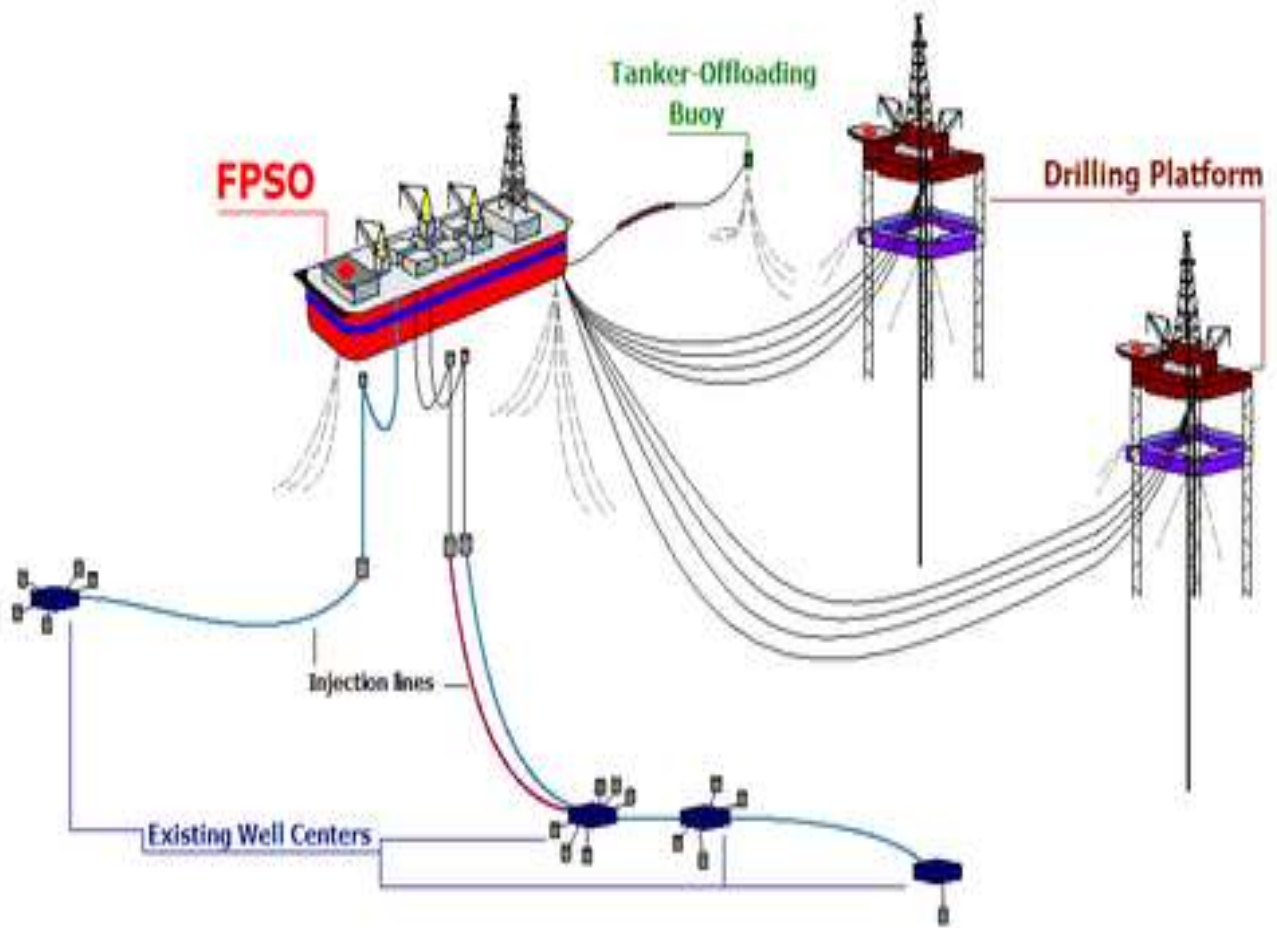


VALUE CHAIN IN OIL AND GAS SECTOR



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1.0 Introduction

Oil and gas resources is one of the key revenue generator to the Gross Domestic Product (GDP) of most oil producing countries. The usefulness of this resource is undeniable. Most countries have benefited immensely from oil and gas resources whiles this same resources have resulted to what is termed as the 'oil curse'.

'The oil curse' is simply viewed as a state where mismanagement of oil resources leads to over dependence on oil revenue, economic hardship, poverty and frequent civil wars (Le Billon, 2006). It has been observed that the oil and gas industry are under severe pressure to meet the high demand of the world's market on affordable and secure energy supply.

The concept of value chain analysis is therefore useful in several ways such as identifying constraints and opportunities in the oil and gas industry. The environmental concerns in exploration is also crucial. The supply-chain in the oil and gas industry is global and involving international trade system.

Significantly, it is key to follow the steps in the value chain. These steps involves decision making, the legal and regulatory framework, licensing and contracting among others. This publication seeks to discuss the value chain, outlining the steps involved.

2.0 Decision Making

This is the stage which involves the decision making process as to deciding. This is the first decision which lies ahead of every country as to when to begin extracting their natural resources. During this stage, government may sought the consent of the citizens within the locality where the oil is discovered.

The community may decide to mark some areas as off- limits to exploration due to several significant and environmental impact of the exploration on their lands and other vital resources. For the government to decide on exploration, cost- benefit analysis will be carried out thoroughly.

The decision making process is very keen as it may go a long way to affect the outcome and the whole exploration and production process. This is the state at which experts in the petroleum industry, economists and several resourceful people in the government sector gather information and derive a knowledge base as to whether to extract the oil or not after oil has been identified in their shores.

Strategically, countries may decide not to touch their hydrocarbon and wait for a while. A typical example of where a country decided not to extract is the scenario of Uganda. Production was delayed in Uganda since the year 2006, when natural gas was discovered along the Albertine rift basin which links its border with that of Democratic Republic of Congo. This decision was mainly due to deciding on which neighbor to host its oil pipeline to the sea. Other reasons included contractual disagreements and infrastructural setbacks.

3.0 The Legal and Regulatory Framework

Good legal and regulatory framework governing the oil and gas sector of every country is key when it comes to ‘getting the good deal’. The Legal and regulatory framework captures local content and participation policies, revenue management of oil and gas revenues, creation of national local content committee, policies that ensures transparency and monitoring of oil and gas activities and several others.

In Ghana, there are several policy and regulatory governing the oil and gas sector. This includes local content and participation policy; Petroleum Commission Act 2011; the Petroleum Revenue Management Act 2011 (Act 815); Ghana Petroleum Regulatory Authority Bill and several others. The local content and participation policy was established in 2010 by the Ministry of Energy. This policy serves as a guidelines for local content and local participation in petroleum activities. Some of the goals outlined under this policy included exploiting of the country’s oil and gas endowment sustainably; the creation of job opportunities in the oil and gas sector and also increasing and attracting local value-added investments in the oil and gas sector. (Handbook on Oil and Gas for Journalists, 2013). Again, the Petroleum Revenue Management Act 2011 was established under the purpose of collection, allocation and management of petroleum revenue in a transparent, responsible, accountable and sustainable manner. Similarly, Nigeria which is another leading producer of Petroleum in Africa also have interesting policies and regulatory governing their oil and gas sector. Among these regulatory framework includes Production sharing contracts (PSC). Under Nigeria Production sharing contracts (PSC), the contractor is appointed and given exclusive rights to carry out the exploration and production operations in the contract area for a period of 30 years. Also, the contractor is entirely responsible for financing all petroleum operations and only in the face of a successful development of discoveries will the oil

company recover exploration and development costs (Handbook on Oil and Gas for Journalists, 2013).

4.0 Licensing and Contracting

Under the licensing and contracting period, contracts in the petroleum sector involves any number of stakeholders and is related to any part of the oil and gas project phase such as the acquisition and exploration stage, production stage and several others. In the development of a nation's natural resources, the government could create a state owned company for exploration and production. Likewise the government also has an alternative option as to employ the services of private investors to develop the natural resources.

The final option could be the combination of private investors and the state owned company. There are several types of contracts by which a country could consider under the licensing and contracting stage of petroleum production. This includes not only concession or the license agreements but also joint venture agreements and production- sharing agreements.

The concession or/license agreement is said to be the most common type of contractual arrangement found in the oil and gas industry. The concession grants an oil company exclusive rights to explore, develop, sell and export oil extracted from a specified area for a fixed time period. Thus, a contractor "owns" the oil in the ground. This type of contract also allows companies to compete for exclusive rights through bidding which in most cases are tied with signing bonuses.

Also, the Joint Venture Agreements are uncommonly used as a basic form of agreement between Oil Company and government. The Joint Venture Agreements involves a comprehensive understanding of the goals and interests of the involved parties. It also entails an extensive negotiation over an extended time period in order to ensure a completion of all matters in stake. With the Production- Sharing agreements, ownership right is not given to the oil but remains in

the state whiles the state contracts out to foreign corporations to operate and manage the development of the oil field instead.

5.0 Acquisition and Exploration

Simply put, it is a stage by which technology is deployed to find new oil resources. Under the acquisition and exploration, three other subsection could be examined. This includes petroleum system, lease acquisition, exploration methods, and development and production. A petroleum system entails not only an active source rock but also all the geologic elements and processes crucial for hydrocarbon accumulations to exist. The essential elements encompasses the source rock, seal rock, overburden rock and reservoir rock. (Bertrand, 2014).

In the exploration of petroleum, there are three streams. This involves the upstream, the midstream and the downstream. These streams are used to refer to the key operational components of the petroleum sector. The upstream encompasses the exploration and extraction of crude oil and natural gas. This sector is also referred to as the exploration and production (E&P) sector. The upstream sector involves the searching for potential underwater or underground oil and gas fields, exploratory drilling and operating wells that recover and bring the crude oil and raw natural gas to the surface.

The midstream sector entails storing, transporting and marketing natural gas, crude oil, natural gas liquids mainly propane, ethane and butane, and by-product sulfur. The final stream which is the downstream involves refining of crude oil and processing of raw natural gas. It also involves petroleum refineries, petroleum product distribution, retail outlets and natural gas distribution companies.

Exploration Methods

a. Seismic Surveys

The Seismic surveys are conducted to identify potential hydrocarbon reserves in geological formations deep below the seafloor. The Seismic technology uses the reflection of sound waves to subsurface formations. (Handbook on Oil and Gas for Journalists, 2013).

b.

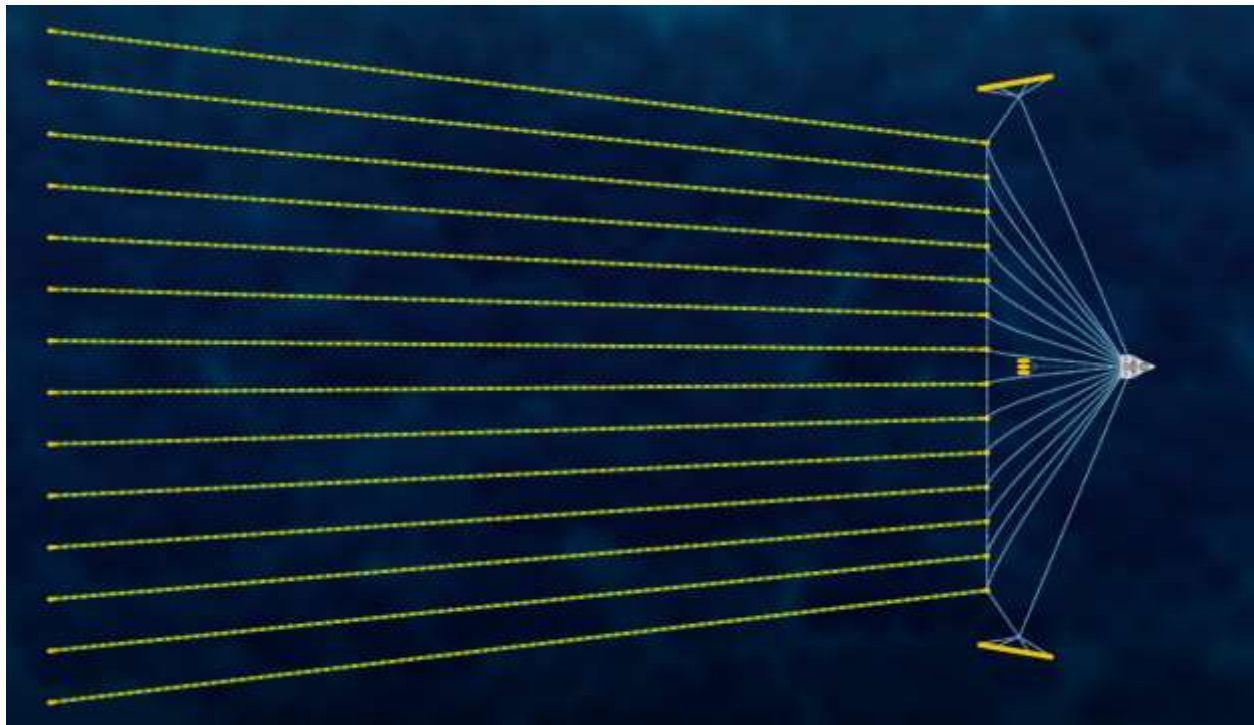


Fig.1 3D Seismic acquisition using GeoStreamer Technology Drilling

Exploration drilling is vital when it comes to the determination of whether a geothermal reservoir is capable of producing the necessary hydrothermal fluids for power generation. Exploration drilling is also a vital step before development drilling will take place. It also assists in examining the actual temperature measurements, fluid sample retrieval and rock sample for chemical analysis.

When evaluating the best locations for drilling, the Geophysical method could provide useful information about the subsurface.

Samples are obtained through exploratory drilling in order to obtain fluid measurement and actual temperature. There are various exploratory drilling techniques. Some of which includes exploratory wells, core holes, slim holes and several others. Despite the fact that exploratory drilling provides the most accurate information during the exploration phase, it is the most expensive method.

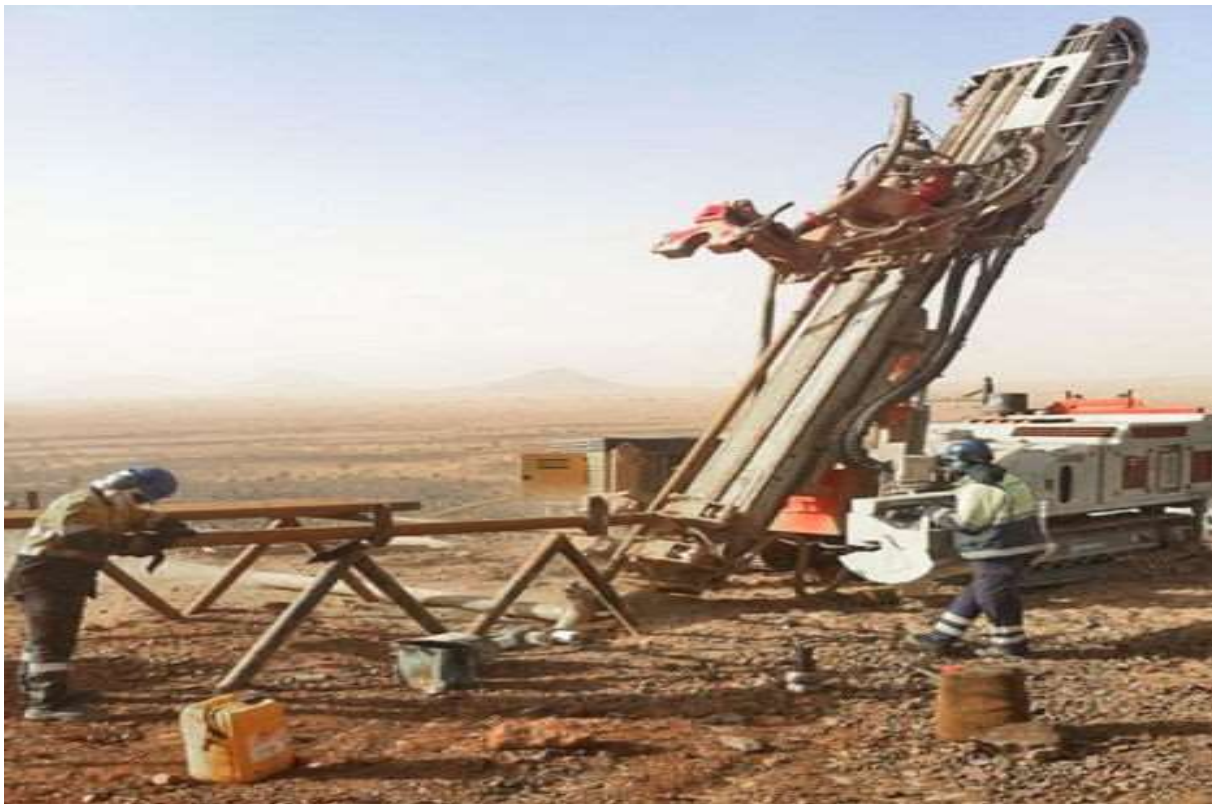


Fig 2. Exploratory drilling onshore



Fig 3. Offshore exploratory drilling

6.0 Production Process

Petroleum production entails two distinct connected general systems. Thus, the reservoir, which is the porous medium with unique storage and flow characteristics; and the artificial structures, which include the well, bottom hole, and wellhead assemblies, as well as the surface gathering, separation, and storage facilities. A complete petroleum production system consists of a reservoir, well, flow line, separators, pumps and transportation pipelines. The reservoir supplies wellbore with crude oil or gas. The well provides a path for the production fluid to flow from bottom hole to surface and offers a means to control the fluid production rate. The flow line leads the produced fluid to separators. The pumps and compressors are used to transport petroleum through pipelines to sales points.

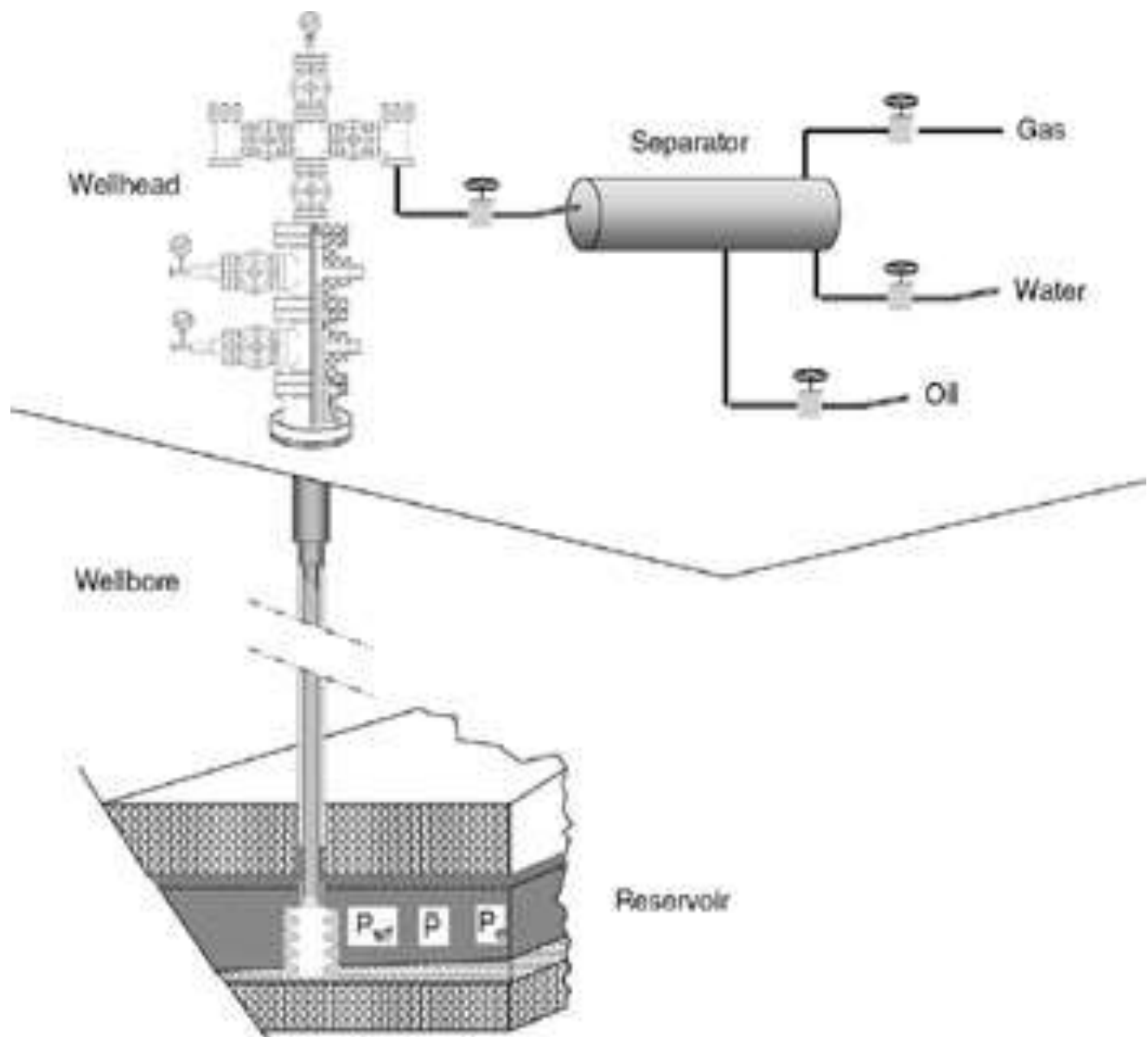


Fig 4. Petroleum Production System ¹

¹<http://www.globalspec.com/reference/33546/203279/chapter-1-petroleum-production-system>

7.0 Refining

The process of converting crude oil into useful products in the petroleum production is known as refining. Refining process is helpful in the separation of crude oil which composes of hundreds of different hydrocarbon molecules. This process is divided into three basic steps, namely; separation, conversion and treatment. Most of these explanation were taken from <http://www.petroleum.co.uk/refining> .



Figure 5. Refining

Separation

Separation refers to the distillation process. In order to separate hydrocarbons, crude oil is heated in a furnace. This separation is made via their boiling point. Heated petroleum vapors in a large tower are separated into fractions according to the boiling point and its weight. Gasoline which happens to be part of the lightest fractions rise to the top of the tower before they condense back to liquids. The heaviest fraction on the other hand, settles at the bottom since they condense early.

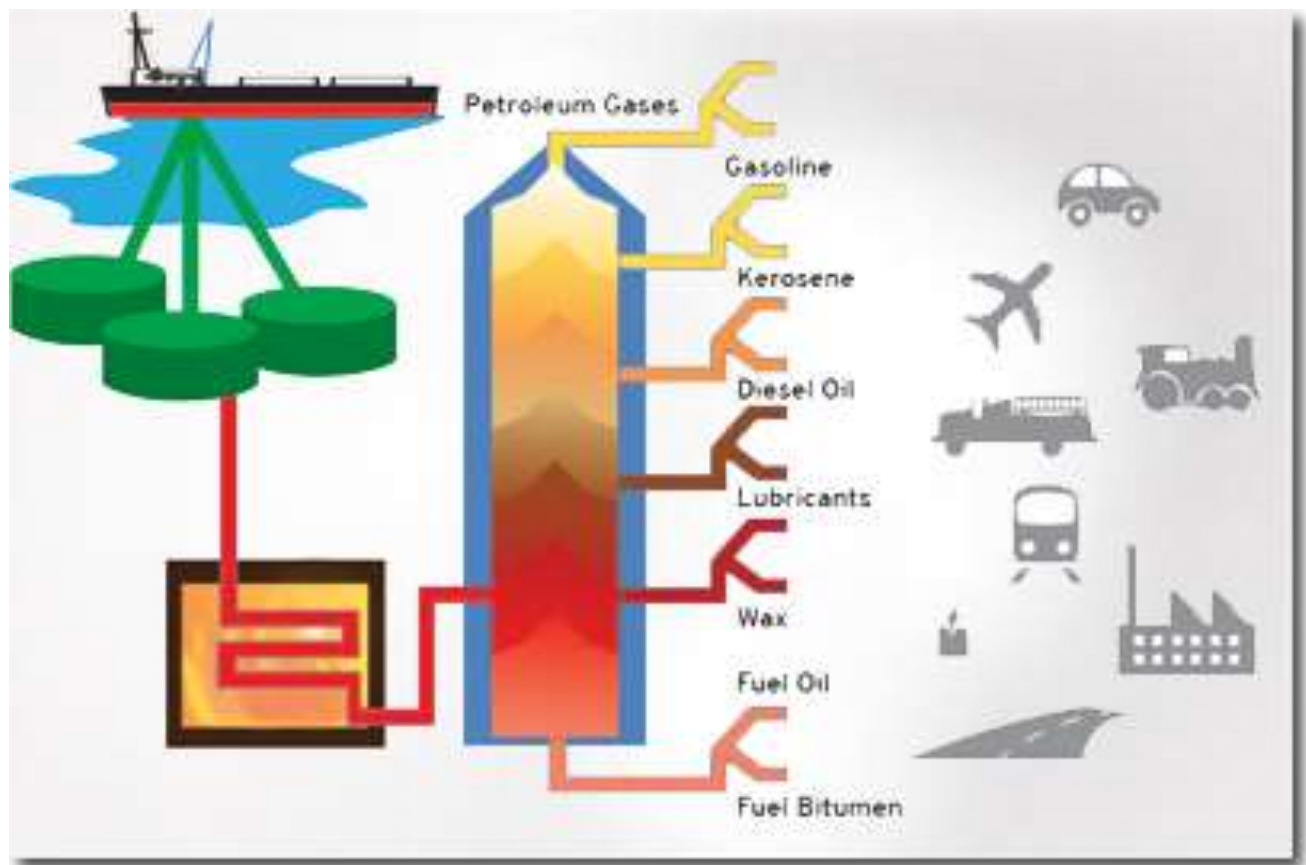


Fig. 6 Separation²

² <http://oilrefinerysystemoftheworld.blogspot.com/2012/05/separation-crude-oil.html>

Conversion

Conversion is basically, the process of transforming one kind of hydrocarbon into another.

Cracking is seen as the process of taking heavier, less valuable fractions of crude oil and converting them into lighter products. This process uses heat and pressure to break heavier elements into lighter elements. The opposite of cracking is Alkylation which is also another common process.

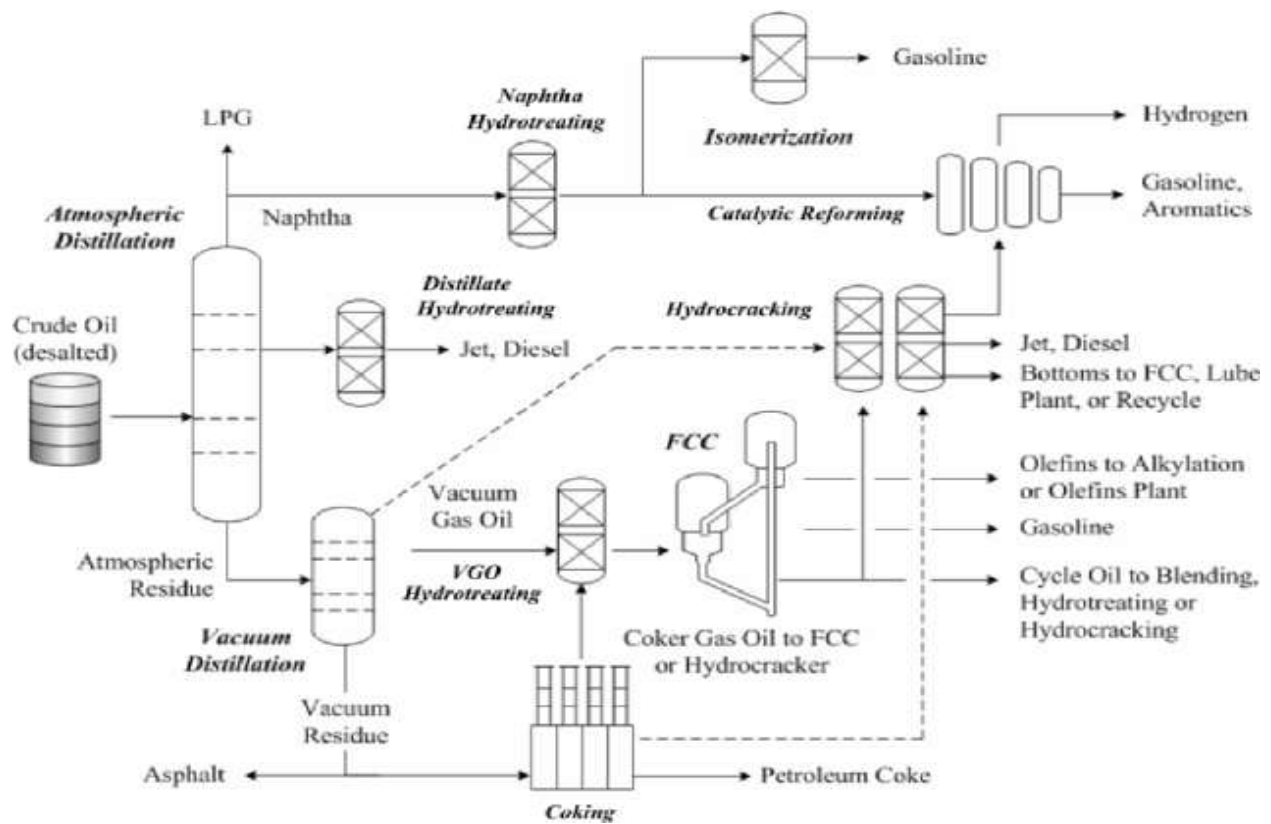


Fig. 7 Conversion³

³ https://www.researchgate.net/figure/227247349_fig1_Figure-1-Layout-of-a-Typical-High-Conversion-Oil-Refinery

Treatment

The final process of refining is treatment. Treatment involves combining processed products used in extreme environments. A typical example of this process is the removal of sulfur from diesel fuel. This is vital in meeting clean air guidelines. Treatment is the most time consuming step in the refining process.

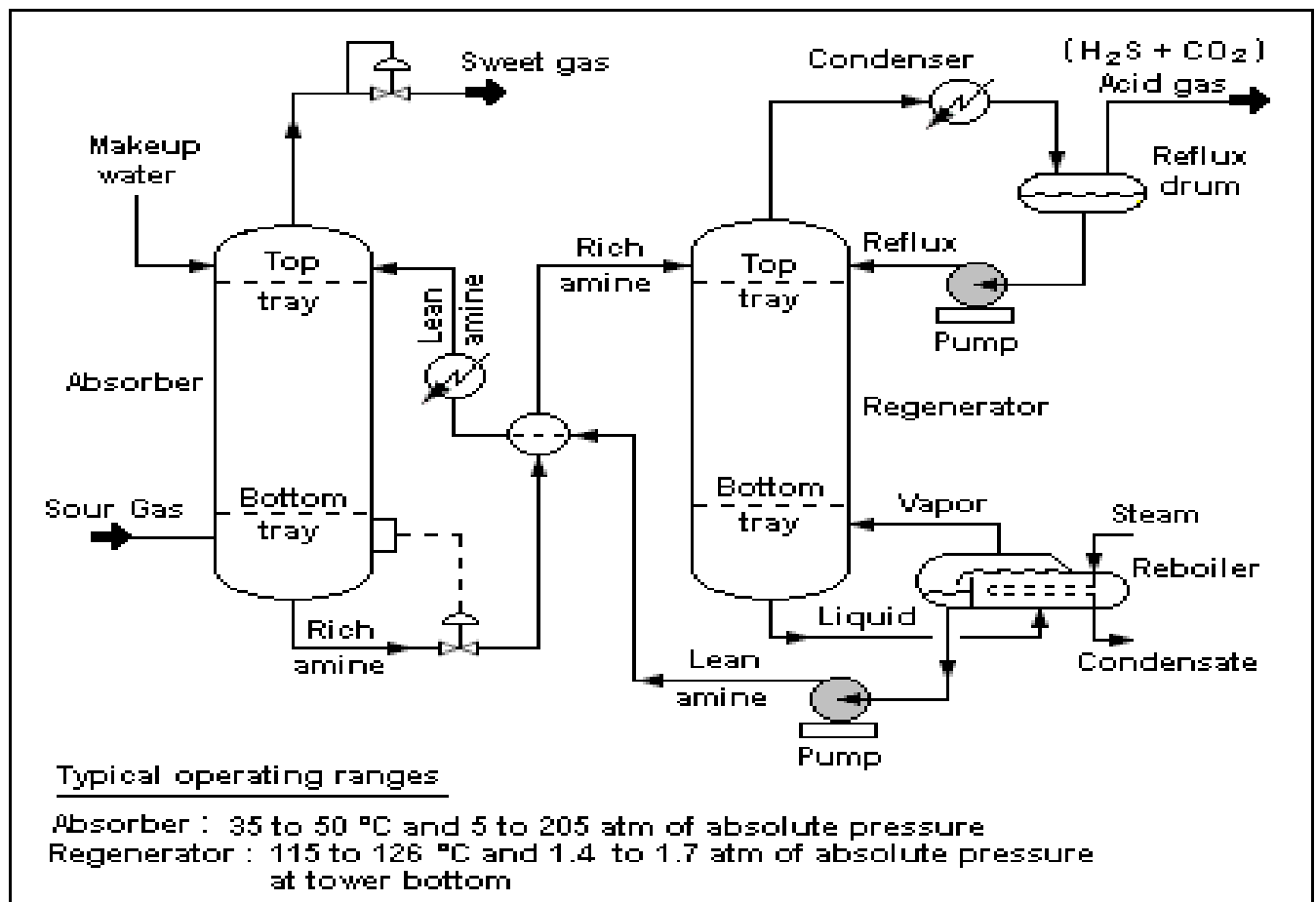


Fig. 8 Treatment⁴

⁴ <https://chemengineering.wikispaces.com/Amine+gas+treating>

8.0 Distribution

Under the distribution system in the petroleum sector, there are three basic subsystems. This includes pipeline segments, pump stations and tactical petroleum terminal. (Dictionary of Military Terms, 2011). The refinery piping, tank storage systems, fueling systems, petroleum distribution systems, diesel exhaust fluid dispensing systems, facility installations and relocations, bio- diesel blend stations, ethanol blend stations and several others are used in the distribution process of the petroleum supply chain.



Fig 9. Crude Oil Tanker



Fig. 10 Pipeline Transport



Fig. 11 .Rail Cars

Conclusion

The concept of value chain analysis is useful when it comes to identifying constraints and opportunities in the oil and gas industry. The conceptual framework of the petroleum supply chain informs the decision of government, individuals, companies and academia at every stage in the value chain process when it comes to making informed decision. The value chain process in a more appropriate perspective begins right from the decision making process to the legal and regulatory framework; licensing and contracting; acquisition and exploration; production process; refining and ends at the distributing to the final consumers.

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