Libya

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Background

Libya is a member of the Organization of Petroleum Exporting Countries, the holder of Africa's largest proven oil reserves, and an important exporter of oil and natural gas. Libya's oil production has begun to resurge since the overthrow of the Qadhafi regime.

Libya produced an estimated 1.65 million barrels per day (bbl/d) of mostly high-quality light, sweet crude oil prior to the onset of unrest in February 2011. Libyan oil and natural gas exports suffered a near-total disruption in the months of intense fighting to follow, as the minimal and sporadic oil production that did occur was mostly consumed domestically. As a result, in the summer of 2011, the International Energy Agency (IEA) coordinated a release of 60 million barrels of oil from the emergency stocks of its member countries through the "Libya Collective Action" – the first such release since Hurricane Katrina in 2005.

Libyan oil production began its resurgence in September 2011, following the deposition of Col. Mu'ammar al-Qadhafi's regime and the gradual consolidation of control over most parts of the country by the Transitional National Council (TNC) and affiliated rebel militias. Crude oil production was estimated to have recovered to at least 1.4 million bbl/d by May 2012, as the impressive pace of the sector's recovery exceeded the expectations of most industry analysts. Nonetheless, there are significant downside as well as upside risks to the outlook for Libyan oil production due to continued uncertainty about security conditions, state cohesion, political institutions, the return of foreign capital and expertise, contract terms, and industry oversight.

The Libyan economy's dependence on hydrocarbons suggests that the continued recovery of the energy industry will be an important determinant of the country's near-term economic fortunes. According to the U.S. Department of State, oil accounted for approximately 95 percent of Libya's export earnings, 75 percent of its government receipts, and 25 percent of its gross domestic product prior to the political upheaval of 2011.

EIA estimates that Libya consumed almost 0.9 quadrillion British thermal units (Btu) of energy in 2010, of which more than 70 percent was from consumption of petroleum and petroleum products and almost all of the remainder was natural gas.

Oil

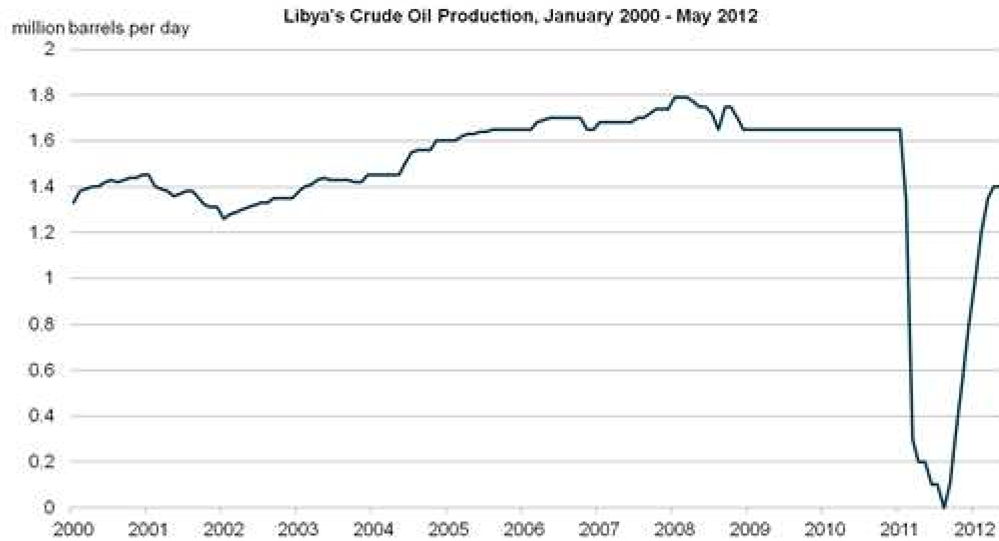
Overview

Libya's oil production was disrupted for much of 2011 due to conflict, but began to recover relatively rapidly following the

Libya, a member of the Organization of Petroleum Exporting Countries (OPEC), holds the largest proven oil reserves in Africa and is an important contributor to the global supply of light, sweet crude. Libya's oil production has been impressively restored after months of conflict and insecurity. However, considerable uncertainty surrounds the future of the oil sector and the

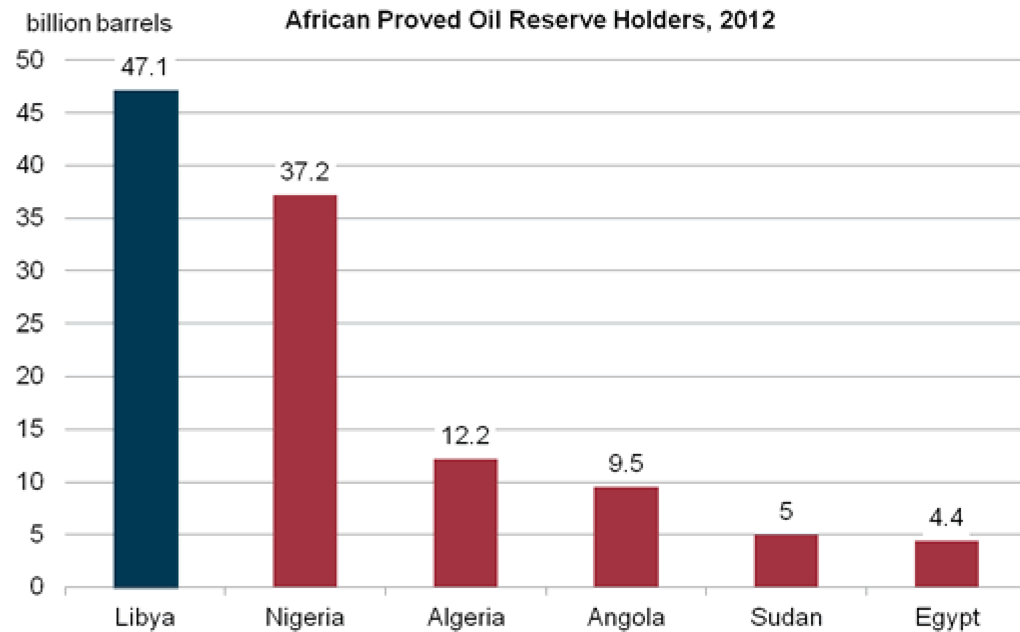
cessation of most hostilities by the autumn of that year.

political regime that will govern it.



Reserves

According to *Oil and Gas Journal (OGJ),* Libya had total proven oil reserves of 47.1 billion barrels as of January 2012 – the largest endowment in Africa, and among the ten largest globally. Close to 80 percent of Libya's proven oil reserves are located in the eastern Sirte basin, which also accounts for most of the country's oil output. Libyan oil is generally light (high API gravity) and sweet (low sulfur content).



Sector Organization

Prior to Qadhafi's ouster, Libya's oil industry was run by the state-owned National Oil Corporation (NOC). The NOC was responsible for implementing Exploration and Production Sharing Agreements (EPSA) with international oil companies (IOCs), as well as its own field development and downstream activities. Its subsidiaries include the Arabian Gulf Oil Company (AGOCO), the profile of which was elevated by its relatively independent action during and after the conflict between Qadhafi and the opposition, and the Sirte Oil Company.

In the wake of Qadhafi's demise, the organization of Libya's oil sector is in flux and could change

considerably depending upon the outcomes of political processes that have yet to run their course completely. Significant changes to the governance of the energy sector are unlikely to be consolidated prior to elections, the installation of a new government, and the rewriting of a constitution. The most significant unanswered questions pertain to the respective authorities of NOC and the newly constituted ministry of oil; the relationship between NOC and its subsidiaries, particularly AGOCO; and the balance of power between the federal government and regional actors, especially in the wake of agitation for greater autonomy in the oil-rich region of Cyrenaica in which AGOCO operates.

Many IOCs have operations in Libya, the upstream activities of which are detailed more extensively in the Exploration and Production section to follow. IOC involvement in Libya experienced a resurgence in the mid-2000s as various rounds of sanctions were lifted by the United States and United Nations. Companies were lured by the country's bountiful resources, which outweighed regulatory uncertainties and the fact that contractual terms of the EPSA-IV (2005) licensing round were unfavorable to foreign investors. Now, IOCs are confronted with new types and unexpected degrees of political risk in Libya, which depending on how they are resolved could either make Libya a much more promising or more perilous place for foreign investors.

In the short-term, IOC involvement in Libya will depend on resolution of the aforementioned political issues, operational security, and the extent to which the new government maintains the relationships of the old, or reorients them in favor of perceived allies. Libyan officials have often attempted to reassure IOCs that they would honor the sanctity of existing contracts, while also reserving the right to review and revise those that were secured through corrupt practices. In recent months, both U.S. and Libyan authorities have announced investigations into improper dealings between the prior regime and some IOCs that dealt with it.

Exploration and Production

Prior to the onset of hostilities, Libya had been producing an estimated 1.65 million barrels per day (bbl/d) of mostly light, sweet crude oil. Libya's production capacity had increased over the previous decade, from 1.4 million bbl/d in 2000 to 1.8 million bbl/d in 2010, but still remained well below peak levels of over 3 million bbl/d achieved in the late 1960s. Though Libya produced below nameplate capacity, output exceeded the country's OPEC target of 1.47 million bbl/d. Libya also produced an estimated 140 thousand bbl/d of non-crude liquids, which include lease condensate and natural gas plant liquids.

Libya's oil sector suffered from months of production shut-ins after civil unrest commenced in February 2011, and only began to recover in September of that year. As of May 2012, crude oil production had been restored to an estimated 1.4 million bbl/d – an impressive pace of recovery when juxtaposed against the challenges faced by authorities and operators, the initial skepticism of most outside analysts, and other countries' past experience with restoring production after a significant disruption.

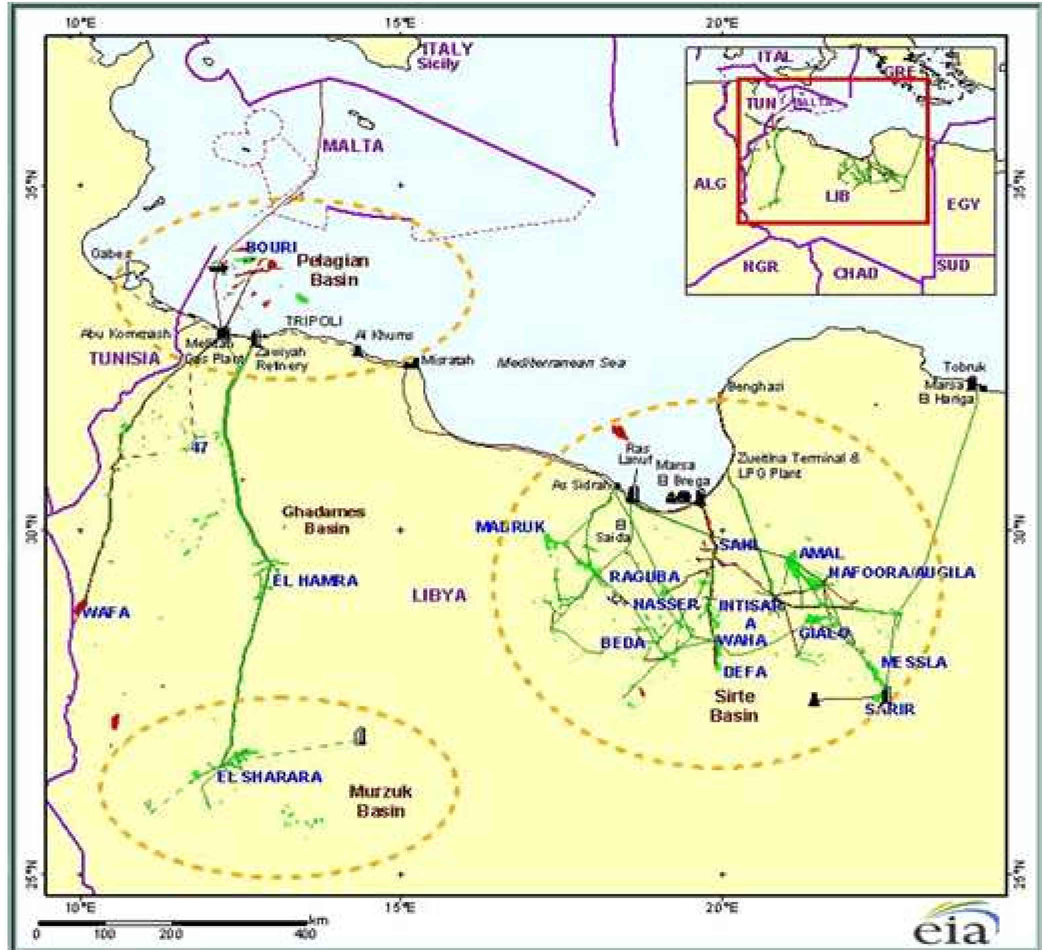
Libyan employees of national and international oil companies have successfully restored oil production to something approaching its pre-crisis levels. However, there are concerns that the drive to ramp-up production as fast as possible has deferred routine and non-routine maintenance, which could cause production to stagnate or even fall slightly in the coming months.

The consensus opinion among energy analysts is that foreign capital and expertise need to return to sustain output at pre-crisis levels or increase it further, but the permanent return of staff and commitment of additional resources is contingent on a more favorable security environment and greater political certainty. For similar reasons, upstream exploration has been limited in the current environment – particularly by foreign firms – and is likely to remain so until the sector finds a firmer footing. This too could impact Libyan oil production in the near to mid-term, as new projects will eventually be needed to offset decline in existing fields. In 2010, NOC targeted an increase in Libya's crude oil production to 2.5 million bbl/d by 2015. Now, its near-term priority is to consolidate a return to pre-crisis production levels, followed by a more modest yet still ambitious target of 2 million bbl/d over the next five years.

Detailed information on the current status of Libya's upstream oil sector is presented in the following paragraphs, in which the country's complex assortment of fields, crude grades, infrastructure, and fiscal arrangements are organized by company or joint venture. Broadly speaking, about two-thirds of Libyan oil production comes from fields in the eastern part of the country (geologically, these fields are part of the Sirte Basin), followed by 25 percent in the southwest (Murzuq Basin), and most of the remainder from the offshore Pelagian Shelf Basin near

Tripoli (there are also small fields in the western Ghadames basin).

Map of Selected Oil Infrastructure in Libya



Source: Wood Mackenzie, U.S. Energy Information Administration

Arabian Gulf Oil Company (AGOCO): AGOCO operates in the eastern region of Cyrenaica, which was a key center of resistance to Qadhafi. The profile of this Benghazi-based NOC subsidiary increased significantly following its relatively early defection from the regime in support of the insurgency. AGOCO claims at least 400 thousand bbl/d of pre-crisis oil production capacity, the largest of any foreign or domestic firm in Libya. Its most significant fields, Sarir (approximately 200 thousand bbl/d nameplate capacity, and also the name of a marketed crude grade) and Messla (approximately 100 thousand bbl/d) are located in the Sirte basin. Related downstream infrastructure includes the Ras Lanuf refinery and Marsa al-Hariga (Tobruk) terminal. There were reports of sporadic AGOCO production during the conflict, while almost all other Libyan production was shut-in, but the firm began to restore production in earnest in September 2011. As of May 2012, production stood at an estimated 350 thousand bbl/d. Impediments to full production include technical problems related to pumps and power supplies and a small, short-lived, but symbolically significant disruption to production in May 2012 when company headquarters were blocked by protestors.

Waha Oil Company ("Oasis"): The Waha consortium consists of American firms ConocoPhillips, Marathon, and Hess, in partnership with NOC. Waha's total production capacity is more than 350 thousand bbl/d, which is divided among a number of loosely defined fields that analysts often refer to by different names. According to the Waha Oil Company, the four main fields in order of production size are Waha, Gialo, Dahra, and Samah. Waha-operated fields, which are all located in the Sirte basin, were among the last to restart, in late 2011 and early 2012. Production had been hindered by a labor strike and infrastructural damage, particularly to its export outlet at the Es Sider terminal. Nonetheless, it has since risen rapidly to around 300 thousand bbl/d. Projects in the Waha pipeline include North Gialo and NC-98, which are each scheduled to come online over the next decade.

Repsol and Akakus Oil Operations: Repsol, a Spanish company, operates in Libya through Akakus Oil Operations, a consortium that includes 50 percent ownership by NOC and smaller stakes by other international oil companies. The company's significant production capacity of approximately 350 thousand bbl/d includes El Sharara, which restarted in October 2011 and is also the name of a high-quality grade of crude oil. Repsol fields are located in the Murzuq basin in Libya's southwest, an area over which federal authorities have little control. Indicators of the region's security situation include reports that militias are securing oil fields, and the brief kidnapping of an Akakus official. Despite considerable challenges, production from Akakus fields is thought to total 300 thousand bbl/d as of May 2012. Related downstream infrastructure includes the Zawiyah refinery and export terminal near Tripoli.

Eni and Mellitah Oil & Gas: Eni's Libyan ventures include various arrangements with NOC through Mellitah Oil & Gas, which are occasionally referred to as Agip. The Italian firm's involvement spans the country. Its largest field, Elephant (El Feel), is in the Murzuq basin. Elephant produces a grade of crude oil marketed as Mellitah, the flows of which restarted in November 2011, despite some looting and conflict-related damage to support facilities. The Sirte Basin fields operated by Eni, which include Bu Attifel and a similarly named crude grade exported through the Zueitina terminal, were among the first to restart after hostilities abated in September 2011. Eni also operates the Bouri field and various condensate fields in the offshore Pelagian basin. The Eni-operated NC-118 block in the Ghadames Basin is one of the few new projects currently proceeding, but has a projected peak production capacity of only 10 thousand bbl/d. Eni's oil production capacity is just over 300 thousand bbl/d, of which nearly 50 thousand bbl/d is condensate and the remainder is crude. In 2009, the Libyan government invested in Eni and a former executive of the company's joint venture, Abdul-Rahman Ben Yezza, was named interim oil minister in November 2011.

Wintershall: The German company operates through a joint venture with NOC that also includes equity stakes by Gazprom of Russia. Its main fields are As Sarah and Nakhla, which are also referred to as the NC96 and NC97 fields, in the Sirte Basin. Crude oil production capacity is just over 100 thousand bbl/d; since restarting in October 2011, actual production has been below capacity due to significant damage to the Ras Lanuf export terminal and the aging pipeline infrastructure that connects Wintershall fields to it.

Suncor and Harouge Oil Operations: Harouge is the name of the joint venture of NOC and Canada's Suncor (the company's Libya arm is often referred to as PetroCanada, even though that firm merged with Suncor in 2009). Harouge operates various fields in the Sirte basin, of which Amal is the most significant and also a gathering point for other smaller fields. Current production is thought to be slightly below full capacity of approximately 100 thousand bbl/d. Harouge production of Sirtica-grade crude oil is exported through the Ras Lanuf terminal.

Sirte Oil Company: Like AGOCO, Sirte Oil Company is a NOC subsidiary that operates in the eastern Sirte basin. It operates the Al-Ruqhubh and other fields, with a total production capacity of at least 100 thousand bbl/d.

Total and Mabruk Oil Operations: The joint venture between French firm Total and NOC is incorporated as Mabruk Oil Operations. It was the first of the foreign consortia to restart operations as the Libyan civil war entered its final phases in the autumn of 2011. The offshore Al Jurf field, which has a capacity of 45 thousand bbl/d and includes participation by Wintershall, restarted in September. Statoil has a stake in Total's Mabruk field in the Sirte basin, which is even smaller. The joint venture's total production capacity is roughly 70 thousand bbl/d.

Occidental, OMV, and Zueitina: The Zueitina consortium is a partnership between NOC, the U.S. firm Occidental, and Austria's OMV, of which the latter has the smallest stake. Zueitina's crude, which is produced in the Sirte basin, is marketed as a grade of the same name via Ras Lanuf. Production capacity is approximately 60 thousand bbl/d, but current output is limited to approximately three-quarters of that due to pipeline issues and a lack of gas for reinjection.

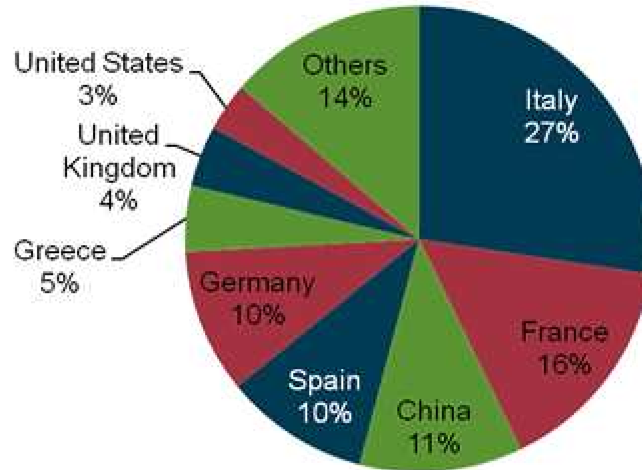
MedcoEnergi: This Indonesian firm is not currently producing in Libya. However, it is partnering with NOC and the Libyan Investment Authority as the operator of Area 47, one of the few significant projects projected to come online over the next five years. Peak production capacity of Area 47 is supposed to be between 50 and 100 thousand bbl/d.

Consumption and Exports

With domestic consumption estimated at roughly 300 thousand bbl/d, and total oil production at 1.8 million bbl/d, Libya's net exports were estimated to be approximately 1.5 million bbl/d in 2010. The vast majority of Libya's oil is sold to European countries, namely Italy, France, Germany, and

Spain. Its oil exports to nearly all destinations plummeted in 2011, along with production, but have since revived.

The United States began to import oil from Libya in 2004, after sanctions were lifted. The United States imported an average of 70 thousand bbl/d from Libya in 2010 (of which 43 thousand bbl/d was crude) and 15 thousand bbl/d in 2011, relative to 2007 highs of 117 thousand bbl/d.



Sources: Global Trade Atlas, U.S. Energy Information Administration

Export Terminals

Libya uses several terminals to export crude oil, some of which were severely affected by the conflict of 2011. In addition to the following terminals, the Farwah floating production, storage, and offloading (FPSO) unit is used for exports from the Al Jurf field and the offshore Bouri terminal is used for exports from the field of the same name.

Es Sider (As Sidrah): This terminal, Libya's largest, came under direct attack as battles raged between loyalist and opposition forces in 2011, and there were reports of damage to its storage tanks, metering equipment, and a feeder pipeline. It has been operational since the beginning of 2012 due to temporary fixes, but significant repairs are believed to be necessary in order for it to perform at full capacity on a sustained basis. Prior to the fighting, this terminal exported approximately 350 thousand bbl/d from the Waha concession.

Ras Lanuf: Ras Lanuf, which is situated between Es Sider and Marsa El Brega, was also in the line of fire and is reported to have sustained damage to its power supply, control rooms, and storage tanks. Though now at least partially operational, damage to Ras Lanuf and problems with the pipeline to it has constrained production from the Zueitina consortium, the Harouge joint venture, and Wintershall.

Marsa El Brega: Like other terminals servicing production from the Sirte basin, Marsa El Brega was affected by the fighting, with several storage tanks set afire. However, there were reports that its operations were restored in January 2012.

Zueitina: This terminal, east of Marsa El Brega of the Gulf of Sirte, is fed by the Attifel and Zueitina streams and accounted for close to 150 thousand bbl/d of exports in 2010.

Zawiyah (Tripoli): Oil production for the Zawiyah export terminal is the Sharara blend produced by Akakus Oil Operations in the Murzuq basin. Exports in 2010 were estimated to be close to 200 thousand bbl/d.

Marsa El Hariga (Tobruk): Oil from eastern fields controlled by AGOCO, including Messla and Sarir, is exported via pipeline to the Marsa El Hariga terminal in Tobruk. AGOCO was able to export at least two shipments of oil via Tobruk during the conflict.

Mellitah: Through its joint venture with NOC,Eni exports liquids via the Mellitah Oil & Gas plant, which is also the starting point for the Greenstream natural gas pipeline. A significant amount of

the oil exported through Mellitah is assumed to be condensate.

Refining

According to *OGJ*, Libya has five domestic refineries, with a combined capacity of 378 thousand bbl/d.

Ras Lanuf: This export-oriented refinery on the Gulf of Sirte, Libya's largest at 220 thousand bbl/d of crude processing capacity, is also the only one to remain offline as of mid-2012. Target restart dates have been repeatedly pushed back; the reasons proffered for the delay have varied, from previously insufficient production from feedstock grades or fields (Sarir and Messla) to damage to storage tanks during last year's fighting. The current operator is the Libyan Emirati Refining Company (LERCO), a joint venture between NOC and the Dubai-based Al-Ghurair business conglomerate. The refinery was completed in 1984, but the current operator has expressed an intention to increase and upgrade the refinery's capacity in the coming years.

Zawiyah: Libya's second-largest refinery, with a capacity of 120 thousand bbl/d, is also the only significant one near the capital of Tripoli. Until an August 2011 attack on the pipeline that connects southwestern fields to the refinery, its production had been maintained in order to supply loyalists with fuel. The refinery's production gradually recovered thereafter, before being declared fully operational in November 2011. It is operated by Zawiyah Oil Refining Co., a subsidiary of NOC.

Tobruk: Near Libya's eastern border, Tobruk is reported to run on crude oil from Sarir, one of the first fields to restart after the conflict. Most sources report Tobruk's capacity as 20 thousand bbl/d, but the operator claims a capacity of 120 thousand bbl/d.

Sarir: Like Tobruk, Sarir is operated by an affiliate of AGOCO and is reported to be processing crude pumped from the field of the same name. It is a topping facility with a capacity of only 10 thousand bbl/d.

Marsa El Brega: The oldest refinery in Libya, the Marsa El Brega refinery has a crude processing capacity of 8 thousand bbl/d. It is operated by Sirte Oil Company.

Libya's refining sector was impacted by UN sanctions, specifically UN Resolution 883 of November 11, 1993, which banned Libya from importing refinery equipment. Libya is seeking a comprehensive upgrade to its entire refining system, with a particular aim of increasing output of gasoline and other light products.

Overseas Investment

Libya also has refinery operations in Europe through its overseas oil retail arm, Tamoil. Tamoil claims refineries in Germany, Italy, and Switzerland, as well as distribution networks in those countries, Netherlands, and Spain.

Natural Gas

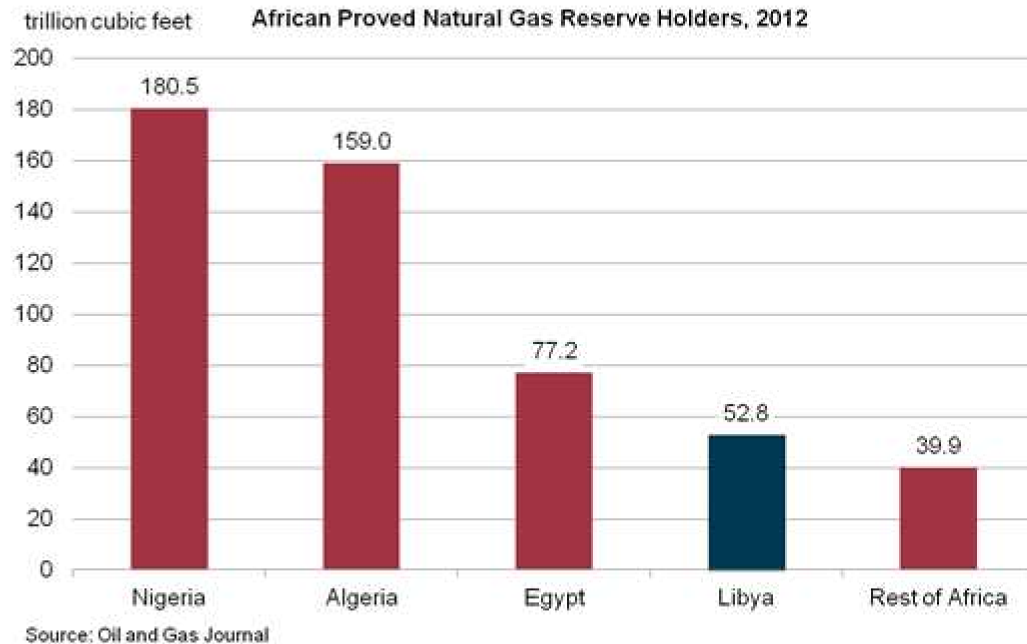
Libyan natural gas production and exports increased considerably after 2003, with the development of offshore fields and opening of the Greenstream pipeline to Europe, but were temporarily disrupted by the civil unrest of 2011.

Overview

As with its oil sector, Libya's natural gas industry is recovering from disruption related to the civil unrest and political upheaval that began in 2011. Libya's rank as a producer and reserve-holder is less significant for natural gas than it is for oil. Most of its natural gas production is exported, almost entirely to Italy via pipeline.

Reserves

As of January 1, 2012, Oil and Gas Journal estimated that Libya's proven natural gas reserves were 52.8 trillion cubic feet (Tcf), a decline of almost 2 Tcf from the levels of a year before. Prior to the transformative events of 2011, new discoveries and investments in natural gas exploration had been expected to raise Libya's proved reserves in the near-term.



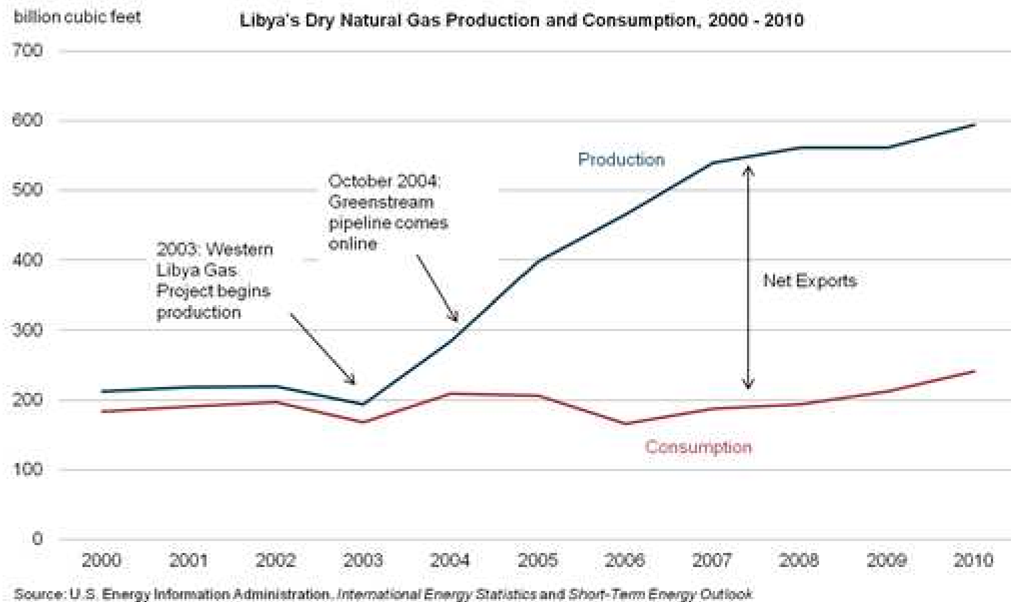
Sector Organization

Many of the same entities involved in oversight and operations of the oil industry exercise similar functions for natural gas. Likewise, some of the same questions and uncertainties about the future are equally applicable to both sectors. Libya's natural gas sector is mostly state-run, by NOC and its Sirte Oil Company subsidiary. International oil companies are less involved in natural gas production than they are in oil production, though Eni is a notable exception due to its stake in the large Western Libya Gas Project. Other companies, including BP, Shell, and ExxonMobil, engaged in exploration prior to the onset of hostilities in February 2011. While BP recently lifted *force majeure* on its activities in Libya, Shell announced its withdrawal from the country due to disappointing results from exploration wells.

Exploration and Production

Libya's natural gas production has grown substantially in the last few years. According to EIA, Libya produced 1,069 billion cubic feet (Bcf) of gross natural gas in 2010, of which 825 Bcf was marketed and 594 Bcf of that was dry natural gas (the fourth largest output of any African state). Approximately half of the remainder (120 Bcf) was re-injected to enhance oil recovery and a roughly equal amount was vented or flared. As with oil, Libyan natural gas production was almost entirely shut-in for sustained periods in 2011, but has since recovered quickly.

The Western Libya Gas Project (WLGP), which is operated by Eni and NOC through the Mellitah Oil & Gas joint venture, accounts for most Libyan natural gas production growth since 2003. In 2007, it attained a production rate of nearly 1 Bcf per day in 2007, a level that operators intend to sustain for the next decade and which currently comprises more than half of the country's dry gas output. The WLGP includes the offshore Wafa and Bahr Es Salam fields. The vast majority of the gas produced from WLGP is exported via the Greenstream pipeline. Most other natural gas in Libya is produced by NOC and its Sirte Oil Company subsidiary in the onshore Sirte Basin.



Prior to 2011, the NOC announced intentions to significantly increase the country's natural gas production. New or expanded projects to support this goal include associated oil and gas fields in various stages of development, most notably Faregh, operated by Waha in the Sirte Basin, and Mellitah's offshore Bouri field. Increased natural gas production would facilitate an expanded use of natural gas in the power sector in order to free up more oil for export, while also maintaining and expanding existing pipeline and liquefied natural gas exports. However, like all prospective oil and gas plans in Libya, greater development of the natural gas sector is contingent upon support and certainty from the new political order.

Consumption and Exports

In 2010, Libya consumed an estimated 242 Bcf of dry natural gas. This satisfied just over one-quarter of Libya's energy consumption needs, a share that has remained relatively constant over the last decade. Natural gas accounted for about 40 percent of Libya's generated electricity as of 2009, according to the International Energy Agency, with the remainder attributable to oil.

With only about 40 percent of Libya's dry natural gas supply consumed domestically, the remainder is available for export. Most of Libya's natural gas exports are transported via pipeline to Europe, with small volumes also shipped in the form of liquefied natural gas (LNG). Libya exported 352 Bcf of natural gas in 2010, relatively unchanged from 2007-2009 levels.

Greenstream

Libya's capacity to export natural gas increased dramatically after October 2004, when the 370-mile Greenstream pipeline came online. The pipeline starts in Mellitah, where natural gas piped from the Wafa concession and offshore Bahr Es Salam fields is treated for export. It then runs underwater to Gela, on the island of Sicily, whence the natural gas flows onward to the Italian mainland. The Greenstream pipeline is operated by Eni in partnership with NOC. According to PFC Energy, total capacity has been 11 billion cubic meters (388 billion cubic feet) per year since a capacity expansion in 2007.

Natural gas exports via Greenstream were completely suspended in March 2011 due to the conflict and resumed in the autumn of that year. Exports have increased steadily since then and, according to Italian import data, stood at roughly three-quarters of pre-crisis levels as of April 2012.

Liquefied Natural Gas (LNG)

In 1971, Libya became the second country in the world (after Algeria in 1964) to export LNG. Since then, Libya's LNG exports have remained low, largely due to technical limitations.

Libya's only existing LNG plant, built in the late 1960s at Marsa El Brega, is owned by NOC and operated by Sirte Oil Company. However, it has been offline since February 2011 as a result of damage sustained during the civil war. According to PFC Energy, its nameplate design capacity is 3.2 million tons per year, but exports have averaged less than one-third of that level since operations began. One reason for the low output is that the plant lacks the requisite technology to separate some natural gas liquids from the LNG stream, which also limits the number of receiving

terminals that are able to process it. Libyan LNG had been mostly exported to Spain, but only on a spot basis in recent years due to a failure to meet the levels stipulated by earlier long-term contracts.

The status of two proposed greenfield LNG projects, which would not come online until after 2015, is highly uncertain, particularly in light of the damage to Marsa El Brega and other issues that could affect the availability of natural gas feedstock. In both projects, NOC would partner with an IOC: Eni for Mellitah LNG and Shell for Ras Lanuf LNG. However, Shell's recent decision to withdraw from exploration activities in Libya could hinder plans for the latter.

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