

Article

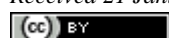
## Ecologically-Informed approaches: International mechanisms for navigating environmental challenges and ensuring sustainability in the oil and gas exploration and production industry

**Bhupali Saikia, Saira Gori**

Department of Law, Gujarat National Law University, Attalika Avenue, Knowledge Corridor, Koba, Gandhinagar, 382426, Gujarat, India

E-mail: saikiabhupali2@gmail.com, sgori@gnlu.ac.in

Received 21 January 2024; Accepted 28 February 2024; Published online 31 March 2024; Published online 1 June 2024



### Abstract

With regard to the world's primary energy sources, the oil and gas industry is regarded globally as one of the leading industries in the energy sector, one that significantly contributes to the global economy. They create possible environmental hazards during their exploration and production processes, primarily in the form of pollution, which exacerbates climate change, disturbs animals and ecology, damages public areas, and endangers the nearby residents. The majority of the nation enhanced the procedures and operations of the energy sector by conserving and utilizing the nation's natural resources in order to achieve economic growth and development. To mitigate such environmental challenges and the consequences through their activities, various international organizations and institutions work to structure, strengthen the environmental provisions and the applicability during their operation. The purpose of this study is to investigate the global regulatory frameworks that govern the exploration and production (E&P) in oil and gas with respect to environmental issues. In addition to examining the structure, policies, and decision-making procedures of organizations like the United Nations Framework Convention on Climate Change (UNFCCC), the Organization of the Petroleum Exporting Countries (OPEC), and the International Energy Agency (IEA), among others, the research will concentrate on sustainability issues in E&P activities while extracting natural resources from the environment for economic benefit. The management of the E&P industry and global energy governance would be significantly altered by the protective lighting this study investigation would bring to bear. Implementing international agreements is fraught with difficulties, such as weak enforcement mechanisms, inconsistent national regulations and priorities, a dearth of comprehensive data reporting, insufficient monitoring and verification systems, and a lack of funding for the adoption of sustainable practices. The study comes to the conclusion that in order to improve the sustainability of the E&P industry, it is imperative to develop collaboration, harmonize standards, improve monitoring and reporting, and provide financial support. Furthermore, attaining a sustainable and responsible future in energy exploration and production requires sustained efforts toward global cooperation and shared accountability.

**Keywords** exploration and production; hydrocarbons; natural resources; energy sector; environmental challenges; sustainability; ecosystem.

Proceedings of the International Academy of Ecology and Environmental Sciences  
ISSN 2220-8860  
URL: <http://www.iaees.org/publications/journals/piaees/online-version.asp>  
RSS: <http://www.iaees.org/publications/journals/piaees/rss.xml>  
E-mail: [piaees@iaees.org](mailto:piaees@iaees.org)  
Editor-in-Chief: WenJun Zhang  
Publisher: International Academy of Ecology and Environmental Sciences

## 1 Introduction

After the unprecedented outbreak of Covid-19, crises all over the world not only calculating the impacts but also looking forward to the future and new normal days to come. This pandemic makes the industries to seek emission leniency and uplifting subsidies to skew competitiveness, and for planning for carbon adjustments are being set in motion. Every Country developed social and environmental controls such as re-evaluating the policies, regulations, self-regulation, liability law, corporate governance and market forces which influenced the industrial performance of hazardous activities (Baram and Lindoe, 2014). Petroleum, considered the top most capital making commodities in the world today. It is one of the most vital resources in the modern world having products like gasoline, diesel fuel, jet fuel, and many other products. The use of such oil products can only be stopped, when there is no more oil to extract from the ground and deep water. Oil extraction is a double-edged sword, as it extracts, refining, and burning of fossil fuels found naturally under the earth and on the other hand such activities and consequences of the uses of extracting products cause serious impacts to the environment and society which is close vicinity to them. For exploration and production of oil and petroleum reserves, the host countries have an agreement with the oil companies or the contractors for sharing of the hydrocarbons (fossil fuels), these agreements are either national or international petroleum agreements (Greenfield and Rooney, 1999). The United Nations Resolution on Permanent Sovereignty over Natural Resources, the Declaration on the Establishment of a New International Economic Order, and the Charter of Economic Rights and Duties of States held universally that sovereignty of a particular country is compromised if control over natural resources is relinquished to a foreign corporation (Smith, 1993). Generally seen that almost all the extracting and production projects are in areas distant from the urban centres and the areas which are rich in natural resources which are most attracted for this project. Petroleum is considered as critical substances because of its impacts on local communities and the surrounding environment (Symon, 2007). Assertions of appropriate social and environmental responsibility and effective regulation by corporations and governments are common but realizing them is often not an easy task. The projects that totally depend on the extraction of natural resources, especially in the developing world with their impact on indigenous communities are very huge and can be very tough to identify. These projects are technologically sophisticated and wealthy, are often operating in remote areas. Environmentally, as the search for resources pushes companies into new frontiers, so they are more likely to affect hitherto untouched natural environments.

The industry has contributed enormously to the world economy in their growth and provided a high standard of living but on the other hand, the downside of petroleum development has left a profound adverse impact on the global environment (Gao, 1998). Such hydrocarbon explorations are seen as increasing scepticism for their environmental consequences. Global climate change has effectively become the greatest environmental concern and is mainly caused by the emission of greenhouse gases from the use of fossil fuels. Therefore, every International and National regulator needs to play the central role in the accountability of their framework and must deal with many challenges in making it work as a solution to any legitimacy issue, such as the need for high level of competency and technical expertise in evaluating oil company performance far beyond the prescriptive regimes.

Therefore, to continue with the research, the methodology includes comprehensive review of international agreements and qualitative descriptive analysis of various International Organizations, conventions, and treaties that adopts the approach towards the sustainability of oil and gas exploration and production industry globally.

## 2 Analytical Approach

This section provided a thorough examination of the numerous international agreements and activities amongst

oil and gas producing and exploration nations with the aim of encouraging and assisting these nations in implementing policies aimed at achieving carbon neutrality. The analysis will go over the successes and actions taken by the nations in the pursuit of sustainable development in the oil and gas production and exploration process.

### **2.1 'Green Trade' under United National Conference on Trade and Development (UNCTAD)**

"Green trade" is a term that refers to the trade of goods and services that have a positive impact on the environment. This includes products and services that are produced using sustainable practices and materials, and that have a lower environmental footprint compared to traditional products and services. Green trade is becoming increasingly important as the world faces urgent environmental challenges such as climate change, biodiversity loss, and pollution, hence by promoting the trade of environmentally-friendly products and services, governments, businesses, and consumers can contribute to a more sustainable and equitable future. However, United National Conference on Trade and Development (UNCTAD) supports and promote the interest of developing countries to deal and access the benefits of a globalized economy more fairly and effectively and helps them to deal with the potential drawbacks of greater economic integration (UNCTAD Handbook, 2022). It offers assistance in analysis, facilitates consensus-building and technical. This helps the developing countries to use trade, investment, finance and technology as vehicles for inclusive and sustainable development. Under the UNCTAD, there is an important shift from traditional model to green industrial activities to achieve their goals. The policymakers succeed in the creating of green industrial activities while simultaneously achieving the destruction of incumbent fossil fuel-intensive activities. It has been recognised that the management of industries of developing countries in today's world in the technology induced global economy, cannot flourish without having knowledge and innovation-based development strategy (Trade and Development Report, 2021) in the industries activities.

Moreover, today's developments goals derive from the global agenda of decarbonising economic activity and international efforts to tackle climate change. As said by the Paris Agreement (Trade and Development Report, 2019) that connecting national projects and its implementing strategies become a part of larger international climate action projects and also need to contribute to international strategies on low carbon development. It is necessary to regenerate or rethink public policy at national level along with to renew the public institutions and create social contract, cooperation and leadership at the global level. As laid out by The Trade and Development Report 2019 the global strategy that not only mitigate the threat of global warming also simultaneously addressing the inequities and fragilities of a financialized world (Trade and Development Report, 2021).

Every fundamental requirement for stabilization climate change i.e. cut the absolute emissions levels irrespective economic growth rates. The most important action requires eliminating carbon dioxide emission to remove the consumption of fossil fuels because it is responsible for about 70–75 per cent of global carbon dioxide emissions (United States Environmental Protection Agency, 2022). The two basic ways through which government policy can advance a clean energy transformation, through either direct public-sector investments or regulations and incentives to encourage private-sector investment and such incentives/regulations includes carbon taxes or carbon caps or contracts for clean energy with prices and subsidized financing (Sarangi, 2018). It has said that in the contemporary trade policy, the concept "Green trade" has got the highest importance and implementation in the energy as well as allied sectors. Such sectors are the leading contributors to environmental issues such as matters related to oil spills, global warming and potential nuclear disasters. Now a days the environmental measures use by both exporting and importing countries through WTO dispute settlement mechanism to claim and defend their rights (UNCTAD, 2000). The GATT and WTO have tackled this environmental issue in some notable disputes (Petroleum and Energy Policies, 2000). The United

Kingdom, the United States, and Canada, and is already part of the European Union's flagship policy in aligning trade and climate, i.e., the Green Deal (European Commission, 2021).

## **2.2 Negotiation “United Nation Framework Convention on climate Change” (UNFCCC)**

The petroleum exporting countries has to face many unexpected and uncontrolled environmental and trade challenges. Therefore, in order to control and prevents such challenges, some environmental measures framed by the United Nations Framework Convention on Climate Change (UNFCCC). UNFCCC is an important instrument whose ultimate effort is to make a potential relationship between trade and environment objectives. Convention came into force in March 1994 and in September 1999, at least 190 countries has ratified and become the member of the convention. The principles, obligations and framework of the convention is to generate stabilization and reduction of the emission of the concentrated greenhouse gases into the atmosphere from the exporting industries, which is considered as the primary cause of the climate change. The emission of gases needs to eliminate in such a level that would prevent harms to human sustainability in relation to the climate change. The Organization for Economic Cooperation and Development (OECD) members and the states of Central and Eastern Europe are generally called them as Annex I Countries due to their developments and contribution, taken much measures and policies with regards to the elimination of greenhouse emissions to fulfil certain targets in their countries own regulations. UNFCCC considered a significant framework that reconciles the trade and environment including the energy sectors which causes massive destruction to the climate through their activities and provides a framework for international cooperation on climate change issues. The United Nations Framework Convention on Climate Change (UNFCCC) has implications for the exploration and production (E&P) industry, as this industry is a significant source of greenhouse gas emissions. Under the UNFCCC, countries are encouraged to transition to low-carbon energy sources and technologies, and to reduce their dependence on fossil fuels.

Moreover, negotiations within the UNFCCC involve representatives from member countries who come together to discuss and develop policies and strategies for reducing greenhouse gas emissions, adapting to the impacts of climate change, and providing financial and technical assistance to developing countries. One of the key negotiating bodies within the UNFCCC is the Conference of the Parties (COP), which meets annually to assess progress and develop new strategies for addressing climate change. The most recent COP was held in Glasgow, Scotland, in 2021. Therefore, UNFCCC requires cooperation and collaboration among all parties, as well as a willingness to make difficult compromises and trade-offs in order to achieve shared goals.

In summary, the UNFCCC has significant implications for the E&P industry, as it requires the industry to take action to reduce its greenhouse gas emissions and transition towards low-carbon energy sources and technologies.

## **2.3 Highlighting the features of “Climate Change” in the Kyoto Protocol**

The Kyoto Protocol undertakes emissions trading sectors and it's accounting together (Aylor et al., 2020). In the year 1997 a protocol was adopted in Kyoto, Japan, through the consent of the Parties of the Climate Change Convention. The Kyoto Protocol recognises as a legal instrument to eliminate carbon emission and also one of the first multilateral instrument which contains obligatory principles for reducing carbon gases. Along with the various mechanisms to achieve its objectives of reducing the emission from the industry, the protocol also maintains a healthy relation between the trading developed and developing countries. As such this protocol implementation was late, meanwhile several OECD countries have made initiatives targeting to reduce the carbon emission i.e the introduction of carbon /energy taxes (Bygrave and Ellis, 2003). The Kyoto Protocol applies by the Annex B countries to reduce their carbon emission and other dangerous greenhouse gases (CHGs) to the climate. Hence, the fossil fuels markets will shift to a new equilibrium because emissions of carbon dioxide mainly attached to combustion of fossil fuels. And the Paris convention launches various

and latest climate change features that will highlight how the society and the energy moving forwards to mitigate the climate change. Lastly, the Lima to Paris Action Agenda has also produced numbers of new commitments and initiatives, which shows much concerns to the addresses the climate change as same as for the Sustainable Development Agenda (Lima-Paris Action Agenda Primer, 2015).

Protocol includes mechanisms for countries to reduce emissions from deforestation and forest degradation, which are often associated with extractive industries such as logging and mining. In addition, the protocol established a system of emissions trading, which allows countries to buy and sell emission credits. This system provides incentives for extractive industries to reduce their emissions and to invest in cleaner technologies. Overall, the Kyoto Protocol represents an important step towards addressing the issue of climate change and reducing emissions from extractive industries. However, it is worth noting that the protocol has limitations and has been criticized for not going far enough to address the problem of climate change.

#### **2.4 Role of Organization of Petroleum Exporting Countries (OPEC) in extractive industries**

The Organization of Petroleum Exporting Countries (OPEC) is an intergovernmental organization that was established in 1960 by five major oil-producing countries: Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela. As an organization, OPEC plays a significant role in the extractive industries, specifically the oil and gas sector and the member countries have significant control over the global oil market, as they are responsible for a significant portion of global oil production.

The "OPEC Special Fund" was created in January 1976 as a collective aid facility of OPEC Member Countries (Shihata, 1980). Therefore, finance provided through such 'OPEC Special Fund' in the name of contributing Parties. In addition to that the financial help from such fund is to empower to provide contributions and loans and grants to international agencies which will definitely help the developing countries. The Oil-exporting countries get help and support from other developing countries who have acted in coordination with the OPEC members' countries. The OPEC countries includes some subsidies for domestic fossil fuels that is the elimination of subsidies for the fuel producers in industrialized countries, in supports of doing R&D programmes for the separation and disposal of CO<sub>2</sub> from their activities and also helping in the development of more efficient hydrocarbon production and use proper green technological infrastructure, and the diversification of energy-exporting countries (OECD, 2013).

OPEC has been criticized for its lack of action on environmental issues, particularly in relation to climate change to address environmental issues and has taken some steps to promote sustainable practices in the oil industry. For example, OPEC has supported the development and use of clean technologies and renewable energy sources. OPEC countries gain the knowledge of the availing the 'greening' as global trends to the world markets. The ultimate objectives of these OPEC countries are to reduce greenhouse emissions compatible with the oil and gas exporting countries along with economic and political stability.

#### **2.5 North America Free Trade Agreement (NAFTA)**

The NAFTA main goal was to promote, create and facilitate the foreign trade between Mexico, Canada and the United States and holds considerable potential interest for petroleum exporting countries some reasons. Such agreement mainly holds between the major petroleum importing country like United States and the major petroleum exporting developing country (Mexico) and also covers the Canada which is also a major supplier to the United States. Therefore, The NAFTA includes various provisions that deal with the trade and its relation with the environment and a separates Agreement on Environmental Cooperation became an important part of the NAFTA institutional structure.

NAFTA environmental provisions are not very specific to some particular items such as to the oil and gas sector, but most important for NAFTA is to maintain a balance between trade and environmental considerations and its consequences in the traded countries. Such considerations much provide some important

measures that how this trade and environment relationships will be treated carefully in relation with the climate change, which may be the direct or indirect consequences of Petroleum trading. It is necessary for the states that may provide some indication of how the relation of trade-environment will be treated carefully and potentially to settle the disputes of climate change in, which are of direct and significant emerging concerns to petroleum exporting states (United Nations Conference on Trade and Development, 2000).

## **2.6 Attaining sustainable way through Paris agreements (2016)**

The landmark Paris Agreement brings the greenhouse gas (GHG) emission into normalize and settle down the conflicting interests by establishing a binding commitment for all countries. Such will help to prepare, communicate and implement nationally determined contributions (NDCs) to reduce GHG emissions. Pickbourn, Nkurunziza and Ndikumana (2022) states that Paris Agreement will achieve the goal of the agreements to keep the increase level of global average temperature to below 2 degrees Celsius (ideally to 1.5 degrees Celsius) compared to preindustrial levels by promoting the countries to established an enhanced transparency framework(ETF)and under such framework every countries will report their transparency on their action taken and the progress made in relation to the climate change mitigation, adaptation measures and support provided or received and also includes international procedures for the reviewing of the submitted reports (The Paris Agreement, 2015). It is very much necessary for the all the developed and developing countries to implement Paris Agreement in fair and also respect the human values to overcome the climate change which is complex multi-faceted global challenges nowadays (OPEC Bulletin Commentary, 2016).

Nowadays, the extracting industries like the oil and gas industry has significantly become more responsive, sincere and environmentally conscious. Moreover, such industry has improved their technology which is sustainable and will enhance efficiency in the future. They have improved technology which will enhance such efficiency in the future. After the establishment of this agreement, the whole world has ratified and implement this agreement in their every sector and community to attain sustainable path that will safe and secure the planet for the coming next generation.

In the year 1987, the Sustainable Development has been defined by the World Commission on Environment and Development, also named as (the "Brundtland Commission") and explain the concept of Sustainable Development that is a process of change in the exploration and exploitation of natural resources, the direction of investments, the ethical way of technological development, and institutional change should be in harmony and should enhance both current and future potential to meet human needs and expectation from the nature and the technological development (Price et al., 2000). This Commission is totally an independent body not under the control of any governments and the UN system (World Commission on Environment and Development, 1989). The Commissions have some objectives like to examine and re-evaluate the critical environment and related developmental issues, secondly to formulate some realistic proposals to deal with the critical environment and the developmental issues, and lastly the commission propose new forms of international cooperation that will policies and events that are needed for the change and also to raise the understanding and commitment levels of the individuals, governments, institutions and other voluntary organization (Report of the World Commission on Environment and Development, 1983).

The commission covers the pollution risks that arise from oil, gas and coal substances and they cause interrelated atmospheric pollution problems such as global warming, urban industrial air pollution, and acidification of the environment. Some of the countries adopted healthier environmental technologies and many developing countries do not adopt to crop these environmental issues. These problems are becoming more widespread concerns particularly in tropical and subtropical regions, but their economic, social, and political repercussions are as yet not fully appreciated by society. With the exception of carbon dioxide emission, air pollutants can be removed from fossil fuel combustion processes at costs usually below the costs

of damage caused by pollution. However, the risks of global warming make heavy future reliance upon fossil fuels problematic. Here, the Table No. 1 will discuss the international agreements and initiatives taken by the countries to focus on the environmental importance.

**Table 1** The international initiatives on energy industry taken by countries to promote clean energy environment.

Agreement/Initiative	Countries/Participants	Purpose/Scope	Environmental Importance
OPEC	Saudi Arabia, Iraq, Iran, Kuwait, etc.	Coordinate and unify petroleum policies	Address environmental impacts of oil production
OPEC+ Agreement	OPEC countries + Russia, others	Stabilize oil prices through coordinated production cuts	Mitigate greenhouse gas emissions and climate change
Paris Agreement	Global	Combat climate change and limit global warming	Set targets for emission reductions and promote clean energy transition
Joint Development Zones (JDZs)	Nigeria, São Tomé and Príncipe	Collaborate in exploring and developing shared reserves	Environmental protection in offshore exploration activities
Arctic Council	Canada, Denmark, Finland, etc.	Address environmental protection and resource activities	Sustainable development and conservation in the Arctic
North Sea cooperation	UK, Norway, Denmark, Germany, etc.	Collaborate on resource sharing, protection, regulations	Environmental impact assessment and protection measures
Energy Charter Treaty (ECT)	Multiple signatories	Promote cross-border cooperation, investment protection	Encourage sustainable energy practices and environmental considerations

Source: Secondary Analysis of data from international organisations website.

### 3 Contractual Rights of Exploration and Production Industry under the Production Sharing Agreements

There are many mechanisms and systems in the field of exploration and exploitation of natural resources, on which the host countries offer right to explore and exploit the petroleum resources (Goel, 2011). After the era of 1970, a new concept of joint ventures of oil companies with the host country started and subsequently this concept of contract named as Production Sharing Contracts. Moreover, the oil companies incorporate the charging of Petroleum Exploration License fees and royalty as well as sharing of profit after the cost recovery. This is the basic development arrangements i.e. the concession and the production-sharing agreement. Many countries prefer and enter into production sharing agreements rather than granting licenses or concessions and such agreement divided into two terms: a term for exploration and development and a subsequent, longer term for production. Under this agreement, the host country, grants or allow the foreign companies contractual rights to explore and develop a specified area and to receive specified production shares from which it will recover its costs and profits and this way the host country retains a production share and such put the

companies in the proper legal perspective. Moreover, in performing the contract, the contractor has to conduct its petroleum Operations with due regards to concern with respect to protection of the environment and conservation of natural resources as mentioned in the provisions of Article 14 of the Model Production Sharing Contract.

For onshore oil exploration and exploitation, India has provided to the oil companies some regulations, for regulating of petroleum operations and grant of licenses and lease for exploration, development and production of petroleum in India such as the Oil Fields (Regulation and development) Act, 1948 and the Petroleum and Natural Gas Rules, 1959 (Saikia and Gori, 2024). Such rules provided the grant of exploration license in the land vested in a state government by that state government with the prior approval of the Central Government. The contract also covers the insurance in relation to Petroleum Operations for such amounts and against such risks in the petroleum industry in accordance with Good International Petroleum Industry Practices and need to furnish the evidence of coverage to the government.

Therefore, the relationship between growth, development and environmental conditions are the areas of constant debates in their role in the growth on climate change and the environmental concerns. In terms of domestic oil production, it was mentioned that India's 26 sedimentary basins have not been exploited to optimum levels. Hence, the government encourages the more exploration. Furthermore, a new uniform licensing policy is being put together to allow for the development of unconventional oil and gas in blocks that can be harnessed along with conventional resources (OPEC Energy Review, 2016). Such called international petroleum agreements ("IPAs") i.e., agreements cover the exploration and production sharing agreements (an "EPSA"), association contracts and concessions (Greenfield & Rooney, 1999).

#### **4 Incorporation of Sustainability Involved in the Development of Hydrocarbons**

The UN Conference on Human Development held in Stockholm in 1972, adopted the concept of the Sustainable Development firstly, and that was the first formal meeting of the international community to consider global environment and development needs. After the adoption of the concept of Sustainable development, the UN set up the World Commission on Environment and Development, also called the Brundtland Commission. It is important for every climate agreement on the energy sectors that they should need to achieve the objectives of the sustainable development goals to end poverty, building stronger economics and safer, healthier and more liveable societies everywhere. Out of 17 sustainable Development Goals, 12 Sustainable Development Goals which are directly involve taking action on climate change including their own goal. Now a days the concept of Sustainable development and sustainability gaining a lot of attentions and popularity, due to the increasing concerns regarding in any business and the environment relationship (The Sustainable Development Goals, 2015).

Moreover, the concept of sustainable development or sustainability in the oil and gas sector doesn't mean that the only sustaining the production of fossil fuel indefinitely whether it refers to sustainability of human existence with relation to carefully balancing social, economic and environmental capital in a continuously changing world (Arscott, 2004). The extracting industries should attain sustainable development with an aim to meets the needs of the global society with fossil fuels at reasonable price, and enhance safety with minimal impact on the environment until suitable alternate energy sources are available (Alnuaim, 2019). International Energy Agency was established in the year 2017, for universal access of energy and also the reduction in emission of Greenhouse gases in relation with the Paris Agreement for the improvement of climate change and the air quality etc (International Energy Agency, 2017). Since World War II, the oil and gas industry has been working actively for economic and social growth of energy transition to future. Since, then several initiatives have been adopted by them in their technological development and also changed the public perception on their



activities (Ben-Naceur, 2019). However, the swift shift to natural gas and its role to low carbon emission played a major role. Major technological developments in this sector contributed larger number of accesses in fossil fuels to all the countries. However, the increasing rate of renewable energy such as solar and wind, which have seen major cost decreases over the past decade and are competing with fossil fuels for power generation.

### **5 Analysis Whether the International Initiatives Improve the Efficiency of the Operations of the Energy Sector Globally**

Many practical action initiatives have been taken by energy sector to mitigate the climate change and the reduction of the carbon footprint of every energy value chains. Such initiatives have been initially started by the International and National oil companies in their policies mainly to monitor and reduce the carbon emission, methane leakage, development of carbon capture and storage projects (Cahill and Swanson, 2023). Moreover, the initiatives undertaken by The Clean Energy Ministerial and Mission Innovation, is to include the public and private organizations including oil and gas industry to include sustainable themes as diverse as gender diversity in the energy sector for efficiency and clean extracting hydrocarbons (The Clean Energy Ministerial, 2019). And also, one initiative introduced by World Bank that is greenhouse flaring reduction partnership to address the issues related to gas flaring, waste resources and its impact and creates environmental problems and this helps the countries to develop specific gas flaring reduction programs.

Technologies that use for carbon capture, utilization and storage may leads to decarbonisation which will play a major role in oil and gas industry to meet the most regulatory requirements. In the downstream activities of oil and gas sector, the energy needs to be efficient and clean in throughout the operation of hydrocarbons and incorporation of advance technologies and other latest innovation which will help the energy sector to improve its efficiency. Oil companies are investing in novel third-generation bio-fuels called as algae which provide expertise for offshore wind projects-based experience developing platforms. Moreover, company strategies should implement cost reduction for energy storage and its improved reliability. In 2018, a memorandum of understanding was signed by the Society of Petroleum Engineers (SPE), the International Association of Oil and Gas Producers (IOGP), and the International Petroleum Industry Environmental Conservation Association (IPIECA) to create the social responsibilities and suitability and to develop and production of oil and gas resources and related technologies and innovation for the public benefits (Eberspaecher, 2017). The member countries of OPEC force hard to every country to adopt economic diversification strategies. Such strategies will help to prompt even greater and faster adoption of sustainability measures across the industry (World Future Energy Submit, 2021). Some measures need to be adopted by the Oil and Gas industry in every country firstly most importantly; the water is used as essential element in various oil production processes, from fracking to separating oil from other elements present in oil sands. Hundreds of millions of barrels of water are utilised every single day, and while the global O&G industry currently manages to recycle the vast majority of this water (between 80-95%), companies are rethinking the extraction process to reduce freshwater from the very outset. In order to decrease freshwater usage, O&G companies are exploring more effective ways of recycling and reusing water for their operations.

Secondly, to reduce methane leaks as outlined by the International Energy Agency a figure that it is financially possible to reduce the methane emissions by utilising easily available emerging technologies. However, there are no such technologies and even innovations that can make oil and gas processing greener and cleaner but can still help to improve the industry's overall sustainability by allowing for more cost-efficient processes. For example, new ultrasound technology allows companies to create 3D images of the inside of oil wells, enabling them to make more informed and cost-effective production

decisions. Similarly, analytics, automation, reserve replacement and emerging artificial intelligence programmes can all help find and eliminate operational inefficiencies. Digitalisation of the O&G industry has allowed for the creation of the 'digital oilfield', a process that is starting to come to prominence. Through the use of cloud technologies and big data, the digital oilfield allows for all operational data to be monitored, analysed and utilised in real time, leading to safer, more sustainable decisions being made. Sustainable development is, to date, a non-issue in the legal frameworks for international petroleum exploration and exploitation.

However, the Traditional Oil Concession Agreements incorporate the legal and commercial relationship between petroleum producing countries and foreign oil companies. It has been seen from the environmental perspective that oil exploration is a potentially environmental destructive process beginning with exploration and ending in extraction and significantly, environmental concerns have generally been neglected by, not only the governments of producing countries and exploiting companies, but also nearly all writers and commentators (Boulos, 1990). Such problems are not extensively documented and consequently have received relatively little attention from the world in general and the petroleum industry in particular (UNCTC, 1983). As far as the environmental aspects of traditional concession agreements are concerned, a careful examination of the concession system confirms that many of the traditional oil concessions are silent. Some countries like Thailand, Indonesia, Brazil displayed very little concerns for social and ecological impact of extractive operation through modern concession contract but China not only developed in modern international petroleum agreements but also the world environmental movement. The Chinese legislation and the hybrid contract system have developed a substantial body of provisions on environmental protection (China National Offshore Oil Corporation, 1983). In the mid-1980s, environmental concern moved one step farther from environmental protection to sustainable use of all environmental resources, including the non-renewable energy of oil and gas. Entering the 1990s, the concept of sustainable development has received widespread support across the world, but the principle has not been picked up by the petroleum industry at either the national or international levels.

Environmental issues have not received enough attention from the representative oil and gas contracts. The report on Environmental Law Reform in the Seychelles, sponsored by the United Nations Development Programme (UNDP), concludes, after a detailed examination of the country's model petroleum agreement, that its "contractual framework includes limited provisions for the protection of the environment" (Gao, 1994).

## **6 Fully or Partially Adoption of International Liability and Compensation Regime for Oil Pollution the 1992 Civil Liability Convention (CLC), International Oil Pollution Compensation (IOPC Funds) in the Developing Countries**

The International Convention on Civil Liability for Oil Pollution Damage (CLC) in 1969 defines "pollution damage" as:

(a) loss or damage caused outside the ship by contamination resulting from the escape or discharge of oil from the ship, wherever such escape or discharge may occur, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken;

(b) the costs of preventive measures and further loss or damage caused by preventive measures.

This definition of oil pollution reflects the policy position of most oil spill liability treaties currently in force, i.e., to impose liability upon oil and gas operators for property and economic loss resulting in damage to the environment, but not to impose liability for damage inflicted upon the environment per se.

In particular, this definition is unsatisfactory because it does not state explicitly what types of damages

are compensable under the convention. With respect to environmental damage, the compensable aspects are limited to removal of hazardous substances and “reinstatement” of the environment. It should also be noted that this definition does not contain a mechanism for compensation for unrecoverable damage to the environment itself. However, being the first of its kind, this definition has substantially influenced the concept of environmental damage in most subsequent international liability regimes. In practice, the extent of damages resulting from a given oil spill depends on a wide range of factors, including the particular characteristics of the spill. Compared with light oils, highly persistent oils such as heavy fuel oil or heavy crude are more likely to cause widespread damage in the intertidal zones of shorelines through smothering, which usually occurs in major oil spill accidents.

The 1971 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (1971 Fund) was created as an additional compensation mechanism for “pollution damage” that exceeded the liability limitation under the 1969 CLC (IMO, 1967). The amended CLC and Fund convention established a new regime that, for all practical purposes, inherited the old liability and compensation framework for ship-source oil spills, but provided much higher limits of compensation which gradually developed into two intergovernmental organizations providing compensation for oil pollution damages resulting from tanker spills of persistent oil.

This reality has significantly impacted the development of the current international regime on liability and compensation for oil pollution through the efforts of the International Maritime Organization (IMO). The regime is comprised of a series of conventions adopted pursuant to the IMO’s objective of keeping the shipping industry safe and clean. Considered together, these conventions establish a liability and compensation framework for ship-source oil pollution, which was adopted and implemented by signatory states. However, in its current form, the regime does not extend to non-ship-source oil pollution, which poses a significant challenge both to assigning liability to offshore and onshore oil and gas operators and to compensating parties suffering damages as a result of pollution caused by such offshore and onshore oil and gas operations.

## **7 Discussion on the Environmental Challenges and the Sustainability Issues**

According to Richard Kozul-Wright, director of UNCTAD’s globalization and development strategies division, and lead author of a report, states that “Climate adaptation and development are inextricably connected and policy efforts to tackle adaptation must acknowledge this in order to have a sustainable and meaningful impact” (UNCTAD, 2021). The only lasting solution, he suggests, “is to establish more resilient economies through a process of structural transformation and reduce the dependence of developing countries on a small number of climate-sensitive activities”.

Now it has become necessary to stabilize the climate and advance the SDGs, therefore, all countries have already started promoting and having discipline trade and investment in line with their Paris Agreement commitments and with the principle of common but differentiated responsibilities. However, disadvantage developing countries that have least responsibility for climate-related damages as their dependence is very less. Trade agreements issues around trade and environment have again gained momentum in the World Trade Organization (WTO) since November 2020, when a group of 23 members (EU as one of them) initiated ‘trade and environmental sustainability structured discussions’ (WTO Member Assess MC12 Options for Trade, Environmental Sustainability work, 2012).

The growth of expansion and production both in every sector of goods and services are of optimal use of the world’s natural resources in the line of sustainable development while seeking both to protect and preserve the environment and to enhance the means for doing so in a manner consistent with their respective needs and concerns at different levels of economic development (Marrakesh Agreement, 1994).

As we know that the activities of extracting industry cause danger to the wildlife, causing loud noises, continuous human displacement and vehicles traffic from drilling operations disrupt animals' communication and their peaceful survival, causing serious disturbances to breeding and nesting, pollination etc. Moreover, any kind of oil spills from drilling and storage plant are big killers and destructors of wildlife ecosystem even cause long-lasting damage to marine ecosystems and the atmosphere. The 2010 incident of BP's Deepwater Horizon spill in the Gulf of Mexico spreads oil across 68,000 square miles of sea surface and killed approximately 1 million seabirds, 5,000 marine mammals and 1,000 sea turtles (NRDC Issue Paper, 2015). Even smaller oil spills can also be dangerous to the environment. It has been seen that the oil spills are common in every producing country as it may be small or big and have a devastating damage to the local habitant and wildlife through inhalation and ingestion of toxic chemicals release from the oil spills. Usually, the common practices in drillings unit where the unused fluids injected into the wells for disposal and often happens that the fluids leaked and are flooded around the drilling sites.

Abu Dhabi Oil Operating Companies, each one in its own way, have been active partners in a progressive effort that highlights the role of environment conservation in their operations and since 1992, an environment management plan has been initiated, whose goal is to identify, control and decrease polluting emissions to the environment resulting from exploration and production activities (Drapier et al., 2000). Moreover, our future depends on our ability to interpret economic growth with environment protection, respect for human dignity and conservation of natural resources for future generations. The sustainability requires co-ordination between stakeholders and local partners, strong capacity in managing change, implementation of communication and training program, monitoring through sustainability indicators. This progressive move from environment protection to development sustainability requires a real transfer from environmental engineering towards development engineering. Finally, such challenge to integrate sustainability in our operations will be a warranty of success in the growing competition among oil companies for the benefit of a more eco-protected and more sustainable world.

## 8 Conclusion

From the above discussion, it can be understood that the relationship between environment and development is now in the process of reassessment and such two are not exclusive but interdependent. From the analysis of various international conventions and agreements it is clear that the environment is also a scarce commodity of great value, should be protected for both present and future generations. Environmental protection can also be considered as the future investment not a cost as to achieve the goals of economic, it is very much needed to protect or saved the environment from extinct. From a various corporate perspective, experience shows that business will be difficult or even come to grief if a company does not pay attention to the wider social and environmental impact of its operations.

The climate adaptation challenge in the developing world needs to be approached from a developmental perspective such as large-scale public investment in building a diversified low-carbon economy, powered by renewable energy sources and green technologies, adopting a green industrial policy, green agricultural policy that protects small producers, provides backward and forward linkages to green industrialization, protects the environment and enhances food security through increased agricultural productivity and income security.

The concept of Precautionary principle developed for the protection of environmental biodiversity and management of natural resources is in demand and has increase accepted principles for the environmental policy and development (Cooney, 2004). Implementation of Precautionary Principle in the upstream oil and gas environmental laws and the implementation are for better environmental protection (Nliam, 2014) by the

oil and gas extracting countries. Other sustainable approach for oil and gas companies towards the association with the development of local populations which is close vicinity to the industry through the adoption of many corporate and social responsibilities and also indicate transparently in their annual reports (IPIECA UNFCCC, 2017).

All developing countries need to adopt environmental management plan by their oil companies ensuring transparency to public access of the information about the extent of wealth in natural resources and the beneficiaries (Adeleke, 2017). Accountability, is also helps to ensure that governments and companies are answerable for their actions.

For the existence of the living creatures in the earth, it is very much important to have a cleaner future, but not to compromise the fossil fuel extraction and the use of public lands to economic growth of countries. But we need to equitably balance the transitions and also to substitute for enjoying energy including solar and wind to fulfil the energy needs of the human lives while preserving our environment and communities (The Wilderness Society, 2021). Only under such a contractual system can energy development be made legally justifiable, politically acceptable, ecologically sustainable, environmentally sound, and economically viable.

### **Acknowledgement**

The authors are gratefully acknowledging the Department of Law, Gujarat National Law University, Gandhinagar, India for supporting and assistance.

### **References**

- Adeleke F. 2017. The Extractive Industries Transparency Initiative and Africa's Mineral Governance Regime. South African Institute of International Affairs. Occasional Paper, 266: 7-10
- Arcscott L. 2004. Sustainable development in the oil and gas industry. *Journal of Energy and Resource Technology*, 126(1): 1-5. doi:10.1115/1.1653768
- Alnuaim S. 2019. Oil and Gas Sustainability. Presentation at the University of Houston, USA
- Aylor B, Gilbert M., Lang N, McAdoo M., Öberg J, Pieper C., Sudmeijer B, Voigt N. 2020. How an EU Carbon Border Tax Could Jolt World Trade. Boston Consulting Group, USA
- Baram M, Renn O, Lindoe PH. 2014. Modes of Risk Regulation for Prevention of Major Industrial Accidents. Risk Governance of offshore Oil and Gas Operations. Cambridge University Press, UK
- Belova N, Posadneva E, Plaksa J, Tesalovsky A, Volkodavova E. 2023. Opportunities of green lending to Finance Environmental Projects to Achieve the Principles of Sustainable Development, *Journal of Law and Sustainable Development*, 11(1): 1-10. <https://doi.org/10.37497/sdgs.v11i1.268>
- Boulos A. 1990. Mutuality of interests between Company and Government- Myth and Fact? Energy and Natural Resources Law (SERL) of International Bar Association (IBA). Proceedings of 9th Advanced Seminar on Petroleum, Mineral and Energy Resources Law. 12-13, Netherlands, London
- Cahill B, Swanson K. National Oil Companies, Climate Commitments, and Methane. Center for Strategic and International Studies (CSIS). <https://www.csis.org/>
- Cooney R. 2004. The precautionary principle in Biodiversity Conservation and Natural Resources Management: An issues Paper for Policy –Makers, Researchers and Practitioners. IUCN
- China National Offshore Oil Corporation. 1983. Art 21 (21.3) of the Model Contract for Offshore Operations. Beijing, China
- Drapier M., Sutton C, Morillon A. 2000. Environment Protection in Oil and Gas Industry: A Gateway To Sustainable Development. Spe 87271. Abu Dhabi International Petroleum Exhibition and Conference.

Abu Dhabi, United Arab Emirates

- Eberspaecher K. 2017. Sustainable Development in Oil and Gas. Advisian's Worley Group. <https://www.advisian.com/en/global-perspectives/sustainable-development-in-oil-and-gas>
- Fransiskus DE, Suwandi N. 2023. Environmental management control systems and environmental performance: Direct and indirect effect. *International Journal of Professional Business Review*, 8(6): 1-26. Doi: <https://doi.org/10.26668/businessreview/2023.v8i6.1753>
- Gao Z. 1994. International petroleum exploration and exploitation agreements: A comprehensive environmental appraisal. *Journal of Energy & Natural Resources Law*, 12(2): 240-256. DOI: 10.1080/02646811.1994.11432990.
- Gao Z. 1998. Environmental Regulation of Oil and Gas in twentieth Century and Beyond: An Introduction and Overview. *Environmental Regulation of Oil and Gas*. Kluwer Law International, USA
- Goel S. 2011. *Global Crude Oil Business*. Pentagon Energy Press, USA
- Greenfield D, Rooney B. 1999. Aspects of international petroleum agreements. *Alberta Law Review*, 37(2): 353
- IMO. 1967. INT'L MAR. ORG. <http://www.imo.org/en/About/HistoryOfIMO/Pages/Default.aspx>
- International Energy Agency. 2017. *The World Energy Outlook*. OECD/IEA, Paris, France
- IPIECA-UNDP-UNFCCC. 2017. *Sustainable Development Goals Atlas*.
- Marrakesh Agreement, 1994. World Trade Organization. <https://www.wto.org/>
- Naceur KB. 2019. How the Oil and Gas Industry Is Contributing to Sustainability, *Journal of Petroleum Technology*. <https://jpt.spe.org/how-oil-and-gas-industry-contributing-sustainability>
- NRDC. 2015. Summary of Information concerning the Ecological and Economic Impacts of the BP Deepwater Horizon Oil Spill Disaster. IP: 15-04-a. <https://www.nrdc.org/sites/default/files/gulfspill-impacts-summary-IP.pdf>
- Nliam SO. 2014. International oil and gas environmental legal framework and the precautionary principle: The implications for the Niger Delta, *African Journal of International and Comparative Law*, 22(1): 22-39
- Oil, Trade Agreements, and Developing Countries, Geneva, Switzerland. 2000. UNCTAD. <https://unctad.org/press-material/oil-trade-agreements-and-developing-countries>
- OPEC Energy Review. 2016. OPEC extends reach of its energy discourse. A successful first dialogue with India. OPEC
- OPEC Bulletin Commentary. 2016. OPEC embraces adoption of historic Paris Agreement on Climate Change. OPEC
- Pickbourn LJ, Nkurunziza JD, Ndikumana L. 2022. Growing the good and shrinking the bad: Output-emissions elasticities and green industrial policy in commodity-dependent developing countries. UNCTAD Research Paper, No. 84 UNCTAD/SER.RP/2022/4
- Price BJ, Boeuf MAG, Son JI. 2000. The Petroleum Industry Experience of Operating in Environmentally Sensitive Areas. Paper presented at the 16th World Petroleum Congress, Calgary, Canada. <https://onepetro.org/WPCONGRESS/proceedings-abstract/WPC16/All-WPC16/WPC-30414/202034>
- Saikia B, Gori S, 2014. Regulatory regime in fixing accountability of inland oil and gas exploration and production industry in India. *Proceedings of the International Academy of Ecology and Environmental Sciences*, 14(1): 17-27
- Saranghi GK. 2018. *Green Energy Finance in India: Challenges and Solutions*. ADBI Working Paper 863. Tokyo: Asian Development Bank Institute. <https://www.adb.org/publications/green-energy-finance-india-challenges-and-solutions>
- Shihata IFI. 1980. *Organization of the Petroleum Exporting Countries: Agreement Establishing the OPEC*

- Fund for International Development, International Legal Materials. International Legal Materials, 19(4): 879-885. Doi: 10-1017/S0020782900039243
- Smith Ernest E. 1993. International Petroleum Development Agreement, Natural Resources & Environment, International Natural Resources, Energy, And Environmental Law (Vol. 8, No. 2). American Bar Association, USA
- Symon A. 2007. Petroleum And Mining In Southeast Asia: Managing The Environmental And Social Impacts, Southeast Asian Affairs. Iseas - Yusof Ishak Institute
- The Wilderness Society. 2021. 7 ways oil and gas drilling is bad for environment. <https://www.wilderness.org/articles/blog/7-ways-oil-and-gas-drilling-bad-environment>
- The Clean Energy Ministerial. 2019. Clean Energy Ministerial (Cem), <https://www.cleanenergyministerial.org/>
- UNCTAD.2022. Handbook of Statistics. [https://unctad.org/system/files/official-document/tdstat47\\_en.pdf](https://unctad.org/system/files/official-document/tdstat47_en.pdf)
- UNCTAD (TDR). 2021. Trade and Development Report 2021: From Recovery to Resilience: The Development Dimension. Sales No.E.22. Ii.D.1. United Nations Publication, New York, USA
- UNCTAD (TDR) 2019.Trade and Development Report 2019: Financing a Green New Deal. Sales No.E.19. Ii.D.15. United Nations Publication, New York, USA
- United Nations Conference on Trade and Development. 2021. Trade and development report. From Recovery to Resilience: The Development Dimension. United Nations, New York, USA
- United States Environmental Protection Agency. 2022. Global Greenhouse Gas Emissions Data. <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>
- United Nations Conference on Trade and Development, Trade Agreements, Petroleum and Energy Policies. 2000. Executive Summary, United Nations, New York, USA
- United Nation Climate Change. 2015. The Paris Agreement. United Nations Publication, New York, USA
- United Nations. 2015. The Sustainable Development Goals. United Nations, New York, USA
- UNCTC. 1983. Main Features and Trends in Petroleum and Mining Agreements. UN Doc ST/CTC/29, 44-45
- UNCTAD. 2021. Green industrial policies key for developing countries to adapt to climate change. <https://sdg.iisd.org/commentary/policy-briefs/wto-members-assess-mc12-options-for-trade-environmental-sustainability-work/>
- World Commission on Environment and Development. 1983. Report of the World Commission on Environment and Development: Our Common Future. General Assembly resolution 38/161 adopted at the 38th Session of the United Nations. United Nations, New York, USA
- World Commission on Environment and Development. 1989. World Commission on Environment and Development Archive Collection on Sustainable Development. United Nations, New York, USA
- World Future Energy Summit. 2024. 8 ways the Oil and Gas Industry is making better use of sustainable technologies. <https://www.worldfutureenergysummit.com/en-gb/future-insights-blog/8-ways-the-oil-and-gas-industry-is-making-better-use-of-sustainable-technologies.html>