

**Summary of Update, Example Field Analysis,
Contents, List of Figures, List of Tables (Partial), Index (Partial)**

This is the 14th Edition of our Report on Iraq's oil
and gas Industry. This report contains 985 pages
and includes data on 127 fields



**Iraq
Oil and Gas Industry
Strategic Report**

By



**14th Edition
October 2024**



Our Product Clients



Introduction

The 14th Edition of our Iraq Oil and Gas Industry Strategic Report provides a comprehensive analysis of the entirety of Iraq's Oil and Gas Industry - encompassing its upstream, midstream, downstream and infrastructure elements.

The primary focus of the report is Iraq's upstream sector. This sector is analysed on a basin by basin format, providing basin and overall resource inventories, data sets for oil and gas fields (both developed and undeveloped) and an assessment of exploration potential.

Iraq is regarded as one of the most prospective oil and gas acreage available in the world today, with the status of its Oil and Gas licensing continually evolving and developing through more bidding rounds.

Highlights of the 14th Edition

The 14th Edition of the Iraq Strategic Report is an update of the 13th Edition and this update reflects the current Oil and Gas industry situation in Iraq. It is a significant expansion of data when compared to the 13th Edition. It is the result of a comprehensive re-assessment of the Oil and Gas Industry in Iraq up to third quarter of 2024. The latest Edition includes the following:

- 985 pages hard copy of the Iraq Strategic Report
- A total of 127 individual fields have been reviewed and updated. The following aspects of oil and gas exploitation are covered for each field:
 - Details of the exploration history and past developments carried out for each field in Iraq
 - Updated reserves and resources estimate for each field using PRMS standards
 - Outline Field Development Plans and costs estimates for each field in Iraq
 - All the fields have had their upstream and midstream content fully reappraised and major revisions have been incorporated into this edition of the Report
 - Operation cost estimates for each field in Iraq
 - In addition to this major update, the Class 5 costs estimation carried out for all the fields reflect price changes within Iraq's Oil and Gas Industry.
 - Up to date historical production volumes for all fields in Iraq
 - Couple of years production forecast for all fields in Iraq
- Information on all onshore and offshore fields and blocks which were offered in Iraq's licensing rounds:
 - Naft Khana – Five fields (Naft Khana, Nau Doman, Jaria Pika, Tel Ghazal)
 - Huwaiza – One field (Huwaiza)
 - Sindbad – One field (Sindbad)
 - Khidher al-Mai – Four fields (Rachi, Jerishan, Khidher Al Mai)
 - Gilabat-Qumar – Two fields (Gilabat, Qumar)
 - Injana-Khashm Al Ahmar – Two fields (Injana, Khashm Al Ahmar)
 - Fao
 - Jebel Sanam
 - Shihabi
 - Zurbatiya

Report Structure

Our report and map products offer our clients an accessible way to track these developments and provide comprehensive information on Iraq's licensing and Oil and Gas infrastructure.

The 14th Edition of Bayphase's Iraq Oil and Gas Industry Strategic Report provides a comprehensive review of Iraq's Oil and Gas Industry, which encompasses the following elements:

- **Upstream:** Oil and Non-associated Gas Fields and Production Facilities
- **Midstream:** Pipelines, Terminals
- **Downstream:** Refineries, Petrochemical Plants, Gas Processing Plants
- **Infrastructure:** Power Generation, Transportation

Our Iraq Strategic Report categorises the report into the following three main sedimentary basins:

- **Northern Folded Zone**
- **Mesopotamian Basin**
- **Western and Southwestern Deserts**

Analysis and detailed data sets for a total of 127 oil and non-associated gas fields is provided, including those fields which are currently in production and others which are undeveloped and awaiting investment.

Report History

- 14th Edition October 2024 – 985 pages
- 1st Edition March 2003 - 250 pages

Included with Each Purchase

- A Hard Copy of our current **Iraq Oil and Gas Industry Strategic Report**
- A Free Searchable Printable and Extractable PDF of our current **Iraq Oil and Gas Industry Strategic Report**
- A Hard Copy of our current **Iraq Fields Database**
- Excel Data Base of our current **Iraq Fields Database**

Our report is supplied in both electronic format and as a hard copy. The electronic version is provided as a PDF document on a CD-ROM, and the hard copy is supplied as a sure-bound document. Both copies of the report will be delivered via FEDEX.

Clients who order the 14th Edition of our Iraq Strategic Report will receive electronic updates to the report as they are issued for 12 months following the start of their subscription. These clients will also receive a hard copy of the 15th Edition of the Report upon its scheduled release date.

As an example of our Analysis, the assessment we have made for the Tawke field is provided below:

3.1.1.4.1.17 Tawke

The Tawke oilfield is located in northern Kurdistan, close to the border with Turkey in the High Folded Zone of the Zagros Fold Belt. It covers an area of approximately 25x3km and is contained in a detached fold-thrust anticline structure which is well defined on 3D seismic. To date, approximately 52 wells have been drilled, and in general production has declined since 2015.

Oil is produced from multiple reservoirs in the structure including the Late Eocene aged Pila Spi Formation, the Campanian-Maastrichtian Shiranish Formation and the Aptian-Albian Qamchuqa Formation and most recently (since 2016) the Mio-Pliocene Jeribe Formation. All of them are carbonate reservoirs. Also reported from one well (Tawke-17) is hydrocarbon encountered in the Mid Jurassic Sargelu Formation but as of 2017 it is not thought that this horizon is a major producer at all. In any case, the vast majority of the production is from the Cretaceous reservoir systems in fractured carbonates. The gross thickness of the Cenozoic reservoir is 180m and the gross thickness of the Cretaceous reservoirs is 900m. Both Cenozoic and Cretaceous reservoirs flow 24–27°API oil with a very low gas content.

In terms of resource volumes, DNO reported that the 2020 year-end gross 1P *Reserves* for the field stood at 173.2MMbbls, 2P at 268.5MMbbls and 3P at 404.1MMbbls. 2C Contingent Resources for the field were quoted at 17.7MMbbls.

Key Field Data

DNO was the first western company to drill for oil in post war Iraq, under a 2004 deal with the Kurdistan Regional Government. In April 2006 twin wells Tawke-1 and Tawke-1A (just 20m apart) drilled in the crest of the structure and tested approximately 5,000bopd from shallow Eocene Jeribe Formation carbonates. Tawke-1 also encountered deeper Cretaceous hydrocarbons but did not carry out a full test on them. In June 2006 located 2km further west, Tawke-2 tested 3,840bopd from the Jeribe Formation. These results were used as the basis for an early production plan, which was approved by the Kurdistan Regional Government. The Tawke-2 appraisal well confirmed the western extension of the Tawke structure.

Tawke-3 tested the deeper Cretaceous reservoirs, which were encountered in Tawke-1 and recovered an aggregate 9,000bopd.

In January 2007 Tawke-4 located 800m northeast of Tawke-1 tested 8,500bopd from a 2in choke.

Tawke-5 located 1.1km east of Tawke-4 recovered a maximum of 9,860bopd and a EWT average of 4,500bopd over two days.

Tawke-6 located 2.7km southwest of Tawke-5 was completed as a producer and not as a water injection well as originally envisioned.

In August 2007 Tawke-8 tested the deeper Cretaceous reservoirs and recovered 8,000bopd from its 'most productive horizon', and an aggregate of 17,000bopd from all tested horizons.

A year later in September 2008 Tawke-9 and Tawke -10 were installed as a producer wells.

In April 2008 Tawke-11 and Tawke-12 were completed as Cretaceous producers. This completed the first phase of the field development plan, as the well capacity had exceeded 100,000bopd.

In 2009 the Tawke Field was tied into Iraq's Northern Pipeline System and full scale production commenced in June of that year, although it was halted temporarily that September.

In 2010 hydrocarbons produced from Tawke were only sold to the domestic market. Extensive down hole pressure monitoring provided new insights into the Cretaceous reservoir properties. BeicipFranlab had completed a fractured carbonate reservoir study as well to help provide more accurate volumetrics for the Cretaceous reservoir and an improved reservoir model. By this stage DNO announced that the P₅₀ STOIP for the Cretaceous was 1,536MMstb and the Cenozoic was 148MMstb.



In 2011 further work was done to enhance the reservoir model, seeing an increase in the estimated recoverable resources.

In 2012 wells Tawke-14, Tawke-14A, Tawke-18, Tawke-16 and Tawke-19 were drilled as Cretaceous producers and also helped to delineate the new areas of the field in the northern flank. At the end of that year Tawke-20 was spudded as the first horizontal well.

Tawke-16 was drilled with the objective to appraise the northern flank of the structure. The well reached a TD of 2,369m in early 2012 with gross oil column of more than 350m in the Cretaceous.

When Tawke-17 was completed in June 2013, it was the deepest well in the field at 4,775m TD. It tested the deeper prospective resources in the Jurassic and Triassic underlying the productive Cretaceous intervals. The well encountered a reservoir interval in the Jurassic Sargelu Formation, which flowed 1,500bopd of 26-28°API oil. The Triassic intervals that were tested proved to be either tight or water bearing. In July 2013 Tawke-20 was completed and set the record for production at Tawke at 25,000bopd, having flowed 8,000bopd from each of the ten fracture corridors in the Cretaceous reservoir. In September Tawke-23 (also horizontal) located 6km away from Tawke-20, encountered continuous oil shows through 930m of horizontal section in the Cretaceous and tested 32,500bopd - a record for the field.

In 2014 five horizontal wells were drilled bringing the total number of wells to 28 with 26 producers. Tawke-24, Tawke-25, Tawke-26, Tawke-27 and Tawke-28. These wells flowed at a rate of about 9,000bopd. A second 3D seismic acquisition programme was also carried out over the field area in 2014.

Figure 3.47: Schematic Profile Along Strike of the Tawke Field

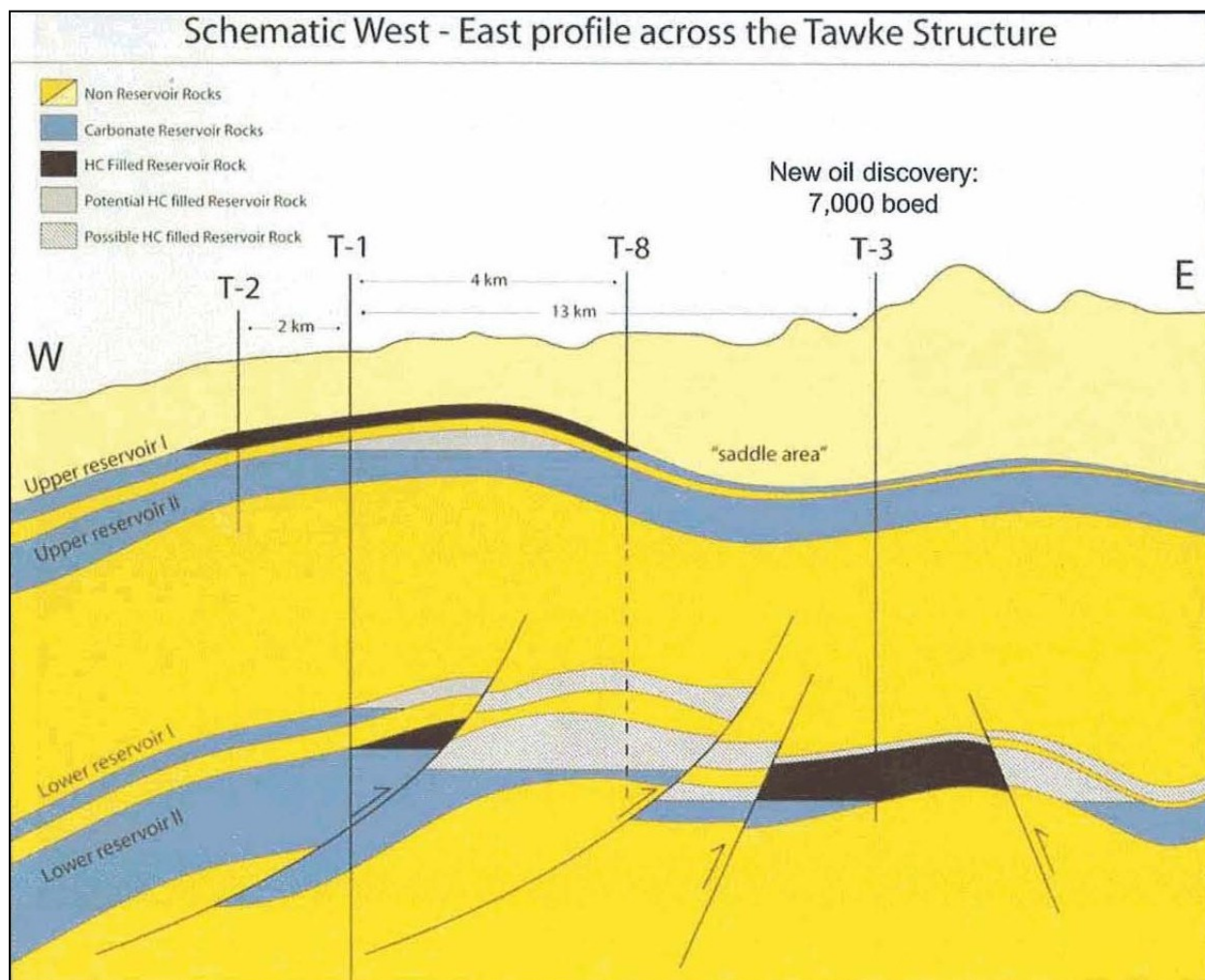


Figure 3.48: Interpreted Seismic Dip Section of the Tawke Field

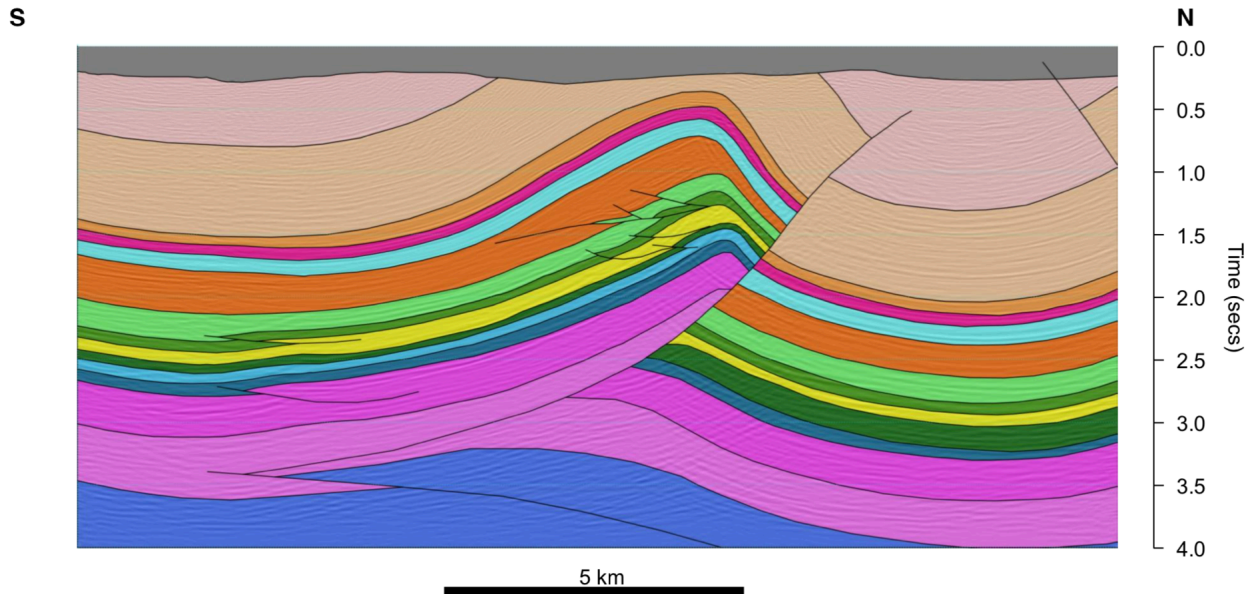


Figure 3.49: Tawke Top Cretaceous Map Cross section C-D in Figure 3.50

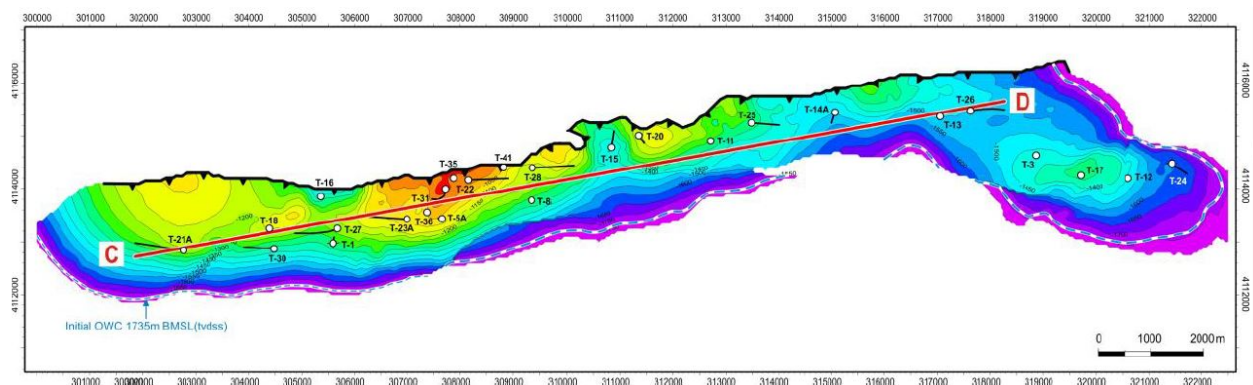
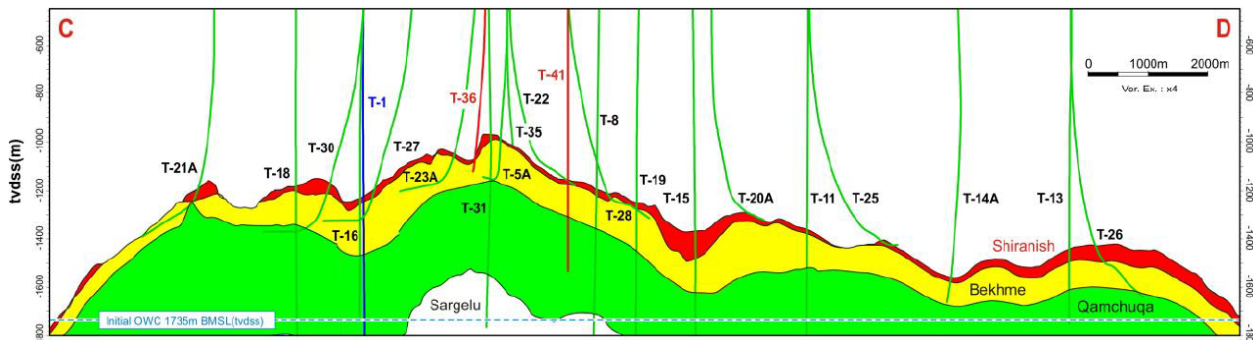
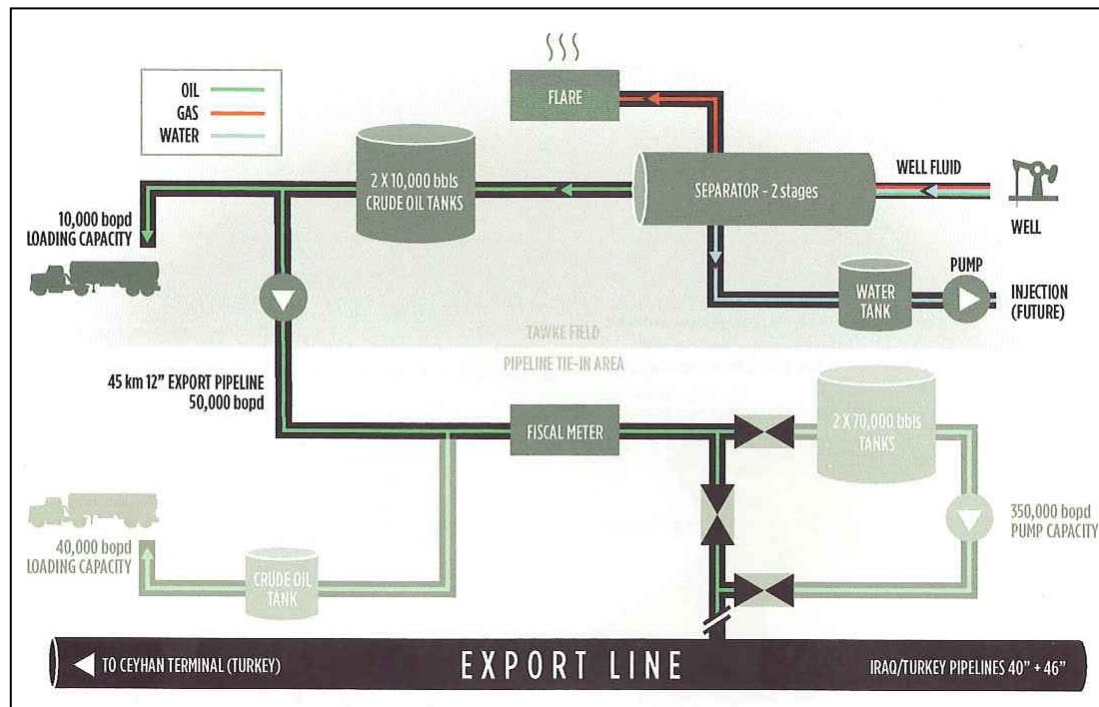


Figure 3.50: Tawke Cross Section C-D Along the Long Axis of the Structure.



In 2015, 44km of 24in export pipeline to Fish Khabour was completed as well as the construction of two new early production facilities to supplement the existing central processing facility which had a 120,000bopd capacity. The facility capacity was increased to 200,000bopd and a record level of 186,000bopd was achieved in May 2015. In the same year, 10 new horizontal wells were drilled, which doubled the production.. Overall production had a mean average of 144,490bopd in 2015. However, production has since declined. DNO's field development plan is diagrammatically represented in the figure below.

Figure 3.51: Tawke Project Development Scheme



In 2016 four production wells (Tawke-31, Tawke-33, and Tawke-34 & Tawke-37) and one water injection well (Tawke-32) were drilled. The objective of Tawke-31 was to become a producer well from the Cretaceous reservoir like previously drilled wells. The four other wells were much shallower and far less expensive, as DNO began to target production from the Miocene Jeribe Formation, which is the formation where the discovery was made in 2006, but had never been developed. These four Jeribe wells were drilled for a cost of 6MillionUSD and they helped to increase production at the field by 10% or approximately 10,000bopd. Overall however production was down in 2016 (107,299bopd were achieved) due to reduced drilling activity in 2015, which was a knock-on effect of the low oil price since 2014.

In 2017 five additional Cretaceous producer wells were drilled (Tawke-35, Tawke -36, Tawke-41, Tawke-42, Tawke-43), two Miocene Jeribe producer wells (Tawke-38 and Tawke-39), as well as one water injection well into the Jeribe (Tawke-40).

A similar drilling campaign was conducted in 2018. This included the Tawke-50 production well, which was drilled into the shallow Jeribe Formation, to a depth of 320m.

Another drilling campaign was implemented in 2019, with a total of 18 wells drilled in the license (Tawke and Peshkabar fields), five of which at Tawke. The field is reported to have produced an average of 71,700bopd in the first quarter of 2019. This production benefited from the Receivable Settlement Agreement and as such a positive impact on the cash flow. A fourth rig, Viking-11, was added to support a 13 wells program in the Tawke Licens in the second quarter of 2019, including a deep well to test the Jurassic potential at Tawke field. DNO reported an average production of 68,600bopd from the Take Field in 2019, with wells drilled 2018 contributing 13 percent of field production (approximately 7,500bopd) at the years end.

Monthly entitlement and override payments were withheld early in 2020 by the Kurdistan Regional Government (KRG) which was itself hit by lower oil revenues and economic dislocations caused by the Covid-19 pandemic. After a four-month hiatus, entitlement payments were resumed in March 2020 and override payments resumed in January 2021. The KRG has put a plan in place to make payments towards DNO's arrears (259MillionUSD) such that if Brent prices exceed 50USD/bbl in any month, the incremental revenue will be shared 50-50 between the KRG and the Tawke license partners. Discussions continue to further improve the terms of recovery of the arrears.

The 110MillionUSD Peshkabir-to-Tawke gas injection project designed to increase oil recovery rates at Tawke while eliminating flaring at Peshkabir came on-stream in September 2020 (a delay from the planned completion in March 2020). It was intended to decrease CO₂ emissions from DNO's operated fields in Iraq from an average 14 to 7kg/boe produced, compared to an average of 9kg/boe on the Norwegian Continental Shelf and a global average of 18kg/boe. This compares to the target set by a group of 12 of the world's largest oil companies comprising the Oil and Gas Climate Initiative (OGCI) to reduce the average carbon intensity of their aggregated upstream oil and gas operations to between 20-21kgCO₂e/boe by 2025 from a collective baseline of 23kgCO₂e/boe in 2017.

Engineering and construction were launched in mid-2018 and commissioning completed in mid-2020 in what is the first gas capture and storage project in Kurdistan. Some 20MMscfd of previously flared gas at the Peshkabir field is gathered, treated and transported 80km by pipeline to the Tawke field where it is injected for storage and reservoir pressure recharging. Gas flaring at the Peshkabir field has been reduced by over 75 percent, with work underway to reduce it further. Any Peshkabir field injected gas produced at the Tawke field will be recovered and recycled into the latter or used as fuel to displace diesel. Reservoir models suggest gas injection will increase gross Tawke field recoverable volume by 15 to 80MMstb of oil, of which 23MMstb are included in the gross proven and probable (2P) Tawke field reserves.

Below we present the Key Field Data gathered for the Tawke Field.

Table 3.85: Tawke Key Field Data			
Parameter			Value
Discovery Date			2004
On-stream Date			July 2009
Reserves	Original	Oil (MMstb)	777
		Gas (MMMscf)	35
	Remaining	Oil (MMstb)	213.96
		Gas (MMMscf) ¹²¹	32.09
Contingent Resources		Oil (MMstb)	17.7
		Gas (MMMscf)	0
Prospective Resources		Oil (MMstb)	51
		Gas (MMMscf)	10
Production	Current	Oil (bopd)	30,684
		Gas (MMscfd)	12 (estimate)
	Potential	Oil (bopd) ¹²²	60,000
		Gas (MMscfd)	17 (estimate)
Geology	Producing Horizon(s)		Jeribe (Mio-Pliocene)
			Pila Spi (late Eocene)
			Shiranish (Camp-Maas.)
			Qamchuga (Apt-Albian)
	Rock Type(s)		Fractured Carbonates
	Reservoir Depth (m)		Upper Reservoir 300-400m Lower Reservoir 2000-2500m
	Porosity (%)		Shiranis - 16 Qamchuga - 14
	Permeability (mD)		Shiranish – 400 Qamchuga - 40
Fluid Properties	Oil	Gravity (°API)	Shiranish –24 –27° Qamchuga - 24-27°
		Sulphur Content (wt%)	2.6-3.0
	Gas	Gas-Oil Ratio (scf/bbl)	150
		Hydrogen Sulphide Content (mol%)	-

¹²¹There is a certain amount of associated gas present, but DNO is not booking these resources as they are using the gas to enhance oil recovery.

¹²² This is based on statements reported to have been made by DNO and represents their view of production potential.

Table 3.85: Tawke Key Field Data				
Parameter			Value	
		Carbon Dioxide Content (mol%)	-	
		Molecular Weight	-	
Existing Facilities	Subsurface		<i>Total now</i>	<i>Total in future</i>
		Number of Producers	~44	52
		Number of Gas Injectors	~3	3
		Number of Water Injectors	~5	5
		Total Number of Wells	~52	60
	Surface	Separation Capacity (bpd)	200,000	
		Compression Capacity (MMscfd)	40,000	
		Acid Gas Treatment Capacity (MMscfd)	-	

A further piece of key data we have been able to establish based on in country research and production data gathered from a number of sources is the field's production history. This is presented in the table below on an average daily production basis; the table has been established largely on yearly reports released by DNO.

Table 3.86: Tawke Average Daily Oil Production History					
Year	Average Daily Oil Production (bopd)	Year	Average Daily Oil Production (bopd)	Year	Average Daily Oil Production (bopd)
2007	7,012	2014	95,255	2021	47,000
2008	7,224	2015	144,492	2022	45,065
2009	15,342	2016	107,299	2023	26,577
2010	11,780	2017	106,000	2024	30,684
2011	51,664	2018	85,360	2025 (proj.)	45,000
2012	45,477	2019	68,749	2026 (proj.)	50,000
2013	39,433	2020	57,570		

DNO's pipe export operations from Tawke started in June 2009 but were interrupted due to non-payment for oil exported from the field in September of that year. Between the years 2009 and 2013, oil production at Tawke was frequently lower than capacity due to issues with exportation licenses, costing operator DNO millions of dollars in lost potential export revenue. The field output is transported along a 24in pipeline from Tawke's main processing facility to Fish Khabur in northwest Iraq close to the Iraq-Syria-Turkey boundary tri-point. This line was completed in early 2014 to supplement an existing 12in line, and runs at a capacity of approximately 200,000bopd.

The cumulative production of Tawke oil Field reached 268MMbbls as at the end of the first quarter of 2019. In mid-December 2020 the Tawke license passed the milestone of 350MMbbls of oil produced, including 300MMbbls from the Tawke field and 50MMbbls from the Peshkabir field.

In January 2021 DNO reported that gross operated production from the Company's flagship Tawke license in the Kurdistan region of Iraq, averaged 110,300bopdbetween the Tawke and Peshkabir fields.

In 2023, the gross production from the Tawke licence, which is operated by DNO and includes the Tawke and Peshkabir fields, averaged 46,276 bopd compared to 107,101 bopd in 2022. The Tawke Field contributed 26,577 bopd as compared to 45,065 bopd produced in 2022 while the Peshkabir field contributed 19,699 bopd far less than 62,037 bopd produced in 2022.

The termination of the ITP export route on March 25, 2023, due to an arbitration ruling in favour of Iraq over Turkey over exporting Kurdish oil without Baghdad's approval resulting in the shutdown of both fields, which was the main cause of the production decline from 2022. The Tawke Field resumed production in July 2023, and the Peshkabir Field followed suit in October 2023. Gross production had essentially recovered by the end of 2023, with an average of 80,000 boepd. In response to the ITP's closure, DNO reduced operational expenditure by approximately 65% from

pre-pipeline shutdown levels. This was achieved by reducing staffing levels and curtailing drilling activity. No production has been reported for Q2 2023 due to the export pipeline being closed.

Production from the Tawke license has largely been restored after the March 2023 Iraq-Turkey Pipeline shutdown as the company continues to use road tankers to sell its oil to local trading companies on a cash and carry basis with payments deposited into Company accounts in international banks.

DNO's average production in Kurdistan reached 79,783 bopd during the Q2 2024, marking a 5% rise from Q1 2024. The output was primarily sourced from the Peshkabir and Tawke fields, which produced 49,099 bopd and 30,684 bopd, respectively.

The Company is also stepping up investments in its Tawke and Peshkabir fields, both within Tawke license, by restarting completion of three development wells that were discontinued last year as a cost saving measure following the pipeline shutdown. In addition, DNO has deployed its two own intervention rigs to conduct routine workovers, including repairing or replacing pumps, zone stimulations and cleaning out asphaltenes among low-cost, quick turnaround production enhancement measures. We have considered that these development activities will further increase oil production in the next couple of years, 2025 (45,000bopd) and 2026 (50,000bopd).

Commercial Data

DNO is the operator and has a 75% participating interest in the Tawke Block. Genel Energy has a 25% interest.

Table 3.87: Tawke Key Commercial Data			
Parameter		Value	
Contact Type		Revised Production Sharing Agreement	
Contract Effective Date		March 2008	
Operator		DNO	
Equity (%)	DNO		75
	Genel Energy		25
	Total		100

Investment Opportunity

DNO now considers this field to be mature. Clearly, the production from the field has peaked at about 145,000bopd in 2015 and has been declining since. The operator's strategy appears to be to arrest the production decline by drilling several new wells each year. In addition, a gas injection scheme involving the gas produced at the field as well as that from nearby Peshkabir (which provided the majority of the gas) has been implemented, increasing the recovery thanks to improved sweep.

In our view, the development of the field has largely been completed and the majority of the future activities will therefore be focused on drilling further producers and injectors.

The above work scope along with associated costs is detailed further in the table below. We have used our cost estimating software - **NETCOSTER** to evaluate the work scope we believe will be required to achieve the production plateau targets associated with the service contract.

Table 3.88: Tawke Development Cost Summary				
Project	Rationale	Time Frame (Years)	Cost Estimate (MillionUSD) ¹²³	
			Low	How
Subsurface				

¹²³ The cost ranges reflect the uncertainty associated with the actual work scope that will have to be implemented. At this stage, not enough is known about the facilities to fully define the costs.

Table 3.88: Tawke Development Cost Summary				
Project	Rationale	Time Frame (Years)	Cost Estimate (MillionUSD) ¹²³	
			Low	How
Drill new development wells	8 new development wells including production, water injection and gas reinjection; mixture of vertical and horizontal wells (Completed).	2 - 5	25.8	47.8
Rounded Subtotal			25.8	47.9
Surface				
None			0	0
Rounded Subtotal			0	0
Rounded Total			25.8	47.9

In addition to development cost the consortium will spend a significant amount on operating costs. We have used our cost estimating software - **NETCOSTER** to estimate what these will be and these estimates are provided below.

Table 3.89: Tawke Operating Cost Summary				
Project	Rationale	Start Date (Year)	Cost Estimate (MillionUSD/year) ¹²⁴	
			Low	High
Subsurface:				
Work over existing wells	Maintenance and improved performance of 52 wells (25 operating)	2025	7.2	14.4
Rounded Subtotal at Peak Production per Year			7.2	14.4
Surface:				
Operation of Facilities	Operation of surface gathering, water injection, and gas reinjection facilities to a total capacity of 50,000bopd	2025	21.9	26.5
Rounded Subtotal at Peak Production per Year			21.9	26.5
General and Administration:				
General and Administration	Operation of surface gathering, water injection, and gas reinjection facilities to a total capacity of 50,000bopd	2025	11.5	14.4
Rounded Subtotal at Peak Production per Year			11.5	14.4
Rounded Total at Peak Production per Year			40.6	55.3

¹²⁴ The cost ranges reflect the uncertainty associated with the actual work scope that will have to be implemented. At this stage, not enough is known about the existing facilities to fully define the costs. Each element of operating cost is additive, so as units are brought into production their operating cost is added to the existing base.

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