting methane gas

This process of exploiting methane gas possess a big number of profit in various domain by the time it is being exploited, the risks of gas eruption that could happen in the next years ,at the same time the power generation will be increasing but we can't ignore that the inconveniences are still arising.

2.1.1 Advantages of exploiting methane gas

It is obvious that the effect of being a landlocked country must push methane gas process of exploitation in order to overcome the energy crisis and the import of petroleum.

2.1.1.1 Domestic sector

Generally, this methane gas play a role of providing a lot of amount of heat and it is used as fuel ,at the same time it ease the domestic needs, essentially cooking but it presents a number of technical skills and commercial difficulties because of its high cost and maintenance.

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$$

2.1.1.2 Industrial sector

Gas utilization in industries contributes more because it has high potential of heat in short moment.

Thus, it is well maintained and eases the work and benefit for the natural forestation stability.

The major industries that use gas are represented by bralirwa brewery at 3km from the Rubona cap; there is another project of transmitting gas using pipelines to pfunda Tea Company at 15km from rubona cap, and third installation which is using by cimerwa cement ltd.

2.1.2.3 Public interest

The transformation of methane gas into a source of electricity, this is going to increase a big number of Rwandan population both urban and rural area to have access on power generation.

Additionally, this exploitation is going to complete the energy needs by EWSA using the national grid so that other cities apart from Kigali will have electricity on street as one of the national targets and help for villages electrification due to population regroupment and even in the hospitals.

2.1.2.4 Transport sector

This process will lead to the reduction of petroleum which is imported on high cost through the use of methane as vehicle fuel.

According to Mr A.I(2012),it has approved that methane content should be used to improve its thermal efficieny and to avoid serious corrosions problems to critical parts of the engine,due to the presence of carbon dioxide ,moisture and hydrogen sulfide in the gas.

2.1.2 Disadvantages of exploiting methane gas

It is important to note that ,when extraction is occurred there are some inconveniences that may disturb the proposed work and cause some various dangerous impacts as these below.

2.1.2.1 environmental degradation

Its exploitation constitutes some mainly natural risks in extraction process which are the alteration of the lake stability ,the deterioration of the lake ecosystem due to the increase of the nutrients inputs,and to waste the resources due to an inefficiency of technology.[3]

2.1.2.2 commercial effects

Surely,the future pilot plant of methane , will disturb the process of fishing because of a lot of installations of the offshores in the lake,then this will make the fishers to get insufficient

[3]Risks of extracting methane gas , available at http://www.lakekivu.org/methane_extraction, accessed on5th,September,2012.

production compared to the demand needed by the consumers .so this will discourage them and move away from the fishing business.

2.2 barriers that affect the process of exploiting methane gas

In general,there are some associated challenges that limit this process to be exploited on the desirable level.

2.2.1 geographical barriers

It's important to note that the technology brings a lot of impact on environmental changes, so with reference from Kassim.T(2012),the people who are in charge of exploiting they always fear on some reason of dissolved methane situation at the bottom of the lake,and they want to care about the kivu beauty within the aquatic animals so that they could not be threatened because sometime they think that it can explode because of gas saturation.

2.2.2.economical barriers

Economically, this exploitation meet with a problem of high demand in the way of producing the required gas but the equipment and other related material which are not enough make the proposed project to be delay and stay in letters without being implementation as required.

Thus, this result into the production of insufficient gas compare to the energy needed.

CHAP 3: STRATEGIES TO OVERCOME THE CHALLENGES DURING THE PROCESS OF EXPLOITATION OF METHANE GAS

3.1 Governmental policies to handle those challenges

Our national unity has set up some strategies in order to accomplish their goal so that this could come as a solution to supplement the existing power supply in our country .

With reference to a visit at kibuye power plant by hon.prime minister of Rwanda,on 26thmarch 2012,he called the concerned members to work hard and meet deadlines so as to allow citizens have access to electricity.[4]

Then,by this strategies it is hoped that it will raise up the economic development of our country.

3.1.1 economical solution

Based on latest research, it has approved that the economical problem which affect methane gas exploitation,this is expected to be solved totally in this next coming years by before 2020 .

As due to funds that have been grouped in order to execute this process of exploitation as required, the US Energy company contour global signed 325million dollars contract with Rwandan government in 2011 to establish 25megawatts at the beginning then extend up to 100megawatts of power from methane.[5]

additionally,there is also Dane associates ,a Scottish registered company with 70% stake in the venture agreed to inject euros 67 million.and this was her shareholding

Apart from the funds, the government has pour the amount required in order to finish construction of kibuye pilot plant and not wait for other days, therefore it is signed that after that inauguration of that plant in the first quarters of 2013 , the expansion of gisenyi pilot plant should start the same year so that the population may start enjoying the power supply from gas.

Kivu Watt Project manager said that the badge and all technical installations are expected to finish by August 2012 and tests start in December same year.
At the beginning of the year 2013 the project will process methane gas trapped deep in Lake

[4] A visit of prime minister and his speech on kibuye pilot plant, http://www.newtimes.co.rw/news/index.php?i=14613&a=40741 , accessed on 15thseptember2012
[5] Subsidiary of contour global company that develops electricity, http://www.guardian.co.uk/environment/2010/aug/16/rwanda-gas-lake-kivu ,visited on 20th/september/2012.

Kivu for use as fuel to generate critically needed electricity, while simultaneously safely removing harmful lake gases.[6]

3.1.2 **use of skilled labors under condition**

I agree with Mr H. Albert who said that"One machine can do the work of fifty ordinary men. No machine can do the work of one extraordinary man". [7]

According to this quote, Rwanda has invest a lot in power generation to accomplish the target of vision 2020,

Hence,the government give opportunities to the campaign that are experienced and qualified in energy development so that they can run the proposed project on methane gas exploitation at a profitable level for our national energy needs relatively to the economic development ,at the same time ,by using skilled labor will make methane use as fuel and reduce the utilization of woods which result into deforestation and soil erosion.

CONCLUSION

In conclusion,the process of exploiting methane gas is one of the major concern in order to reach the Rwandan targets especially in the case of economic development and environment protection.

Although, this process is not yet finished completely, the government has undertaken the main strategies that can empower the methane process of exploitation on a good level which can benefit to the existing energy resources and so that its contribution may bring a high rate of positive changes which could solve the energy crisis inside and even in the regional country.

In fact, there is kivu monitoring program which is charged to always take care of the lake awareness in order to prevent all associated problems that can occur at an uncertain time considering to the research that have been carried out and then try to handle those problem in the sustainable ways.

[6]Expectation from Kivuwatt project manager , http://www.newtimes.co.rw/news/index.php?i=14613&a=40741 ,visited on 10thseptember2012.

[7] Albert h. quotes about success, http://www.brainyquote.com/quotes/topics/topic_technology.html, visited on 23rd/September/2012.

RECOMMENDATION

Within this research paper, I have realized that Rwanda still faces the problem of energy means which is still causing the high rate importation of petroleum from the large port because of being a landlocked country .as result, the consumers are too many compare to the energy which is produced here in our country which makes high cost.

According to the benefit that our country is targeting from this project ,it is so good if the energy sector strategic plan (ESSP) makes a serious agreement with the company that have all the exploitation requirement for methane gas future project and ensure that it will meet the deadline signed in the contract.

For the best choice, Rwanda has to encourage the investors to invest their money in energy sector especially methane gas because of its potential of being transformed into power supply and it naturally form that differ from others dissolved gas that exist all over the world and motivate them the way there is availability of the market for the quantity produced so that they will get favor in job and share the profit within the agreed time.

Lastly,Rwandan government have to acquire some professors in techniques of exploiting on world wide and then provide the required training to youth so that they can get a lot of knowledge and become more creative on that field of energy sector so that they will be the one to expand the future project plan on methane gas. Thus it will be easy for Rwandan to invest their money in the process of exploiting methane gas adequately.

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