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Research Article

IMPACT OF EXPLORATION AND PRODUCTION ACTIVITY OF OIL AND NATURAL GAS RESOURCES ON ENVIRONMENT IN INDIA

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ABSTRACT

In recent years, due to public concern over perceived and actual environmental impacts, the petroleum industry has been moving towards a more sustainable framework. Environmental management (EM) has grown rapidly in the last few years as a sudden set of managerial practices as well as a new sub-discipline in the field of corporate responsibility of every management. The wide range environmental issues of the oil and gas exploration and production industry are witnessed at both local and global levels. They include protection of habitat and biodiversity, air emissions, waste water management and incidents and oil spills.

The objective of the study is to identify all environmental aspects of the exploration and production activities further it also focuses on the management system to improve upon and minimize the environmental impacts.

From this study it is found out that, the percentage emission from consumption of petroleum has declined considerably from 2005 to 2012 (26. 31 % in 2005 to 23.77% in 2012). Apart from this, environmental expenditures have increased from Rs. 2.35 Billion in 2006-07 to Rs.4.95 billion in 2011-12.

This study analyses the robustness of different environment management strategies adopted by oil industries in India, to bring about energy economic development and sustainability of resources.

INTRODUCTION

In recent years, due to public concern over awareness about the environmental impacts, the petroleum industry has been moving towards a more sustainable framework. In the petroleum industry, there are a number of fundamental issues with regard to assessing sustainability. Usually realized as a finite and non-renewable resource, long-term oil and gas production trend of declining the reserves and reserve-accreditation. The core sustainability issues include- air emissions, waste water management and incidents and oil spills also known as 'resource intensity.'

The broad environmental issues faced by the oil and gas exploration and production industry are manifested at both local and global levels. They include: protection of habitat and biodiversity, air emissions, marine and freshwater discharges, incidents and oil spills, and contamination of soil and groundwater. The industry has responded to these issues. The challenge is to ensure that all operations conform to current good practice. In the past, environmental problems were considered largely as an economic burden. But this situation has gradually changed onto global dimension in 1987 because of Bruntland Commission report. At present environmental issues are given first priority at the national and international level.

Objectives

- To identify all environmental aspects of the exploration and production activities.
- To analyse the environmental impacts of exploration and production process.
- To focus on the management system to improve upon and minimize the environmental impacts.

METHODOLOGY

The present study is both analytical and descriptive in its framework. The analytical approach will establish a clear understanding of the following:

- Identification of variables like oil and gas reserves (proven) extraction or production, of these resources in India.
- Emissions from flaring and consumption of oil and gas.
- Waste arising from exploration and production activities.

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Sources of Data

Data used for reserves were collected from the compiled reports of the Ministry of Petroleum and Natural Gas (MoPNG) and information were collected from annual reports and field visits to Oil and Natural Gas Corporation.

REVIEW OF LITERATURE

Levy (1997) stressed that environmental management is a major step toward environmental sustainability. Further, he analyzed the various stripes tend to dismiss EM as reformist, managerial instrumentalism that ignores the root cause of environmental degradation. The study emphasized the influence over governmental agencies comprised of consumer groups, environmentalists, and organized labour help in bringing about environmental management.

Shankar (1998) analyzed the role and importance of rules and regulations, institutions and policies governing environmental protection in India. Economic instruments provide an opportunity to the polluters to make use of their private information in finding least cost means of complying with the standards. Complying with the standards, a polluter pay mechanism was suggested wherein the pollution charge was levied for each pollutant, according to the marginal abatement cost at the prescribed standard and provided incentives to internalize the negative externality arising from the production activities.

Merchant, (1992) emphasized that the role of environmental management towards bringing about environmental sustainability has been recognized some people, others criticized it as a business technique of "green washing". Further environmentalists ignore the root cause of environmental degradation as they were not in a position to find exactly the root cause of such changes.

Nicholas Z. Muller, Robert Mendelssohn (2007) measured the damages due to emissions of air pollution in the United States. They used an integrated assessment model to calculate the marginal damage associated with emitting an additional ton of pollution from nearly 10,000 sources in the U.S. The study found out that emission of fine particulates (PM2.5), ammonia (NH_3), sulphur dioxide (SO_2), and volatile organic compounds (VOC's) caused 80% of total damages. SO_2 emissions, which are 19% of total emissions by weight, produced 26% of total damages and PM2.5 emissions, which are only 6% of total emissions by weight, caused 23% of total damages.

Historical Background of Oil and Gas in India

The development policy of the many less developed countries during the 1950's and 1960's placed great emphasis on the Agriculture sector, because this sector is the most energy intensive. Commercial energy consumption rose rapidly in the developing world. The first oil crisis of 1973 marked a historic change from an era of cheap oil to an era of high cost primary energy. Although the consumption of less developed countries is small when compared to world consumption, the evolution of energy sector in India has mirrored the economic growth strategy of the country. In the post-independence India, the political necessity of keeping the country together and the need for large-scale investments in infrastructure and manufacturing industry laid the foundation for the government's involvement in the business.

The Indian Petroleum industry is one of the oldest in the world, first oil struck in 1867 at Makum near Margherita in Assam. This sector gained importance since the mid nineties, from a state of complete protection of the phase of open competition. This paved the way for attracting funds and technology from abroad in the petroleum sector.

India has significant amounts of oil and natural gas, and most of India's revenue-generating companies are from the oil and natural gas business. India has an indigenous source for around 60 percent of its oil needs and has worked diligently to use substitute forms of energy to fulfil the other 40 percent. The Oil and Natural Gas Commission was established in 1954 as a department of the Geological Survey of India, but Oil India Limited was established according to the parliament act of 1959. But this study gives emphasis only to the role of ONGC in the economic development of India. ONGC is the leader in E&P activities in India. In 2012-13, ONGC has contributed 69% of India's total production of crude oil and 62% of natural gas.

The production of Oil and natural gas was about 651.61 MMT in 2004-05 and went up to 665.53 in 2007-2008 and increased to 856.49 in 2011-12. The production of natural gas by private players from the discovered fields has increased over the last few years, indicative of the potential role they can play in improving the gas supply position in the Country.

Table No 1 Production of Oil and Natural Gas in India

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Oil Production(MMT)								
a) Onshore								
OIL	31.96	32.34	31.07	31.00	34.68	35.72	35.82	38.47
ONGC	83.20	80.95	80.58	79.21	75.65	75.15	74.47	73.86
JVC's	0.74	1.01	1.61	1.92	2.43	7.34	54.00	67.94
Total	115.90	114.30	113.26	112.13	112.76	118.21	164.29	180.27
b)Off shore								
ONGC	181.65	163.09	179.93	180.20	178.01	173.40	169.73	163.30
JVC's	42.26	44.51	46.69	48.85	44.31	45.29	42.82	37.33
Total	223.91	207.60	226.62	229.05	222.33	218.69	212.55	200.63
Oil Production Total(a+b)	333.981	321.90	339.88	341.18	335.08	336.90	376.84	380.90
NG Production(onshore and Offshore)	317.63	322.02	317.47	324.17	328.45	474.96	522.19	475.59
Grand Total OEG	651.611	643.92	657.35	665.35	663.53	811.86	899.03	856.49

Source: MoPNG 2011-12

During the year 2010-11 India has produced 376.84 MMT of oil and 522.19 OEG of gas which is higher compared to previous year 2009-10 (336.90 MMT of oil and 474.96 OEG gas)

Impact of Oil Exploration Activity on Environment

The broad environmental issues faced by Oil and gas exploration and production industry are witnessed in both national and global levels. The oil and gas exploration have the potential for a variety of impacts on the environment. These impacts depend upon the surrounding environment and pollution prevention and control techniques.

Further the exploration and production operations lead to changes in the following:

Socio-economic aspects

The Exploration and production operations bring out the following changes in the socio-economic aspects

- Land use pattern, such as agriculture and fishing
- Creation of employment opportunities thereby increasing the level of income
- Need for housing, education
- Transportation and development of infrastructure

Atmospheric Impacts

The following are the sources of atmospheric emissions arising from oil and gas operations:

- Flaring, venting and purging gases.
- Combustion process such as diesel engines and gas turbines
- Fugitive gases from loading operations
- Airborne particulates from soil disturbance and other burning sources

The main atmospheric emissions from fuel combustion include NOx,, SOx, Co and volatile organic carbons. Apart from these, these activities generate

- Ozone depleting substances
- Flaring of produced gas
- Carbon dioxide emissions arise from production operations like flaring, venting and combustion.

Aquatic Impact

The main aqueous waste stream from exploration and production activities of oil and gas are

- Produced water
- Drilling and well heat fluids
- Wash and drainage water.

Apart from the above waste water arises from the processing and injection of water into the reservoir and used for drilling activities and work over activities.

Impact on Biodiversity

Due to drilling and production activities, there was a prolonged change in vegetation cover and disturbance to the eco system. Further the animal populations are also largely affected by the changes in vegetation, soil, water and noise levels.

Environmental Management strategies followed by Oil & gas Industry (case study of ONGC)

Oil and gas development activities gained importance to meet the need of rapidly industrializing countries, and efforts were made to carry out safely with minimum adverse environment impact. This can be achieved only through a strong company commitment to environmental protection. To achieve sustainable growth ONGC has undertaken following environmental management measures

Eco foot Printing (Water, Carbon and Waste) from entire operations are developed though carbon management and low carbon growth. Undertaken Methane reduction projects in association with US Environmental Protection Agency. In 2012-13 GHG emissions are reduced by 5% and fresh water consumption by 15%.

Reduced Gas Flaring from 807 MMSCM in 2012 to 631 MMSCM in 2013 due to up gradation of facilities and technological intervention like installation of compressors and pipelines.

Produced water Management: Produced water is the major effluent in the production of oil and gas. This is separated and sent to Effluent Treatment Plants (ETP) for further treatment. The produced water in 2011-12 was 0.82 billion liter and it has been reduced to 0.62 billion liter in 2012-13.

Table No 2 CO2 Emissions from Oil and Gas Consumption (MMT)

Year	Emission from consumption of petroleum	% of emission to total energy	Emission from consumption and flaring of Natural Gas	% of emission to total energy	CO_2 from Consumption of Energy
2005	314.15	26.31	71.52	5.98	1194.01
2006	332.33	25.69	77.35	5.98	1293.17
2007	353.4	25.87	82.25	6.02	1366.01
2008	372.14	25.68	85.25	5.88	1448.99
2009	414.14	25.20	105.69	6.43	1642.93
2010	427.41	24.92	127.44	7.43	1714.72
2011	413.94	23.61	126.44	7.21	1752.67
2012	435.27	23.77	115.71	6.31	1830.93

Source: EIA 2012

From the above table no 2 we can understand that the percentage emission from consumption of petroleum has declined considerably from 2005 to 2012 (26. 31 % in 2005 to 23.77% in 2012) and the percentage emission from flaring of natural gas also declined when compared to 2010.

Mangrove Plantation: In order to protect the environment nearly 1.2 million saplings and about 0.5 million seed were planted in the soil erosion prone area of Ankaleshwar and Hazira.

Spill management: In offshore operations ONGC deals with transportation of crude oil through pipelines and tankers. In

order to combat minor oil spills ONGC made agreement with Mumbai-Port Trust for the implementation of National Oil Spill Disaster Contingency Plan.

Environmental Expenditures have increased from Rs. 2.35 Billion in 2006-07 to Rs.4.38 Billion in 2009-10 to Rs.4.95 Billion in 2011-12

Findings, Suggestions and Conclusion

Findings

- The production of Oil and natural gas was about 651.61 MMT in 2004-05 and went up to 665.53 in 2007-2008 and increased to 856.49 in 2011-12.
- The percentage emission from consumption of petroleum has declined considerably from 2005 to 2012 (26. 31 % in 2005 to 23.77% in 2012) and the percentage emission from flaring of natural gas also declined when compared to 2010.
- In case of Produced water of oil and gas has come down due to environmental management programmes of ONGC. It has declined from 0.82 billion litres in 2011-12 to 0.62 billion litres in 2012-13.
- The environmental expenditures have increased from Rs. 2.35 Billion in 2006-07 to Rs.4.95 billion in 2011-12.

Suggestions

- Government should formulate a detailed and feasible cleaning development planand incorporate into the overall development plan for the economy for environmental management of fossil fuels.
- Implement tax incentives to promote clean mechanism and efficient utilization of energy.
- To raise fees on waste discharges to internalize the external cost involved.

CONCLUSION

Environment management can be understood in the context of intensifying public concern over environmental issues and the increased institutional pressures on corporations to improve their environmental accomplishment. Environment management of oil and gas resources can be made sustainable one by following stringent regulations and also private and public cooperation in following the measures. Further environment management will be successful only by identifying profitable opportunities for reducing harmful emissions and resource use and strengthening innovation of alternative products and processes.

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