Managing the Dynamics of the US Gas and Oil Market:  
An In-depth Analysis

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ABSTRACT
The United States of America (US) has long been a key player in the global energy landscape, with its gas and oil market serving as a critical component of both its domestic economy and international relations. This paper provides a comprehensive overview of the US's gas and oil market, analysing its historical evolution, current state, and prospects. The paper begins by tracing the historical developments that have shaped the US's gas and oil industry, including key milestones such as the discovery of major oil fields, the growth of shale gas production, and the impact of geopolitical events on market dynamics. It then delves into the contemporary landscape, examining the major players in the industry, production and consumption trends, infrastructure, and distribution networks, as well as the regulatory frameworks that govern exploration, extraction, and trade. In this article, the author tries to make an overview of the US gas and oil market from the market from its appearance until today. The gas and oil market legislation and the authorities that regulate and supervise the market are identified and presented. The federal and states transport and distribution system is an overview and their connection. This article also offers a comprehensive analysis of the US gas and oil market, encompassing its historical trajectory, current landscape, economic significance, environmental challenges, and future directions. By examining these facets, it will be provided valuable insights into the complex interplay between energy resources, economic development, and environmental sustainability within the context of a rapidly evolving global energy landscape.

KEYWORDS: US, gas and oil market, energy price evolution, transport system, distribution system

JEL CLASSIFICATION: K32, L94, L95

1. INTRODUCTION

Speaking about energy and energy market beginnings in the US, we should start, like also in other places in the world, with the sun and the wind. Starting with 1775, the wood became the first source of energy until the 1850s when it was replaced by coal.

The graphic bellow issued by Energy Information Associations shows the history of energy consumption in United States 1990-2021 and the projections until 2050.

In 1855, George Henry Bissell and an investor group established the Pennsylvania Rock Oil Company (later renamed Seneca Oil Company) in their quest for a more efficient alternative to kerosene derived from asphalt. They enlisted the services of Edwin Drake, who successfully drilled the inaugural oil well on August 27, 1859, at Oil Creek near Titusville, Pennsylvania. This event is widely regarded as the inception of the modern oil era. Roughly a little over ten

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years later, the prominence of the Seneca Oil Company was eclipsed by John D. Rockefeller's Standard Oil Company, which gained control of nearly 80% of the oil products market.

The purpose of this article is to present the gas and crude oil energy market from its emergence to the present day. We shall start with identification of the legal framework which regulates and assures operation framework for oil and gas industry.

The US oil and gas market operates in a competitive environment, with regional and national markets. Market deregulation, as seen in some states, has led to increased competition among energy providers, offering consumers more choices but also facing challenges in maintaining reliability (Bushnell, 2019). Market prices fluctuate due to supply-demand dynamics, regulatory changes, and geopolitical factors, impacting both producers and consumers (EIA, 2021c).

As a federal state, the US oil and gas market is regulated both at the federal and states levels.

We shall try to identify the main organisation which regulates and oversees activity of this sector, starting with the Department of Energy and going to Public Utilities Commissions, at state level.

Also, the transport and distributions actors will be reviewed, and the article will end with a short presentation of today’s market situation and its development prospects.

The US energy market, and in particular the gas and oil market, is in a constant state of transformation, influenced by evolving demand patterns, technological advancements, policy changes, and environmental concerns. Transitioning to a sustainable, resilient, and diverse energy landscape remains a critical challenge. Understanding the dynamics of the US energy market is crucial for policymakers, stakeholders, and researchers to develop effective strategies that promote economic growth while addressing environmental and societal needs.

2. LITERATURE REVIEW

The US's gas and oil industry has undergone significant historical developments that have shaped its current state. The discovery of the Spindletop oil field in Texas marked a turning point, propelling the US into a major global oil producer (Yergin, 1991). Furthermore, the technological breakthrough of hydraulic fracturing revolutionised shale gas production, positioning the US as a leading gas producer (Maugeri, 2013).

The shale revolution has transformed the US's gas and oil market by unlocking vast unconventional resources. This shift has led to increased domestic production and a reconfigured global energy landscape (EIA, 2021). Shale gas production has enabled the US to become a significant exporter (Brown et al., 2020).

The US's gas and oil sector plays a vital economic role, contributing to GDP growth, employment, and trade balance. Fluctuations in oil prices impact various economic indicators, influencing consumer behaviour and investment decisions (Hamilton, 1983). The transition to net energy exporter status has also reshaped global trade dynamics (EIA, 2021).

Environmental considerations are increasingly relevant in the US's gas and oil market. Fossil fuel consumption contributes to greenhouse gas emissions, which requires a shift toward cleaner

The future of the US's gas and oil market is intertwined with geopolitical dynamics and energy policy decisions. Energy policies, such as emissions regulations and renewable energy incentives, play a pivotal role in shaping the industry's trajectory (Brown et al., 2020). The US's gas and oil market relies on a complex network of infrastructure for exploration, extraction, and distribution. Pipeline systems, refineries, and storage facilities are crucial components of the market's functioning (Gilbert, 2012).

Technological advancements have been instrumental in expanding the US's gas and oil production capabilities. Innovations in drilling techniques, reservoir characterisation, and data analytics have improved efficiency and resource recovery (Bentley et al., 2015).

The regulatory framework that governs the gas and oil industry in the US has evolved over time. Environmental regulations, permitting processes, and safety standards play a crucial role in shaping industry operations and mitigating environmental impacts (Hoffman & Highsmith, 2011). The US's gas and oil market is intricately linked to energy security and geopolitical considerations. Dependence on foreign oil sources, supply disruptions, and international conflicts can influence market dynamics (O'Sullivan, 2017).

In their notable contribution to the field of energy and economics, Cicea et al. (2021) embarked on a comprehensive exploration of the intricate relationship between energy and economic growth. Their insightful study, published in the esteemed journal Energies, represents a meticulous investigation of the dynamics that underpin the interconnectedness of energy consumption and economic development. Through a meticulous examination of empirical evidence and theoretical frameworks, the authors skilfully navigate the multifaceted terrain of this relationship. By delving into this pivotal nexus, the authors offer a compelling analysis that extends our understanding of the mechanisms driving energy-economic interactions, thus providing a significant stepping stone for informed policy decisions and sustainable development strategies.

Investment and financing play a critical role in the development of the US's gas and oil resources. Capital flows, project financing, and risk assessments impact exploration, production, and infrastructure development (Stern, 2011). The integration of renewable energy sources presents opportunities for diversification in the US's energy mix. Policies promoting renewable energy adoption and technological advancements influence the competitive landscape (Sovacool & Cooper, 2018).

The public perception and social acceptance of the gas and oil industry influence its development. Community engagement, environmental concerns, and public discourse play a role in shaping industry practices (Dillard & Peoria, 2020). Effective management strategies are crucial to navigate the complexities of the US gas and oil market. Strategic management approaches encompass exploration, production, and distribution processes, guiding industry players toward optimising resource utilisation and operational efficiency (Porter, 1980).

The management of risk and investment is paramount in a volatile market. Industry leaders employ risk assessment tools, financial hedging, and diversified investment portfolios to manage uncertainties arising from price fluctuations and geopolitical tensions (Stulz, 1996). Environmental considerations drive the adoption of sustainable management practices.
Responsible industry players implement environmental impact assessments, pollution control measures, and initiatives to minimise the ecological footprint of extraction and production activities (Vlek & Steg, 2007).

Geopolitical factors significantly influence the management of the US gas and oil market. Industry management must navigate international relations, regulatory frameworks, and energy policies to ensure stable trade relations and secure supply chains (Dannreuther & Ostrowski, 2017). Effective management of supply and demand dynamics is essential for market stability. Strategic inventory management, demand forecasting, and production scheduling contribute to ensuring a consistent supply of gas and oil (Coyle et al., 2017).

The ongoing transition to renewable energy sources requires adaptive management strategies. Industry leaders engage in diversification, investment in renewable technologies, and the integration of clean energy sources into their portfolios. Adherence to regulatory frameworks is a critical facet of industry management. The effective management of compliance with safety, environmental, and operational regulations ensure the sustainable and responsible operation of gas and oil assets (EPA, 2021).

Technological advancements drive operational efficiency and resource optimisation. Advanced drilling techniques, real-time monitoring systems, and data analytics enable informed decision-making and improve management strategies (Yildirim & Beral, 2018). Collaborative innovation plays a role in effective industry management. Partnerships between academia, government, and industry facilitate knowledge exchange, research, and technology transfer, enhancing the sector's management practices (Li et al., 2019).

In a comprehensive study exploring the effective implementation of Waste Electrical and Electronic Equipment (WEEE) management systems, Ciocoiu et al. (2011) harnessed the Analytic Hierarchy Process (AHP) as a robust evaluative framework. Their meticulous investigation, presented in the context of the 5th WSEAS International Conference on Renewable Energy Sources, delved into the intricate facets of sustainable practices. Through their rigorous analysis, the authors illuminated the multifaceted dimensions underpinning WEEE management systems, contributing significant insights into the realm of environmentally responsible practices within the energy sector (Ciocoiu et al., 2011).

The management of crises and disruptions is a fundamental aspect of the gas and oil sector. Effective crisis management strategies include emergency response plans, business continuity measures, and risk communication protocols (Lerbinger, 2012). The research conducted by Cicea et al. (2014) delved into the realm of environmental efficiency within renewable energy investments, offering a comparative analysis on a macroeconomic scale. Their study, featured in the Renewable and Sustainable Energy Reviews, critically examined the multifaceted aspects of investments in renewable energy, shedding light on the intricate interplay between environmental considerations and sustainable development.

This comprehensive literature review highlights various dimensions of the US gas and oil market, including historical evolution, economic significance, environmental considerations, technology, regulations, geopolitics, and future trends. The complex interplay of these factors shapes the trajectory of the industry within the broader energy landscape. Please ensure to verify and update the references as needed based on the latest research available.
3. ASSESSMENT OF THE PRE- AND POST-LIBERALISATION SITUATION

3.1 US gas and oil market legislations
US’s energy market is one of the biggest in the world and like other big markets involve a lot of participants with different roles in regulation, production, transmission, transport, and distribution of the energy to the end users.

Having in view the federal organisation of the US we have institutions which overlook this domain at federal level and institution which overlook at states level.

On the federal level, the energy domain is under supervision and control of the Department of Energy, whose main scope is to establish federal policy on this field.

2005’s The Energy Act (EPA) regulates the production of energy in States as well as energy efficiency. The law identifies as main energy production sectors renewable energy, oil and gas, coal, tidal energy, nuclear, ethanol, hydrogen, hydro and geothermal.

It establishes also the tax incentives in order to encourage a certain kind of energy production.

There are also regulations regarding oil and gas operations, and the measures that should be taken in order to protect the environment, cultural resources, as well as safe use of workforce.

Oil and gas operation are regulated by Federal Government but also by the States and local authorities depending on the ownership of the involved land.

Mainly the Federal Government looks to environment and people protection, the land of Native American and Outer Continental Shelf. The law is enforced by local branches of the local, state, or federal government.

Figure 1. Federal and Native American lands in the United States. Colors indicate which federal agency oversees and regulates activities on these lands
Source: U.S. Geological Survey
As a representative law, we can mention: The Clear Air Act (1963), The Clear Water Act (1972), and The Safe Drinking Water Act (1974).

The legal framework for oil and gas drilling procedures and rules is established on the federal level by the Interstate Oil and Gas Commission (IOGCC), founded in 1935.

![Figure 2. States belonging to the Interstate Oil & Gas Compact Commission](image)

**Source:** American Geosciences Institute, produced with mapchart.net

**State Regulation**
The are 33 states in the US which are involved in oil and gas production. Each State establishes its own rules and norms for oil and gas production for their lands, waters, and the ocean cost up to 9 miles.

The States regulations are focused on waste prevention, good management of the natural resources in order to assure also future exploitation and as well environment protection.

**Federal Regulation**
The Federal Government exercise his regulating role on non-federal land, where it is focused mainly on environmental issues of exploitation and production. Through Environmental Protection Agency, the Federal Government set standards in order to protect air, water, and other environment components.

The onshore federal land is under jurisdiction of the Bureau of Land Management (BLM) which overlooks all exploitation and production facilities and enforce existing law on all operations.

Exploitation and production of oil and gas for oceanic shelf which is less than 3/9 (depending on the State) nautical miles from the coast is under the authority of the States.

For oceanic shelf between 3/9 miles to 200 miles exploitation and production is overlook be BOEM (Bureau of Ocean Energy Management).

These agencies, together with the Bureau of Safety and Environmental Enforcement and the Office of Natural Resources Revenue whose main role is to collect rents and royalties, formed a sole entity called Mineral Management Service.
3.2 US market regulatory authorities

Federal Energy Regulatory Commission (FERC)

The activities of the Federal Energy Regulatory Commission (Commission) are organised under industry areas from electricity, continuing with natural gas and hydro and ending with oil.

In natural gas sector, FERC regulate the construction of the pipelines and storage faculties. Also, it regulates the transport of natural gas and connection of the internal net with its import and export facilities. Liquified natural gas safe operation is controlled by FERC which ensures that approved LNG terminals and associated LNG vessel traffic meet safety and environmental requirements during construction and operation.

In oil sector FERC regulates rates and practices of oil pipeline companies engaged in interstate transportation. His role is to assure equal service and equal access to the pipeline transport system for all the players involved (www.ferc.gov view on May 2023).

The reliability and operation according establish standards of bulk power system is overlook by a federal non-profit regulatory organisation named NERC (The North American Reliability Corporation).

NERC also have attribution to audit the power companies in order to assure that their activity is according to reliability regulations in force.

States Public Utilities Commissions (PUCs)

In federal states, utilities like electricity, gas, and water are under regulation of state commission which is generally called Public Utilities Commissions (PUCs). Usually one commission regulates all utilities, but there are some states where their attribution is spited in two or more agencies.

These commissions are appointed by governors or elected, depending state’s policy.

PUC’s main role is to assure that companies and housekeeping have non-discriminated access to utilities and at the fair and reasonable prices. Their activities include price surveillance and regulation, quality survey of the services offered, resource planning, etc.

In order to assure non-discriminatory access to the competitive markets of all participants, these are under control of ISO (Independent System Operator) or RTO (Regional Transmission Organisation) who control also the transmission system.

In states with vertically integrated utilities, PUCs regulate generation, transmission, and distribution to customers. In restructured states, PUCs only regulate distribution, while the ISO/RTO oversees the generation markets and transmission system.

3.3 US gas and oil transport and system operators. Distribution system

The production, transmission, and distribution system is presented by the American Gas Association in the figure bellow:
Where:

- **Production**: Extracting raw natural gas from beneath the Earth's surface.
- **Collection and Refinement**: Removing impurities, hydrocarbons, and fluids to generate pipeline-grade natural gas that adheres to specified regulations (pipeline-quality natural gas consists of 95-98 percent methane).
- **Transportation**: Conveying natural gas from the well and processing facility to city gate stations or industrial consumers. This transport is facilitated through an extensive network of high-pressure pipelines. The storage of natural gas is encompassed within this segment, often occurring in depleted underground reservoirs, aquifers, and salt caverns.
- **Distribution**: Distributing natural gas from major pipelines to end users, such as residential, commercial, and industrial sectors.

In the oil industry, some underground crude contains natural gas that is entrained in the oil at high reservoir pressures. When oil is removed from the reservoir, associated natural gas is produced.

According American legislation in force, states establish the operation rules for transport pipelines as well as for gathering gas lines. A federal organisation called the Federal Department of Transportation (DOT)'s Pipeline and Hazardous Materials Safety overlook transmissions of gas on long-distances pipe but also local distributions.

Air emissions are under permanent control of Environment Protection Agency which supervises the emissions from refineries and fuel distribution system including trucks, dispensing facilities, service station for trucks and pipelines.

Transport of oil and gas interstates is under FERC’S supervision and regulation. FERC also approves the construction of new pipelines, import or export terminals for liquefied natural gas (LNG), verifying with priority the compliance with the environment and safe regulations.

Below is represented transport system for oil and gas.
There are more than 2.6 million pipelines that transport trillions of cubic feet of gas and hundreds of billions of tons of liquid petroleum.

Most of the pipelines are buried underground and their existence is not known to the public.

The US gas and oil transporting system is the largest in the world (1.9 mil km for gas and 240.711 km for petroleum) before Russia and Canada.

The transportation system of petroleum and liquid natural gases is divided into three:

- Gathering pipeline system- collect oil and liquid gases from extraction facilities
- Transport pipelines – transport oil and liquid gas from gathering points to refineries
- Refined products pipeline- transport refined products like gasoline, kerosene, diesel from refineries to storage or distributions stations
- Gas transportation system is also divided into three:
  - Gathering pipelines system- collect raw material from production wells
  - Transmission pipelines – transport gas from gathering points to ports, refineries, or cities
  - Distribution system – distribute the gas to final consumers (industries and housekeepers).

### 3.4 Today gas and oil market

Deloitte analysis of the gas and oil sector over the 6-year period before COVID 19 (2014-2020) shows a very volatile market which rise to $100/BBL in 2014 and decrease to $37/BBL in 2020 and experience also disruptions regarding the availability of supply.

As a general description of the US gas and oil industry until the beginning of 2022 is underinvestment. The market actors prevent themselves to invest in this industry and impose a strict financial discipline which leads the oil and gas market to a very tight position/ stage.

In this position / stage was found by Russian invasion of Ukraine which led to breaking of oil and gas supply to Europe and the other countries which support the embargo.

The immediate effect was the increase of the prices to levels never seen before, which generated very imported cash infusion to the industry.
It remains to see if that unforeseen money infusion will be used in order to overpass industry underinvestment policy.

Deloitte (Oil and gas Outlook, 2023) considers that in the 2023, investments in oil and gas sector will be influenced by:

- The choices that sector players are making regarding keeping balance between capital discipline and increase investment.
- The decision of sector company for following state policies for renewable energies.
- Evolution of gas demand and the implication regarding US Environmental Policy.
- Adaptation of the existing refineries to current market demands.

Even it is estimated that this capital infusion will balance accounts of the industry, the capital disciplined applied till now will continue. According to Deloitte figures (Oil and Gas Outlook, 2023), the sector experienced in 2022 the highest level of its cash-flow, reaching to $1.4 trillion considering the price of $106/BBL for Brent Oil.

Russian invasion of Ukraine put the US and Europe in a position to reanalyse the commitments taken in the Paris Agreement in order to reduce gas consuming energy in order to reduce CO2 emissions and propose a new strategy which include even incentive for gas industry investment but accompanied with GHG and CO2 emission reduction.

The US decides jointly with the UE to increase exports of US LNG until 2030 but with the commitment of investing in a new infrastructure in order to decrease emissions of the gases which harm the environment.

In order to predict the development of US gas and oil industry development, it is very important to analyse The Inflation Reduction Act stipulations.

The Act tries to reduce the methane emissions by taxation and to stimulate the oil and gas companies which take measures to reduce methane emissions.

The Act also promotes the movement of the industry to off-shore and stimulates gas lease sales. Taxation of methane emissions are imposed and grants are offered to companies which ensure methane emissions monitorisation.

It is expected that demand of natural gas from Europe and Asia to remain high, putting pressure to development of LNG production, storage, export, and transport facilities.

Also, it is estimated that about eight floating storages will come in operations for Europe supply and more the 104 LPG carrier vessels were ordered globally during the first seven months of 2022, which is the highest ever recorded.

Despite this boost of natural gas export, the US legislation maintain its pressures in order to reduce carbon and methane emissions on industry. The results start to appear. The quantity of low carbon natural gas increase more than 100 times since late 1980’s.

4. CONCLUSIONS

As presented before, despite record profits realised during 2022, the oil and gas industry is still tributary to trade restrictions and regulatory burdens that they faced during last years.
Following the commitments taken in the Paris Agreement, the US Government allocated about 1.5 billion US dollars in order to promote hydrogen and underground CO2 storage hubs.

The huge investment for clean energy is also expected in order to promote technologies like electrolyse and fuel cells and infrastructure (pipelines and storage hubs for hydrogen and biofuels). The intended investment in renewable energies and their promoted access on the market will force the actual grid connection to expand and to seek modernisation.

The US's gas and oil market stands as a dynamic and multifaceted component of both its domestic economy and the global energy landscape. This comprehensive overview has illuminated key facets that collectively shape the industry's trajectory, from its historical evolution to its contemporary state and prospects.

Historically, significant milestones, such as the discovery of major oil fields and the technological breakthrough of hydraulic fracturing, have propelled the US to its status as a global energy powerhouse. The shale revolution has redefined production capabilities, enhancing domestic output, and transforming the nation into a notable gas and oil exporter. These developments have not only bolstered economic growth, but also introduced novel geopolitical dynamics.

Economically, the gas and oil sector remains a driving force, contributing substantively to GDP, employment, and trade balances. The fluctuations in oil prices hold far-reaching implications, influencing consumer behaviour, investment decisions, and overall economic health. This sector's transition towards net energy exportation further resonates on the international stage, reshaping global trade patterns and reinforcing the US's energy security.

Amid economic successes, the industry grapples with pressing environmental considerations. Fossil fuel consumption remains a significant contributor to greenhouse gas emissions and climate change. The pursuit of cleaner energy alternatives, such as renewables and low-emission fuels, emerges as an imperative for sustainability and environmental stewardship.

The future of the US's gas and oil market lies at the nexus of technology, policy, and energy diversification. Continued technological advancements and innovation have the potential to further expand production capabilities and enhance efficiency. Energy policies and regulations will play a pivotal role in guiding the industry's evolution, with an increasing emphasis on environmental responsibility and renewable integration. As renewable energy sources gain prominence, the US's energy landscape is poised for transformation, presenting both opportunities and challenges.

In conclusion, this comprehensive examination underscores the intricate interplay between historical legacies, economic vitality, environmental considerations, and future pathways within the US's gas and oil market. As the nation navigates its energy future, strategic decisions, technological investments, and international collaborations will undoubtedly shape the industry's course, ultimately defining its role in the broader context of sustainable energy development and global leadership.

REFERENCES


