

Publicado en Actualidad Jurídica Ambiental el 10 de junio de 2024

**“NATURAL GAS REFORMS IN INDIA: ANALYSIS OF THE
NEOTERIC APPROACH TOWARDS ENVIRONMENT
SUSTAINABILITY”**

**“REFORMAS DEL GAS NATURAL EN LA INDIA: ANÁLISIS DEL
ENFOQUE NEOTÉRICO HACIA LA SOSTENIBILIDAD
MEDIOAMBIENTAL”**

Author: Raghava Parthasarathy, Research Scholar, Gujarat National Law University

Author: Prof. Sanjeevi Shanthakumar, Director, Gujarat National Law University

Fecha de recepción: 18/04/2024

Fecha de modificación: 13/05/2024

Fecha de aceptación: 22/05/2024

Doi: <https://doi.org/10.56398/ajacieda.00370>

Abstract:

Wars in Europe and Middle East has posed serious challenges for developing economies like India and other South East Asian nations in terms of energy fulfilment and energy security. Evolving policy approach of exploring other energy reserves has become imminent than ever before. The Government of India, accordingly, has approved the ‘Natural Gas Marketing Reforms’ with a major objective to move towards Gas-based economy. The consumption of natural gas in India presently is hovering around 6% gradually moving upwards. Whereas, the Government of India has set an ambitious target of reaching 15% by 2030.

The statutory framework in India for the upstream sector was established back in the year 1948 with Oilfields (Regulation and Development) Act, and Rules framed thereunder. Whereas, for the Downstream sector an established framework is already in place through the Petroleum and Natural Gas Regulatory Board Act, 2006. The recent policy shift by the Government of India through Natural Gas Marketing Reforms, is move towards gas based economy and it arose out of the obligations imposed under the Paris Agreement. The Government of India ratified the Agreement which obligates members to reduce carbon emissions by the year 2030, by meeting energy requirements with renewables and natural gas. European energy consumption trend offers an insight on further reducing carbon emissions, as approximately 23% of Europe's energy comes through natural gas. Excessive emissions from burning of coal and petroleum products, depleting fossil reserves and abundant gas reserves provide an opportunity for growing economies to shift from coal-based to gas-based economies. This requires augmentation and expansion of natural gas supply, distribution and uninterrupted global supplies and a rationale policy framework. The focus of the article is two-pronged, focusing on the impact of the Natural Gas Marketing Reforms as a policy and the Environmental and health concerns relevant from this perspective.

Resumen:

Las guerras en Europa y Oriente Medio han planteado serios retos a las economías en desarrollo como India y otras naciones del Sudeste Asiático en términos de satisfacción energética y seguridad energética. El planteamiento político de explorar otras reservas energéticas se ha hecho más inminente que nunca. En consecuencia, el Gobierno de India ha aprobado las "Reformas de comercialización del gas natural" con el objetivo principal de avanzar hacia una economía basada en el gas. El consumo de gas natural en India se sitúa actualmente en torno al 6%, con un aumento gradual. Sin embargo, el Gobierno indio se ha fijado el ambicioso objetivo de alcanzar el 15% en 2030.

El marco legal en India para el sector upstream se estableció en el año 1948 con la Ley de Yacimientos Petrolíferos (Regulación y Desarrollo) y sus normas. Mientras que para el sector Downstream ya existe un marco establecido a través de la Petroleum and Natural Gas Regulatory Board Act, 2006. El reciente cambio de política por parte del Gobierno de India a través de las Reformas de Comercialización del Gas Natural, se mueve hacia una economía basada en el gas y surgió de las obligaciones impuestas en virtud del Acuerdo de París. El Gobierno de India ratificó el Acuerdo, que obliga a los miembros a reducir las emisiones de carbono para el año 2030, cubriendo las necesidades energéticas con energías renovables y gas natural. La tendencia del consumo energético europeo ofrece una perspectiva para seguir reduciendo las emisiones de

carbono, ya que aproximadamente el 23% de la energía de Europa procede del gas natural. Las emisiones excesivas derivadas de la combustión de carbón y derivados del petróleo, el agotamiento de las reservas fósiles y las abundantes reservas de gas brindan a las economías en crecimiento la oportunidad de pasar de economías basadas en el carbón a economías basadas en el gas. Para ello es necesario aumentar y ampliar la oferta de gas natural, su distribución y suministro mundial ininterrumpido y un marco político racional. El artículo se centra en dos aspectos: el impacto de las reformas de la comercialización del gas natural como política y las cuestiones medioambientales y sanitarias pertinentes desde esta perspectiva.

Keywords: Natural gas. Paris Agreement. Environment Sustainability. Gas based economy. Conservation. Climate change.

Palabras clave: Gas natural. Acuerdo de París. Sostenibilidad medioambiental. Economía basada en el gas. Conservación. Cambio climático.

Index:

1. Introduction
2. Evolution of Natural Gas Law and Policy in India
 - 2.1. Regulatory framework for upstream natural gas sector
 - 2.2. Regulatory framework for downstream natural gas sector
 - 2.3. Nomination basis to NELP
 - 2.4. HELP, OALP & DSF
3. Natural Gas Reforms and Environment Sustainability
 - 3.1. Transition towards lessening emissions
 - 3.2. Gas and SDGs
4. Conclusion and Suggestions
5. Bibliography

Índice:

1. Introducción
2. Evolución de la legislación y la política en materia de gas natural en la India
 - 2.1. Marco regulador del sector upstream del gas natural
 - 2.2. Marco reglamentario para el sector posterior del gas natural
 - 2.3. Bases para la designación del NELP
 - 2.4. HELP, OALP y DSF
3. Reformas del gas natural y sostenibilidad medioambiental
 - 3.1. Transición hacia la reducción de emisiones

3.2. Gas y SDG

4. Conclusiones y sugerencias
5. Bibliografía

1. INTRODUCTION

Energy is one of the critical components for building and upkeep of infrastructure. It is also the key input in raising the standard of living of citizens, which can be directly correlated to per capita electricity consumption and Human Development Index¹. However, overwhelming reliance of petroleum and other fossil fuels have raised concerns of import dependency, supply chain fluctuations, excess carbon emissions, economic indicators of balance of payment among others. Such being the scenario, the Governments across the world are tasked with responsibility of ensuring uninterrupted supply of energy at affordable prices.

Natural Gas sector in India has witnessed a slow and gradual growth since the industry started operations in 1960s. The sector accelerated only in the 1970's upon discovery of first major gas fields in the western offshore. Due to lack of supply and infrastructure, the natural gas consumption was lower compared to coal and petroleum. The dependency on coal and petroleum only increased over time and it has not seen reduction. Liberalization, Privatization and Globalization in 1990's presented an opportunity for the natural gas sector to thrive in India. On the other hand, geographical and geophysical landscape of mainland India offers an extensive coastline of over 7500 kilometers, along with the archipelagic coastline and areas beyond the territorial waters extending up to 200 nautical miles. The vast coastline offers deep sea offshore blocks for exploration and extraction. Due to the government and policy intervention, the natural gas sector among other sectors, opened for private domestic and foreign investors to explore and extract hydrocarbons including natural gas and petroleum. To cater to the domestic energy needs, increase in share of other energy resources like natural gas became imminent. India is highly dependent on imports as roughly 46% of the total natural gas comes from other countries.²

The ratification of Paris Agreement (on Climate Change) obligates the member states to combat climate change and to maintain global temperatures from increasing well below 2 degrees Celsius. In addition to this, the member states

¹NITI Aayog, Government of India. (2017, June 27). *Draft National Energy Policy*. [See this link](#).

²Sinha, A. S. K., Kar, S. K., Ojha, U., & Balathanigaimani, M. S. (2022). Role of Natural Gas in India: Recent Developments and Future Perspectives: Natural Gas – New Perspectives and Future Developments. IntechOpen. [See this link](#).

are also responsible to reduce greenhouse gas (GHG) emissions, along with an Intended Nationally Determined Contributions (INDC) to achieve about 40% power of installed capacity from non-fossil fuel based resources. In order to fulfill obligations as set forth in the Paris Agreement, the Government of India has an alternative in the form of Natural gas, which is considerably less polluting than any other fossil fuels. Due to this, it is commonly referred to as 'the Green Fossil'³, as the emissions from burning natural gas is fractional compared to coal and lignite. Natural gas has the potential to address environmental concerns as it contributes positively to Sustainable Development Goals (SDGs).⁴

In the year 2016, the Government of India, announced that the share of natural gas in the total energy mix would be increased. Accordingly, the Government set out on an ambitious path to increase the share of natural gas from the present 6% to 15% by the year 2030.⁵ The usage for the years from 2011 to 2021 has been highlighted in the Figure 1, as it reflects declining trend in usage of Natural gas from over 10% in 2011 to an abysmally low average of around 6.7%. Some of the key states in India like Gujarat have installed necessary infrastructure and the share of natural gas consumed is around 25% (2022-23), followed by Maharashtra and Uttar Pradesh.⁶ Whereas, the trend is anticipated to change as the Natural gas sector is expected to grow manifolds in the coming decades which would be strongly led by renewables, natural gas and nuclear.⁷ Moreso, the Indian gas market is also projected to grow in the next few decades. In order to achieve the desired goal by 2030, necessary infrastructure and regulatory framework must be suitably modified to adapt to natural gas.

³ Chugh, G. (2021). *The Green Fossil: The Next Stop – Natural Gas and India's Journey to a Clean Energy Future*. Harper Collins.

⁴ Aksyutin, O. E., Ishkov, A. G., Romanov, K. V., & Grachev, V. A. (2020). *The Role of Natural Gas in Achieving Sustainable Development Goals*. *International Journal of Energy Economics and Policy*, 10(4), 463-472. [See this link](#).

⁵ Powell, L., Sati, A., & Tomar, V. K. (2024). *India as a Gas-based Economy: Six Years to Go*. Observer Research Foundation. [See this link](#).

⁶ Petroleum Planning and Analysis Cell. (n.d.). *State-wise Consumption*. [See this link](#)

⁷ BP. (2023). *BP Energy Outlook 2023*. [See this link](#).

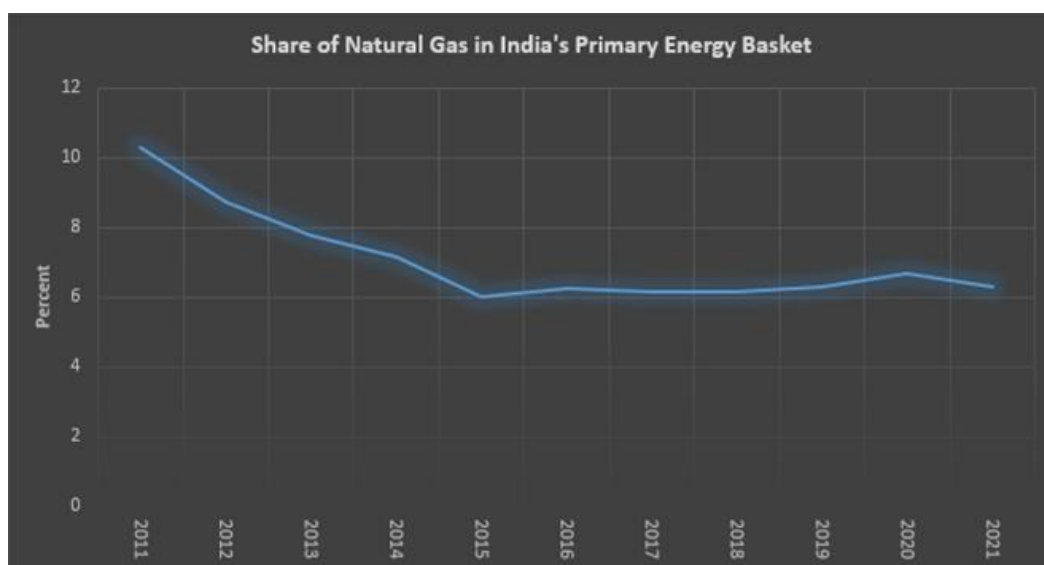


Figure 1: Usage of Natural Gas from 2011 to 2021

2. EVOLUTION OF NATURAL GAS LAW AND POLICY IN INDIA

The Government at the Centre i.e., Union of India, is authorized under the Constitutional framework to regulate and legislate on the matters of exploration and production of Oil and Gas.⁸ Article 246, 7th Schedule List I, Entry 53, talks about “Regulation and development of oilfields and mineral oil resources; petroleum and petroleum products”. The exclusive domain vests with the Central Government over allocation of oil and gas resources and upstream activities. Whereas, under the 7th Schedule, List II, Entry 17 – Water; Entry 18 – Land; Entry 25 – Gas and gas works, are within the domain of the State Governments.⁹ The Government under the Constitutional framework is empowered to regulate the industry and acts as a Trustee, to distribute the resources equally to the people. The Government, as a trustee of all natural resources, is under legal and Constitutional duty to protect the natural resources. This doctrine is part of Indian law and was applied by the Supreme Court, in the landmark case of *Reliance Natural Resources Limited*.¹⁰ The areas falling in territorial waters, continental shelf and resources within the exclusive economic zones vests with the Union of India.¹¹ It is also a settled position that the states do not possess legislative competence to frame a legislation on the subject of natural gas and the legislative competence is specially assigned to the Union/Central Government. Due to this, the States have little role to play in

⁸ Constitution of India (n.d.). *The Constitution of India*. [See this link](#).

⁹ Constitution of India (n.d.). *The Constitution of India*. [See this link](#).

¹⁰ *Reliance Natural Resources Limited v. Reliance Industries Limited*, (2010) 7 SCC 1.

¹¹ Constitution of India (n.d.). *The Constitution of India*. [See this link](#).

the decision making process, as can be seen from the analysis in the Special Reference case No.1 of 2005.¹²

2.1. Regulatory Framework for upstream Natural Gas Sector

The Union of India through parliament has enacted legislations for regulating the upstream sector like that of –

- Oilfields (Regulation and Development) Act, 1948 (hereafter ‘the Oilfields Act’);
- Petroleum and Natural Gas Rules, 1959 (hereafter ‘the PNG Rules’);
- Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008;
- Mines Act, 1952;
- Oil Mines Regulations, 2017;

The Oilfields Act,¹³ was the first and the foremost legislation brought in to regulate the development of natural gas and petroleum resources. This law provides for issuance of license and grant of areas on lease. Through this law, the Government of India also has powers to collect royalties for extraction of petroleum and natural gas. Through various rules enacted under the Oilfields Act, the Government of India exercises the regulatory powers including the procedures and process for grant of exploration and extraction license and leases for both onshore and offshore areas.

The PNG Rules, 1959¹⁴ introduced under the Oilfields Act, in addition to the grant of license and lease, prescribes the area and term of license (Rule 10); Payment of security deposits, license fee and shedding of areas (Rule 11); royalties and furnishing returns (Rule 14); Suspension and cancellation of licenses and lease (Rule 20); Conservation, Development, prevention of waste (Rules 24, 25 and 26). Additionally, the Rules also prescribe measures to prevent waste, imposes restrictions and powers of supervision Rule 27, 28 and 32). The Rules also imposes penalties in case of violations (Rule 32-A) and arbitration of disputes (Rule 33).

Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008¹⁵, enacted under the Oilfields Act, prescribes under Rule 3 – Safe Petroleum

¹² Association of Natural Gas & Ors. V. Union of India (2004) 4 SCC 489

¹³ Ministry of Petroleum and Natural Gas. (n.d.). Oilfields Act, 1948. [See this link.](#)

¹⁴ Directorate of Geology & Mining, Assam. (n.d.). PNG Rules, 1959. [See this link.](#)

¹⁵ Ministry of Petroleum and Natural Gas. (n.d.). Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008 User. [See this link.](#)

activities at the offshore places, considering all the factors at the planning and implementation stages for health, safety and environment. Under Rule 5 and 6, health, safety and environment friendly culture has to be promoted and to ensure interests of stakeholders are taken care of.

The Mines Act, 1952¹⁶ was enacted to bring in regulation of labour and safety in Mines. Section 57 grants the powers to Central Government to stipulate prescriptions for safety measures among other things. Accordingly, the Oil Mines Regulations, 2017¹⁷ were enacted. It lays down duties and responsibilities of Management, contractors, Manufacturers, competent persons and Workmen towards general safety, precautionary measures and mitigating plans in cases of emergency.

An elaborate mechanism for exploration and extraction process has already been established. The major concern that remains for consideration of Government is about the implementation. The regulatory mechanism for handling and maintenance of infrastructure along with safety, health, welfare, environment and ancillary aspects are covered under the prevailing framework.

As discretionary and residuary powers, the Government also can formulate steps for such areas of operation including allocation of blocks for exploration and extraction activities. The policy framework provides abundant scope for the Government to enforce such conditions that may be necessary. From the environmental perspective, key policies are Guidelines for Management of Oil and Gas Resources¹⁸ and Good International Petroleum and Industry Practices, 2016.¹⁹

2.2. Regulatory framework for downstream natural gas sector

The present day economic conditions in India are an encouraging sign for the Government to boost activities in the downstream sector. At present, India has established itself as a significant exporter of petroleum products to the world.²⁰ Petroleum and Natural Gas Regulatory Board Act, 2006 (hereafter 'the

¹⁶ Ministry of Labour and Employment. (n.d.). Mines Act, 1952. [See this link](#).

¹⁷ Directorate General of Mines Safety. (2017). Oil Mines Regulations, 2017. [See this link](#).

¹⁸ Ministry of Petroleum and Natural Gas. (n.d.). Guidelines for Management of Oil & Gas Resources. [See this link](#).

¹⁹ Directorate General of Hydrocarbons. (2016). Good International Petroleum and Industry Practices. [See this link](#).

²⁰ Azhar, M. (2021). INDIA'S EMERGENCE AS A PETROLEUM PRODUCTS EXPORTER. The Journal of Energy and Development, 47(1/2), 75–100. [See this link](#).

PNGRB²¹) is a key piece of legislation for regulating the downstream sector.²¹ Board established under the Act, regulates the refining, processing, logistics and reaching the end consumers through retail and wholesale mechanisms.

The State of Gujarat in the western part of India has been at the forefront of natural gas consumption at around 24%. Due to the consistent steps taken by the Government of Gujarat since 1970s, it has been able to achieve beyond the target set by the Government of India. Some of the major reasons can be attributed to establishing an independent corporation to handle the Oil and Gas business in the State, more so for Exploration and Production. By setting up City Gas Distribution (CGD) networks across the state, Gujarat has been able to provide easy access of gas at the household level. Towards furthering the initiative, Gujarat Gas (Regulation of Transmission, Supply and Distribution) Act, 2001 was introduced way before the PNGRB Act, 2006, was in place.²² However, the legislation was struck down by the Supreme Court in *Association of Natural Gas & Ors. V. Union of India* (2004) 4 SCC 489 (referred earlier), on the ground that only the Central Government had exclusive powers to regulate the various aspects of natural gas. This paved way for the Central Government to enact the PNGRB Act.

In contrast to the Directorate General of Hydrocarbons (DGH), the sole regulator under the Ministry of Petroleum and Natural Gas (MoPNG) for upstream, the board functioning are better institutionalized under PNGRB. Board has enacted the Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010.²³ The Regulations mandates the entities involved in the processing, transportation, storage and any forms of handling hydrocarbons to adopt certain safety and precautionary measures. In cases of leaks, spills, fire explosions, pipeline ruptures, natural calamities, the operating entity shall ensure Pre-emergency planning and mitigations measures. The Regulations imposes environmental protection measures and also links it to the Environmental statutes that are already in place. Key environmental legislations including the Environment (Protection) Act, 1986; Disaster Management Act, 2005 are other prevailing legal prescriptions are to be mandatorily followed.

²¹ Prasad, N. K. (2008). Regulation of Natural Gas in India. *Economic and Political Weekly*, 43(39), 21–24. [See this link](#).

²² Namdeo, K. S., & Srivastava, K. (2024). Evolution of Gas-based Economy in India: A Case of Gujarat State. *Academy of Marketing Studies Journal*, 28(1S), 1-16.

²³ Petroleum and Natural Gas Regulatory Board. (2010). Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010. [See this link](#).

2.3. Nomination Basis to NELP

Late in the 1970's when the world witnessed disruption in oil supplies leading to soaring energy prices, an alternative to oil felt necessary. The developed economies systematically reduced their dependence on oil and shifted to natural gas and nuclear power. At the same time, India introduced the first licensing regime under the Nomination Basis, wherein the two National Oil companies were granted Petroleum Exploration License. Under the regime, the sector never really took off and the exploration was confined on-land and shallow off-shore waters.²⁴ This necessitated the Government to reevaluate the policy mechanism leading to introduction of Pre - NELP era where Petroleum Mining Lease was awarded between 1991- 1996. According to the Directorate General of Hydrocarbons, in the Nine rounds of Exploration, 28 blocks were awarded out of which, a Production Sharing Contract was signed with one, without any success. In the two subsequent rounds, no Production Sharing Contract was signed. Whereas, in all other rounds, the Government offered blocks for geophysical and other surveys to develop hydrocarbon potential of India.²⁵

In addition to the policy changes, the regulatory regime also witnessed changes wherein the Directorate General of Hydrocarbons (DGH) was brought into regulate and oversee the upstream activities in the petroleum and natural gas sector.²⁶ The role of DGH was to fill in the regulatory gap to manage the petroleum and natural gas sector and to have a balanced approach towards environment, safety, technology and economic aspects of the sector. Conceived as a regulator to oversee various activities and to advise the Government, the DGH was empowered through subsequent legislations to cater to the growing needs of the sector.

Since, the previous two policies did not pave way for India to be energy independent, and rapid depletion of explored reserves led the Government to come up with the New Exploration Licensing Policy (NELP) in the year 1997. This was introduced with an objective to increase investments towards boosting indigenous reserves by augmenting domestic oil and gas production. NELP regime allowed foreign and domestic entities to participate in the International Competitive Bidding process along with the national oil companies. The Government ensured that there is an equal footing for the participating foreign and Indian entities. Under the said policy, the Government awarded over 254

²⁴ Directorate General of Hydrocarbons. (n.d.). Awarding of Acreages. [See this link.](#)

²⁵ Directorate General of Hydrocarbons. (n.d.). Awarding of Acreages. [See this link.](#)

²⁶ Ministry of Petroleum and Natural Gas, Government of India. (1993, April 08). Resolution. [See this link.](#)

blocks out of 360 offered under various rounds starting from 1999 till 2012.²⁷ Out of the total awarded, 222 blocks are already under the consideration of the Government to be relinquished or with a pending proposal for relinquishment. Further, only 32 blocks are operational as on April 01, 2023, and it reflects the intent of the Government to move to a more rational approach of awarding blocks.

2.4. HELP, OALP & DSF

As the new government took charge in the year 2014, a wholly different approach was expected to be brought in by overhauling the previous policy regimes. Instead of incremental policy changes, the Government decided to overhaul the entire policy structure. Accordingly, the Government of India moved from its NELP regime, to be replaced with the Hydrocarbon Exploration Licensing Policy (HELP), Open Acreage Licensing Policy (OALP) and Discovered Small Fields (DSF) Policy. Additionally, the Government also came out with a Draft National Energy Policy (NEP)²⁸, replacing the Integrated Energy Policy. The Integrated Energy Policy 2006 (IEP)²⁹ emphasized on nuclear and non-conventional sources of energy to fulfil energy demands for sustainable development with efficient integration, planning and forecasting, by setting new agenda to meet the present day challenges.

HELP was formulated with a clear objective to reduce hydrocarbon import dependency. The policy envisaged liberal approach towards the market granting more freedom to the contracting parties. For submission of formal bids, the entities had to wait for bidding rounds, which has undergone changes under the HELP. The bidding parties may submit their bids anytime of the year. The HELP regime brought in a single license system, covering exploration and production of different kinds of hydrocarbons including oil, gas, shale gas, Coal bed methane, gas hydrates, shale oil etc. As regards the contractual arrangement, under the previous regime the contracting parties executed Production Sharing Contracts (PSC) which was replaced by Revenue Sharing (RS) model. This allows the business to conduct operations with minimal government intervention. Among the fiscal and tax incentives, the RS Model exempted

²⁷ Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India. (2023, July 11). *India's Oil & Gas, Ready Reckoner, FY 2022-23*. [See this link](#).

²⁸ NITI Aayog, Government of India. (2017, June 27). *Draft National Energy Policy*. [See this link](#).

²⁹ Integrated Energy Policy. (2006). [See this link](#).

royalty for the first seven years and subsequent royalties were at nominal rates. Cess on crude oil and custom duty for equipment and services were exempted.³⁰

The OALP³¹, was formulated and launched as a part of HELP, to facilitate the investors to submit their interest (Expression of Interest), by carving out blocks of their choice by assessing the data available on the National Data Repository (NDR).³² The blocks sought for exploration must be within the sedimentary basins, and should not be already licensed to other party, along with the restrictions as provided under NDR. OALP provides an option for investors to enter into Petroleum Operations Contract or Reconnaissance Contract³³. The Petroleum Operations Contract permits licenses for exploration, production and development operations in frontier, onshore, shallow water, deep water, and ultra-deepwater blocks for a period of six years with an option for subsequent explorations. In contrast, the Reconnaissance Contracts permits exploration of all hydrocarbons in any onshore, shallow water, frontier, deep water, and ultra-deepwater blocks.

The Discovered Small Field Policy, earlier known as the Marginal Field Policy, was approved in October 2015. It was introduced to exploit and monetize those reserves awarded under the Nomination basis, which remained non-monetized and were categorized under the Marginal fields.³⁴ In addition to the changes in contractual framework, the licensing scheme was unified to make a single license for exploration and to extract conventional and non-conventional hydrocarbons. The DSF policy was introduced to align with the Ease of Doing business. The first round of DSF bid was launched in May 2016 for 46 contract areas consisting of 67 fields to monetize 85 MMT oil and Oil Equivalent of Gas reserves. The Hydrocarbon Vision for India aims to position the North East Region as pivotal hub in the nation's energy sector. It targets doubling oil and gas production by 2030, ensuring universal access to clean fuel for households at economical rates, and advancing infrastructure like natural gas grids, city gas distribution networks, and CNG highways.³⁵

³⁰ Ministry of Petroleum and Natural Gas, Government of India. (n.d.). *Hydrocarbon Exploration and Licensing Policy (HELP) – A Win – Win approach*. [See this link](#).

³¹ Government of India. (2017, June 30). *Notification – Open Acreage Licensing Policy (OALP): Modalities for Operationalization Hydrocarbon Exploration & Licensing Policy (HELP)*. [See this link](#).

³² National Data Repository. (n.d.). [See this link](#).

³³ Directorate General of Hydrocarbons. (n.d.). *Awarding of Acreages*. [See this link](#).

³⁴ National Data Repository. (n.d.). *Major Policy reforms by Government*. [See this link](#).

³⁵ Ministry of Petroleum and Natural Gas, Government of India. (n.d.) *Policy for encouraging E & P activities in North East (NE) India – Hydrocarbon Vision 2030*. [See this link](#)

In order to attract foreign investors, the government as recently as in 2022, deregulated the sale of domestically produced crude oil.³⁶ To create a level playing field, promoting competition and incentivizing investment in the oil and gas value chain. The obligation to first sell crude to Government or Government Nominee or Government companies was done away with, and any such conditions under the PSC stood excluded. This was necessary from the perspective of ease of doing business, granting more freedom for the entities to market and sell. On the whole, the Revenue sharing model was a step ahead in liberalizing the sector from bureaucratic micro-management. The upstream sector witnessed slew of reformative measures by the Government to make the market more accessible for investors and to keep a healthy competition.

3. NATURAL GAS REFORMS AND ENVIRONMENT SUSTAINABILITY

At present, India and other developing economies are caught in an unhealthy nexus between energy security, energy affordability and environment sustainability. The economic growth of India and other developing nations are built around fossil fuels. This has led to excessive carbon emissions although per capita consumption of oil, natural gas, coal and nuclear are lower compared to other nations. It is also acknowledged in the Draft NEP that climate change concerns are much more apparent than ever before, due to repeated instances of untimely natural disasters. It is in this background that the Government has taken a step forward to move to Gas as a primary fuel. One of the major factors which contributes to better standard of living is the environment that one lives in. Whereas, India alone has 6 cities out of top 10 cities in the list of most polluted cities, with Particulate Matter (PM) >50.1 (exceeding by over 10 times).³⁷ Nevertheless, in terms of total energy consumption, India ranks third as per the Report published for the Financial Year 2022-23 (Figure 2)³⁸.

³⁶ Ministry of Petroleum and Natural Gas. (2022, July 11). Gazette Notification - F. No. Expl-15019 (25)/161/2019-ONG-D-V (E-34367) (Deregulating sale of domestically produced crude oil). [See this link](#).

³⁷ Broom, D. (2020, March 5). 6 of the world's 10 most polluted cities are in India. *World Economic Forum Agenda*. [See this link](#)

³⁸ Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India. (2022). *India's Oil & Gas, Ready Reckoner, FY 2022-23*. [See this link](#).

Sl. no.	Country	Unit	Oil	Natural Gas	Coal	Nuclear Energy	Hydro Electricity	Renewables	Total Energy
1	China	Mtoe	653.36	322.91	2110.02	89.74	291.89	317.42	3785.35
	Percentage share	%	17.26	8.53	55.74	2.37	7.71	8.39	100%
	Per capita consumption	Toe	0.46	0.23	1.49	0.06	0.21	0.22	2.68
2	USA	Mtoe	836.61	757.04	235.56	174.46	58.00	201.19	2262.86
	Percentage share	%	36.97	33.45	10.41	7.71	2.56	8.89	100%
	Per capita consumption	Toe	2.51	2.27	0.71	0.52	0.17	0.60	6.79
3	India	Mtoe	233.18	49.88	479.47	10.02	39.14	51.31	863.01
	Percentage share	%	27.02	5.78	55.56	1.16	4.54	5.95	100%
	Per capita consumption	Toe	0.16	0.04	0.34	0.01	0.03	0.04	0.62
4	Russian Federation	Mtoe	163.57	350.60	76.13	47.97	44.39	1.91	684.58
	Percentage share	%	23.89	51.21	11.12	7.01	6.48	0.28	100%
	Per capita consumption	Toe	1.14	2.44	0.53	0.33	0.31	0.01	4.77
5	Japan	Mtoe	153.36	86.40	117.42	11.22	16.71	36.52	421.62
	Percentage share	%	36.37	20.49	27.85	2.66	3.96	8.66	100%
	Per capita consumption	Toe	1.23	0.69	0.94	0.09	0.13	0.29	3.37
6	Canada	Mtoe	99.07	104.53	9.31	18.62	89.26	14.08	334.87
	Percentage share	%	29.59	31.22	2.78	5.56	26.66	4.20	100%
	Per capita consumption	Toe	2.54	2.69	0.24	0.48	2.29	0.36	8.60
7	Germany	Mtoe	98.84	66.35	55.61	7.40	3.82	58.47	290.49
	Percentage share	%	34.03	22.84	19.14	2.55	1.31	20.13	100%
	Per capita consumption	Toe	1.18	0.79	0.66	0.09	0.05	0.70	3.45
8	Brazil	Mtoe	116.24	27.45	14.08	3.10	95.70	60.38	316.96
	Percentage share	%	36.67	8.66	4.44	0.98	30.19	19.05	100%
	Per capita consumption	Toe	2.25	0.53	0.27	0.06	1.85	1.17	6.14
9	Iran	Mtoe	85.61	196.66	1.91	1.43	1.67	0.48	287.76
	Percentage share	%	29.75	68.34	0.66	0.50	0.58	0.17	100%
	Per capita consumption	Toe	0.40	0.91	0.01	0.01	0.01	0.00	1.34
10	South Korea	Mtoe	126.91	53.22	68.50	37.95	0.72	12.41	299.71
	Percentage share	%	42.35	17.76	22.85	12.66	0.24	4.14	100%
	Per capita consumption	Toe	1.43	0.60	0.77	0.43	0.01	0.14	3.38

Figure 2: Global primary energy consumption, 2022-23.

Hence, with an avowed objective to move to a gas based economy, the Government of India formulated a policy mechanism and approved the ‘Natural Gas Marketing Reforms’.³⁹ The policy focuses mostly on the downstream sector, as it aims to discover market prices of gas through formulation of a standard procedure, by the producer of gas. The other objectives are focused on establishing mechanisms ensuring transparency and maintain competition, participation of affiliates in bidding process for sale of gas, and to allow marketing freedoms to certain Field Development Plans (FDPs). The Policy also lays down discovery of market prices in a transparent and competitive manner for sale of natural gas, through framing guidelines by way of electronic bidding. The ancillary benefit of such a development as perceived by the Government is to facilitate and promote competition in the natural gas exploration and production. Considering the recent developments in the geopolitical scenario especially with the ongoing Russia – Ukraine and Israel – Gaza conflicts, along with other threats emanating mostly from the OPEC+ countries, the Government of India has a major responsibility to ensure energy security.

³⁹ Corbeau, A.-S., Hasan, S., & Dsouza, S. (2018). Challenges Facing India towards a gas-based economy. [See this link](#).

3.1. Transition towards lessening emissions

Increasing population coupled with improving economic parameters, inevitably leads to demand for more energy. The transition however, should be facilitated by installing necessary infrastructure. To reach the target figure of 15%, India must increase the consumption of natural gas to over 200 bcm from current 59 bcm.⁴⁰ Major industries contributing to the consumption of natural gas are fertilizers (29%), electric power generation (18%), refining (13%), City gas distribution including transport (15%) and petrochemical (5%). The industrial sector is the major consumer of natural gas with domestic and commercial sector also picking up gradually.⁴¹

At present, India needs abundant supplies to fuel its economic growth. Whereas, the developed economies are under further obligations to move to net zero emissions at a faster pace. Considering India's position in terms of its developmental needs to climate goals, a lenient approach is adopted. Under the United Nations Framework Convention on Climate Change (COP 26), India declared to reach net – zero by 2070.⁴² India has recently finalized its Third National Communication, including a Green House Gas Inventory from 2019, alongside an Initial Adaptation Communication. The efforts undertaken are to prioritize climate action without prejudicing welfare and developmental concerns of its people. During the period from 2005 till 2019, India has been able to effectively reduce emission intensity relative to its GDP by 33%, meeting the NDC target set initially up until 2030, a decade ahead of schedule. In terms of electrification, India has achieved 40% of its installed capacity through non-fossil fuel sources, meeting its 2030 target within 9 years. From 2017 – 2023, approximately 100 GW of installed electric capacity has been added, with around 80% attributed to non- fossil fuel resources. This has prompted India to revise the NDCs towards fulfilment of targets under COP 28. Europe transitioned to natural gas and now aims to achieve net – zero emissions by as early as 2050.⁴³ Therefore, natural gas could be a transition fuel to move to alternative sources and to gradually phase out the fossil fuels.⁴⁴

⁴⁰ CEDIGAZ. (2017, October 10). India's vision to a gas-based economy: Drivers and Challenges [Country Report]. CEDIGAZ. [See this link](#).

⁴¹ Ministry of Statistics and Programme Implementation, Government of India. (2022). *Energy Statistics India – 2022*. [See this link](#).

⁴² Agora Verkehrswende & GIZ. (2023). Towards Decarbonising Transport 2023: A Stocktake on Sectoral Ambition in the G20. [See this link](#).

⁴³ European Commission. (n.d.). *2050 Long-Term Strategy*. [See this link](#).

⁴⁴ Gürsan, C., & de Gooyert, V. (2021). *The systemic impact of a transition fuel: Does natural gas help or hinder the energy transition?* *Renewable and Sustainable Energy Reviews*, 138, 110552. [See this link](#).

3.2. Gas and SDGs

As a signatory to Paris Agreement, the obligations to reduce carbon emissions coupled with fulfilling energy requirements of thriving economy falls upon the Government. In continuation to this, several policy reforms in the downstream sector are initiated, with an aim to increase the consumer base of natural gas. By introducing new Gas Pricing Guidelines, 2014 following the Reliance fiasco,⁴⁵ Government fixed the decade old gas pricing conundrum. Furthermore, to improve the supply side chain, expanding the City Gas Distribution (CGD) Network, Piped Natural Gas (PNG) coverage and development of National Gas Grids are some of the key steps.⁴⁶ Additionally, the gas supply and distribution infrastructure has been expanded by moving from monopolistic practices and permitting private entities to participate. This would enable consumers to get access to multiple gas suppliers at competitive prices.

Government of India has introduced numerous schemes to enhance the consumer base of natural gas for domestic purposes mainly for household.⁴⁷ This was introduced in accordance with the World Health Organization (WHO), as approximately 2.4 billion people worldwide use open fires or inefficient stoves fueled by biomass, fire wood, kerosene, coal and other types of fuels for cooking. Mortality risks due to illness such as lung cancer, ischemic heart, and chronic obstructive pulmonary diseases are heightened. The problem is more rampant among rural women and girls who are at increased risk of exposure to these. It has also been observed that due to usage of solid fuels, there would be delay in achieving the Sustainable Development Goals. The United Nations General Assembly Resolution on the '2030 agenda for sustainable Development'⁴⁸ lists out 17 Sustainable Development Goals. All of the goals are connected in one way or another.⁴⁹ In order to list out some of them which are relevant for the purpose of this article are:

- SDG 3: Ensure healthy lives and promote well-being for all at all ages;

⁴⁵ Reliance Natural Resources Limited v. Reliance Industries Limited, (2010) 7 SCC 1.

⁴⁶ Deb, K., & Kohli, P. C. (2022, December). Assessing India's Ambitious Climate Commitments [Report]. Columbia University Center on Global Energy Policy. [See this link](#)

⁴⁷ Ahmad, N., Sharma, S., & Singh. (2018, February). Pradhan Mantri Ujjwala Yojana (PMUY): Step towards Social Inclusion in India. [See this link](#).

⁴⁸ United Nations. (n.d.). *Transforming our world: the 2030 Agenda for Sustainable Development*. [See this link](#).

⁴⁹ Aksyutin, O. E., Ishkov, A. G., Romanov, K. V., & Grachev, V. A. (2020). *The Role of Natural Gas in Achieving Sustainable Development Goals*. International Journal of Energy Economics and Policy, 10(4), 463-472. [See this link](#).

- SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all;
- SDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
- SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable;
- SDG 13: Take urgent action to combat climate change and its impacts.
- SDG 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Daily lives of people are dependent on easy accessibility of energy, which is affordable and acceptable to manage day to day affairs. Currently, India is heavily inclined towards usage of Oil and its derivatives with very little utility for natural gas. Towards continuous supplies of energy, diversification becomes a crucial factor. Heavy reliance on oil and coal poses the risk of deteriorating environment quality due to excessive carbon emissions. Whereas, the European model of economic growth is mainly based on consumption of natural gas. Gas Authority of India Limited (GAIL) one of the government entities has successfully implemented a comprehensive environmental strategy by using natural gas as both feedstock and fuel in its process plants. This approach has been effective in reducing emissions of suspended particulate matter (SPM) and oxides of sulfur (SO_x) through measures such as ensuring adequate stack heights for flue gas dispersion and continuous ambient air quality monitoring. The use of online analyzers in stacks has enabled real-time monitoring of emissions, while energy conservation measures have aimed to minimize fuel consumption. Safety measures have been implemented, such as connecting valves to a reliable flare system for smokeless burning and loading facilities with vapor return circuits. Study undertaken clearly reflects that penetration of gas for cooking and domestic use has been found to be environmentally beneficially due to reduced PM₁₀. Furthermore, the use of low NO_x burners and preventive maintenance practices have helped control emissions. GAIL has set the benchmark for other Governmental and private entities to foster ecological balance and to protect and conserve biodiversity. In line with the CSR objectives, GAIL has invested on multiple projects for environmental protection and sustainability. For instance, in Varanasi, GAIL has supported in conversion of diesel boats to CNG, thereby significantly reducing the air and water pollution.⁵⁰ Whereas, in Bhubaneshwar and Cuttack, GAIL has supported in usage of CNG in crematoriums instead of fire wood. Another instance is from Parambikulam Tiger Reserve, Kerala, wherein GAIL has set up Coir root

⁵⁰ Business Standard. (2023, January 22). Environment-friendly CNG replaces diesel as fuel on boats in Varanasi. [See this link](#).

training manufacturing units, aligning with its commitment to environmental conservation and community welfare.

The example of GAIL, is one among several other entities who have undertaken conservation and sustainability efforts under the statutory mandated CSR programmes.⁵¹ A bottom up approach would expedite implementing Net Zero targets which forms a part of various obligations under many Agreements that India has ratified. In addition to this, the efforts to reduce emissions are available through nature – based solutions. This results in protection, restoration and management of ecosystems and protect vulnerable species.⁵²

The other areas of concern include the emissions from natural gas exploration, drilling, production and its impact on environment. Irrespective of where the exploration and production activities are taking place, biodiversity both on and off shore are under threat. Since this would require laying down pipelines, drilling wells, methane emissions during production and release of effluents all contributes to environmental degradation. The Gross Domestic Product (GDP) of European Union (EU) and its correlation with consumption of natural gas are linked to each other. From the data gathered for the years 1967 till 2016, shows that the economy of EU has increased steeply from 1 trillion in 1967 to 19 trillion in 2016 (Figure 3)⁵³.

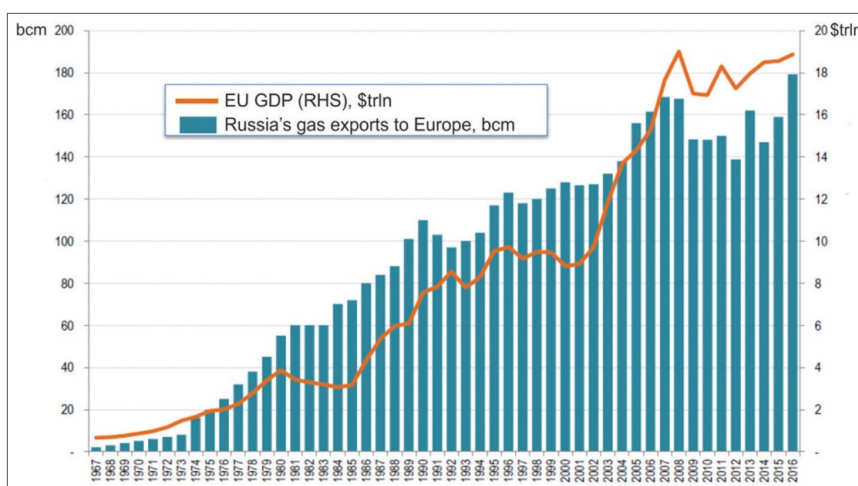


Figure 3: Correlation between natural gas exports to Europe and the EU economic growth.

⁵¹ Kansal, M., Joshi, M., Babu, S., & Sharma, S. (2018). Reporting of Corporate Social Responsibility in Central Public Sector Enterprises: A Study of Post Mandatory Regime in India. *Journal of Business Ethics*, 151(3), 813–831. [See this link.](#)

⁵² GAIL (India) Limited. (2010). *GAIL CSR Policy*. [See this link.](#)

⁵³ Aksyutin, O. E., Ishkov, A. G., Romanov, K. V., & Grachev, V. A. (2020). *The Role of Natural Gas in Achieving Sustainable Development Goals*. *International Journal of Energy Economics and Policy*, 10(4), 463-472. [See this link.](#)

As a developing economy, the environmental burden is relatively low compared to a developed economy. Therefore, the policy implementation and decision making becomes a critical factor in the long term for effective utilization of gas. Despite numerous efforts to increase the domestic reserves, its non-availability plays a major role leading to increasing imports.

4. CONCLUSION AND SUGGESTIONS

India has abundant potential for development of the natural gas sector wherein several types of natural gas including the biogas, shale gas, deep natural gas, coalbed methane, Tight gas are some of the available forms. However, the Natural Gas resources have not been extracted to the best and beneficial use of the country. With a tall objective ahead of the Government, to increase gas in the entire energy mix to 15% from the current average of 6-7%, whereas the world average is around 24%. The increase in usage of gas has benefits which will in turn benefit the citizens in addition to achieving the climate goals. Multiple factors are relevant for consideration by the Government to effectively transition to a gas based economy. From the point of import dependency, suitable alternate technologies must be implemented at various levels of manufacturing to increase the share of usage of natural gas. This can be effectively implemented by modifying fiscal and tax policies relevant for each of the sectors. Without environmental considerations, growth of economy would only work contrary to the objective of improving overall well-being.⁵⁴ The existing legal and regulatory framework were developed during the times of Independence, where India was still recovering from the pains of partition. It doesn't reflect the societal, scientific and legal developments over the past 75 years, therefore, requiring amendments or a complete overhaul. The Oilfields Act, 1948, though has been the primary legislation governing the sector, it has not been able to keep up with the developments over time. Penalties as prescribed under these legislations are minimal and are almost obsolete. As a result, the oil and natural gas sector has suffered and this may be one of the reasons for failure to achieve the policy goals of increasing the natural gas consumption. As regards the downstream sector, the key issues about supply and distribution remains. Several states in India are not equipped with the necessary infrastructure to move to a gas based system. Therefore, key measures to expand the gas infrastructure becomes a crucial factor.

⁵⁴Kumar, V. V., Shastri, Y., & Hoadley, A. (2020). A consequence analysis study of natural gas consumption in a developing country: Case of India. *Energy Policy*, 145, 111675. [See this link](#).

The policy developments especially the present HELP, OALP and DSF are providing a fresh perspective. Albeit, these policies have its own loopholes and issues to be addressed, wherein without addressing uncertainties surrounding procurement and production of natural gas, the policy is bound to fail. With the move to natural gas, the necessary infrastructure to cater to the needs must be developed. The crowd – out risks always remains, as natural gas remains a mediate fuel, with an option to switch back to convention fuels. The investments in natural gas should not diminish investments in renewable sectors.⁵⁵ It is anticipated that the demand for oil and petroleum products would decline in the coming years, whereas, the demand for natural gas is expected to increase due to it being clean. To buttress the fact, TAPI (Turkmenistan-Afghanistan-Pakistan-India) Gas Pipeline⁵⁶, a Trans-country natural gas pipeline commenced with an estimated investment of \$10 bn, and an expected completion date as of 2021. However, due to the change in the geopolitical scenario, the project completion seems far-fetched. These uncertainties are not just haunting the developing countries like India, but also some of the developed nations in Europe. Several European countries are at a risk of suffering fluctuations in supply due to the ongoing Russia – Ukraine, Israel – Gaza conflicts. Considering the healthy ties of India with Qatar and Russia, it would be an opportune moment to increase the share of natural gas in the total energy mix. Thereby, moving a step closer to tackling the imminent issue of air pollution and achieving the targets as obligated under various treaty arrangement.

5. BIBLIOGRAPHY

- Agora Verkehrswende; GIZ *Towards decarbonising transport 2023: a stocktake on sectoral ambition in the G20*. Germany: Agora Verkehrswende; GIZ, 2023. URL: https://www.niti.gov.in/sites/default/files/2023-07/98_Towards_Decarbonising_Transport_2023_compressed.pdf (Last access 29-05-2024).
- AHMAD, Nasimuddin; SHARMA, Shalaghya; SINGH, Anjani K. Pradhan Mantri Ujjwala Yojana (PMUY): step towards social inclusion in India. *International Journal of Trend in Research and Development*, vol. 5, n. 1, 2018. URL: https://www.researchgate.net/publication/342804302_Pradhan_Mantri_Ujjwala_Yojana_PMUY_Step_towards_Social_Inclusion_in_India (Last access 29-05-2024).

⁵⁵ Unruh, G. C. (2002). Escaping carbon lock-in. *Energy Policy*, 30, 317-325. [See this link](#).

⁵⁶ Asian Development Bank. (n.d.). *Project Information: Strengthening Climate Resilience in Urban and Rural Areas of Uzbekistan*. [See this link](#).

- AKSYUTIN, Olga E.; ISHKOV, Alexander A.; ROMANOV, Konstantin V.; et al. The Role of Natural Gas in Achieving Sustainable Development Goals. *International Journal of Energy Economics and Policy*, vol. 10, n. 4, 2020, pp. 463-472. URL: <https://doi.org/10.32479/ijeep.9359> (Last access 29-05-2024).
- Asian Development Bank. *Project Information: Strengthening Climate Resilience in Urban and Rural Areas of Uzbekistan*. Philippines: Asian Development Bank, n.d. URL: <https://www.adb.org/projects/44463-013/main> (Last access 29-05-2024).
- Association of Natural Gas & Others V. Union of India. 4 SCC 489, 2004.
- AZHAR, Muhammad. India's emergence as a petroleum products exporter. *The Journal of Energy and Development*, vol. 47, n. 1/2, 2021/2022, 75–100. URL: <https://www.jstor.org/stable/27188914> (Last access 29-05-2024).
- BP. *BP Energy Outlook 2023*. Reino Unido: BP, 2023. URL: <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2023.pdf> (Last access 29-05-2024).
- Broom, Douglas. 6 of the world's 10 most polluted cities are in India. *World Economic Forum Agenda*, 5th of March 2020. URL: <https://www.weforum.org/agenda/2020/03/6-of-the-world-s-10-most-polluted-cities-are-in-india/> (Last access 29-05-2024).
- Business Standard. Environment-friendly CNG replaces diesel as fuel on boats in Varanasi. *Business Standard*, 22nd of January 2023. URL: https://www.business-standard.com/article/current-affairs/environment-friendly-cng-replaces-diesel-as-fuel-on-boats-in-varanasi-123012200479_1.html (Last access 29-05-2024).
- CORNOT-GANDOLPE, Sylvie. India's vision to a gas-based economy: Drivers and Challenges. *CEDIGAZ*, 10th of October 2017. URL: <https://www.cedigaz.org/indias-vision-gas-based-economy-drivers-challenges/> (Last access 29-05-2024).
- CHUGH, G. *The Green Fossil: The Next Stop – Natural Gas and India's Journey to a Clean Energy Future*. New York: Harper Collins, 2021.
- Government of India. *The Constitution of India*. New Delhi: Government of India, 2021. URL: <https://lddashboard.legislative.gov.in/sites/default/files/COI...pdf> (Last access 29-05-2024).
- CORBEAU, Anne-Sophie; HASAN, Shahid; DSOUZA, Swati. *The Challenges facing India on its road to a gas-based economy*. Saudi Arabia: KAPSARC, 2018. URL: <https://doi.org/10.30573/KS--2018-DP41> (Last access 29-05-2024).
- DEB, Kaushik; KOHLI, Pranati Chestha. *Assessing India's ambitious climate commitments* [Report]. Columbia: Columbia University Center on Global Energy Policy, 2022. URL: https://www.energypolicy.columbia.edu/wp-content/uploads/2022/12/Indias-climate-commitments_CGEP_Commentary_120622.pdf (Last access 29-05-2024).

- Directorate General of Hydrocarbons. *Awarding of Acreages*. Noida (India): Directorate General of Hydrocarbons; Ministry of Petroleum and Natural Gas, Government of India, [2024]. URL: <https://dghindia.gov.in/index.php/page?pageId=25> (Last access 29-05-2024).
- Directorate General of Hydrocarbons. *Good International Petroleum and Industry Practices*. Noida (India): Directorate General of Hydrocarbons; Ministry of Petroleum and Natural Gas, Government of India, 2016. URL: <https://www.dghindia.gov.in/assets/downloads/gipip.pdf> (Last access 29-05-2024).
- Directorate of Geology & Mining, Assam. PNG Rules, 1959. URL: https://dgm.assam.gov.in/sites/default/files/swf_utility_folder/departments/dgm_medhassu_in_oid_4/menu/document/png%20rules.pdf (Last access 29-05-2024).
- Directorate General of Mines Safety. *Oil Mines Regulations*. New Delhi: Directorate General of Mines Safety, 2017. URL: <https://www.dgms.net/OMR2017.pdf> (Last access 29-05-2024).
- European Commission. *2050 Long-Term Strategy*. Brussels: European Commission, 2024. URL: https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en (Last access 29-05-2024).
- GAIL (India) Limited. *GAIL CSR Policy*. India: GAIL, 2015. URL: https://www.gailonline.com/pdf/CSR/final_policy2010.pdf (Last access 29-05-2024).
- Directorate General of Hydrocarbons. *Notification – Open Acreage Licensing Policy (OALP): Modalities for Operationalization Hydrocarbon Exploration & Licensing Policy (HELP)*. New Delhi: Directorate General of Hydrocarbons; Ministry of Petroleum and Natural Gas, Government of India, 2017. URL: https://www.ndrdgh.gov.in/NDR/?page_id=2243#:~:text=Government%20of%20India%20in%20October,to%20both%20government%20and%20contractor (Last access 29-05-2024).
- GÜRSAN, C.; GOOYERT, V. de. (2021). The systemic impact of a transition fuel: does natural gas help or hinder the energy transition?. *Renewable and Sustainable Energy Reviews*, vol. 138, march 2021, 110552. URL: <https://doi.org/10.1016/j.rser.2020.110552>. (Last access 29-05-2024).
- Integrated Energy Policy*. 2006. URL: https://cdn.climatepolicyradar.org/navigator/IND/2006/integrated-energy%20policy_ecd711441b2a0b9c8f712f72435cce20.pdf (Last access 29-05-2024).
- KANSAL, Monica; JOSHI, Mahesh; BABU, Shekar; et al. Reporting of Corporate Social Responsibility in Central Public Sector Enterprises: A Study of Post Mandatory Regime in India. *Journal of Business Ethics*, vol. 151, n. 3, September 2021, pp. 813–831. URL: <http://www.jstor.org/stable/45022698> (Last access 29-05-2024).

- KUMAR, Vinod Vijay; SHASTRI, Yogendra; HOADLEY, Andrew. A consequence analysis study of natural gas consumption in a developing country: Case of India. *Energy Policy*, vol. 145, October 2020, 111675. URL: <https://doi.org/10.1016/j.enpol.2020.111675> (Last access 29-05-2024).
- Ministry of Labour and Employment. Government of India. . *The Mines Act, 1952*. India: Government of India, 1983. URL: <https://labour.gov.in/sites/default/files/theminesact1952.pdf> (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas. Government of India. . *Guidelines for Management of Oil & Gas Resources*. India: Government of India, n.d. URL: https://mopng.gov.in/files/TableManagements/ogmgmt_1.pdf (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas. Government of India. *Petroleum and Natural Gas (Safety in Offshore Operations)*. India: Government of India, 2008. URL: https://mopng.gov.in/files/TableManagements/2020-12-08-134436-stjpn-rule_0.pdf (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas. Government of India. *The Oilfields Regulation and Development Act, 1948*. India: Government of India, 1948. URL: <https://www.dghindia.gov.in/assets/downloads/19.pdf> (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas. Government of India. *Resolution No.O-20013/2/92-ONG, D-III*. India: Government of India, 1993. URL: <https://dghindia.gov.in/assets/downloads/56cc049f79208Resolution.pdf> (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas, Government of India. *Policy for encouraging E & P activities in North East (NE) India – Hydrocarbon Vision 2030*. India: Government of India, 2020. URL: <https://mopng.gov.in/en/exp-and-prod/northeast> (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas. Government of India. *Gazette Notification - F. No. Expl-15019 (25)/161/2019-ONG-D-V (E-34367) (Deregulating sale of domestically produced crude oil)*. India: Government of India, 2022. URL: <https://mopng.gov.in/files/ExpAndProd/Acts%20Rules%20and%20Guidelines/11072022deregulating-sale-of-domestically-produced-crude-oil.pdf> (Last access 29-05-2024).
- Ministry of Petroleum and Natural Gas. Government of India. *Hydrocarbon Exploration and Licensing Policy (HELP) – A Win – Win approach*. India: Government of India, 2020. URL: <https://mopng.gov.in/en/exp-and-prod/help> (Last access 29-05-2024).
- Ministry of Statistics and Programme Implementation. Government of India. *Energy Statistics India – 2022*. India: Government of India, 2022. URL: https://www.mospi.gov.in/sites/default/files/publication_reports/Energ

- [y Statistics 22/Energy%20Statistics%20India%202022.pdf](#) (Last access 29-05-2024).
- NAMDEO, K. S.; SRIVASTAVA, K. Evolution of gas-based economy in India: a case of Gujarat state. *Academy of Marketing Studies Journal*, vol. 28, n. 1S, 2024, pp. 1-16.
- National Data Repository. URL: https://www.ndrdgh.gov.in/NDR/?page_id=6 (Last access 29-05-2024).
- Directorate General of Hydrocarbons. *Major Policy reforms by Government*. India: Directorate General of Hydrocarbons. Ministry of Petroleum and Natural Gas. Government of India, 2024. URL: https://www.ndrdgh.gov.in/NDR/?page_id=2243#:~:text=Government%20of%20India%20in%20October,to%20both%20government%20and%20contractor (Last access 29-05-2024).
- NITI Aayog, Government of India. *Draft National Energy Policy*. India: NITI Aayog, Government of India, 2017. URL: https://www.niti.gov.in/sites/default/files/2022-12/NEP-ID_27.06.2017.pdf.pdf (Last access 29-05-2024).
- Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India. *India's Oil & Gas, Ready Reckoner, FY 2022-23*. India: Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India, 2023. URL: https://ppac.gov.in/uploads/rep_studies/1689760261_PPAC_READY%20RECKONER-FY2022-23_web_compressed-compressed-min_compressed.pdf (Last access 29-05-2024).
- Petroleum and Natural Gas Regulatory Board. *Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010*. India: Government of India, 2010. URL: [https://www.pngrb.gov.in/OurRegulation/PNGRB%20Regulations/D.%20Technical%20Standards%20and%20Specifications%20including%20Safety%20Standards%20\(T4S\)/D.2.%20ERDMP%20Regulations/ERDMP-Post%20Amendment-17.09.2020.pdf](https://www.pngrb.gov.in/OurRegulation/PNGRB%20Regulations/D.%20Technical%20Standards%20and%20Specifications%20including%20Safety%20Standards%20(T4S)/D.2.%20ERDMP%20Regulations/ERDMP-Post%20Amendment-17.09.2020.pdf) (Last access 29-05-2024).
- Petroleum Planning and Analysis Cell. *State-wise Consumption*. India: Petroleum Planning and Analysis Cell, Ministry of Petroleum and Natural Gas, Government of India, n.d. URL: <https://ppac.gov.in/consumption/state-wise> (Last access 29-05-2024).
- POWELL, Lydia; SATI, Akhilesh; TOMAR, Vinod Kumar. India as a gas-based economy: six years to go. *Observer Research Foundation*, 9th of April 2024. URL: <https://www.orfonline.org/expert-speak/india-as-a-gas-based-economy-six-years-to-go#:~:text=Background,%E2%80%9Cgas%2Dbased%20economy%E2%80%9D> (Last access 29-05-2024).

- PRASAD, Neeranh K. Regulation of natural gas in India. *Economic and Political Weekly*, vol. 43, n. 39, 2008, pp. 21–24. URL: <http://www.jstor.org/stable/40277994> (Last access 29-05-2024).
- Press Information Bureau. Government of India. *The consumption of Natural gas in India reflects a marginal growth trend, standing currently at 6.7%, with an increase of 0.4% from the previous year. Share of Natural Gas in Total Energy Mix*. India: Press Information Bureau, Government of India, 2023. URL: <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987803#:~:text=Presently%20in%20India%20the%20share,in%20energy%20basket%20is%206.7%25> (Last access 29-05-2024).
- Reliance Natural Resources Limited v. Reliance Industries Limited. (2010) 7 SCC 1.
- SINHA, Akhoury Sudhir Kumar; KAR, Sanjay Kumar; OJHA, Umapasana; et al. Role of Natural Gas in India: Recent Developments and Future Perspectives. In: RAVANCHI, Maryam takht (ed.). *Natural Gas – New Perspectives and Future Developments*. London: IntechOpen, 2022. URL: <https://doi.org/10.5772/intechopen.101346> (Last access 29-05-2024).
- United Nations. *Transforming our world: the 2030 Agenda for Sustainable Development*. New York: United Nations, 2015. URL: <https://sdgs.un.org/2030agenda> (Last access 29-05-2024).
- UNRUH, Gregory C. Escaping carbon lock-in. *Energy Policy*, vol. 30, 2002, pp. 317-325. URL: [https://doi.org/10.1016/S0301-4215\(01\)00098-2](https://doi.org/10.1016/S0301-4215(01)00098-2) (Last access 29-05-2024).