ASSET REPORT

Wood Mackenzie
A Verisk Business

SEPTEMBER, 2021

Shenandoah (WR 52)

Key facts

Under Development			Offshore
Location	**Timetable**		
Sector, Basin: Central Gulf, West Gulf Coast Tertiary	Discovery Date		Feb 2009
Block: WR/51, Area: 23 km^2	FID		Aug 2021
Block: WR/52, Area: 23 km^2	Expected Startup		2024
Block: WR/53, Area: 23 km^2	Peak Gas Production (108 mmcfd)		2025
Water Depth: 1772m	Peak Oil Production (93,650 b/d)		2025
Operator	**Participants**		**%**
Beacon Offshore Energy	Navitas Petroleum		49.00
	Beacon Offshore Energy		31.00
	HEQ Deepwater		20.00
Primary Reservoir(s):			
Paleogene\Eocene\Ypresian\Wilcox\Wilcox			
Initial Resources (2P/2C)	**Hydrocarbon Quality**		
317 mmbbl Oil	GOR (scf/bbl)		1,100
365 bcf Sales Gas	Gravity (°API)		33
Remaining Resources at 01/01/2021			
317 mmbbl Oil			
365 bcf Sales Gas			
Contract	**Financial Summary**		
Concession	Capital costs (2021 terms)		US$3,020M
	Capital costs per boe (2021 terms)		US$7.92/boe
	Operating costs (2021 terms)		US$2,841M
	Operating costs per boe (2021 terms)		US$7.45/boe
	Remaining PV (10.0% nominal)		US$2,683M
	Remaining PV per boe (10.0% nominal)		US$7.03/boe
	Rate of return		37.2%

Source: Wood Mackenzie

Summary and key issues

Summary

Shenandoah (WR 52) is a large Lower Tertiary discovery in the remote northwestern portion of the Walker Ridge protraction area. The field was discovered in February 2009. The discovery, along with Chevron's Anchor and Total's North Platte, is one of several exploration successes in the Inboard Lower Tertiary trend, which is thought to extend from Walker Ridge into Keathley Canyon, Garden Banks, and Green Canyon. LLOG took over the operatorship from Anadarko in 2018. Beacon took over operatorship from LLOG in Q3 2020.

Key issues

On 25 August 2021, Beacon and partner Navitas agreed to farm down some of their working interest to HEQ Deepwater (a new partnership between Houston Energy and Quantum Energy Partners) and simultaneously sanction the Shenandoah project. HEQ Deepwater now holds a 20% working interest. This is Beacon's first major greenfield project as operator.

Transocean was awarded a US$252 million contract for the new-build ultra-deepwater drillship Deepwater Atlas, which will begin drilling in 2022. This is the second new-build 20-kpsi capable rig that has been awarded in the US GoM and it has an implied day rate of US $455,000, inclusive of upgrade and mob fees. This follows the Hyundai Heavy Industries US$577 million contract win to build the semi-sub facility earlier in August 2021.

Shenandoah will be developed in phases, with the first phase to include four development wells. We estimate development costs for phase I (including future sidetracks) at US$1.98 billion and a post-tax remaining value of US$2.3 billion (NPV10). Woodmac has modelled four wells and three sidetracks in Phase 1 and three wells and two sidetracks in Phase 2. The Shenandoah project has also secured debt financing of US$900 million to fund the facility and other development costs.

The Lower Tertiary has widely varying production rates across the play and high costs. No production has been achieved from the Inboard Lower Tertiary, which includes Beacon's Shenandoah, Total's North Platte, and Chevron's Anchor. This part of the play, closer to the sediment source, is understood to have better reservoir properties than Outboard discoveries on the eastern and western extents of the play, but the reservoirs are deeper and the pressures are higher.

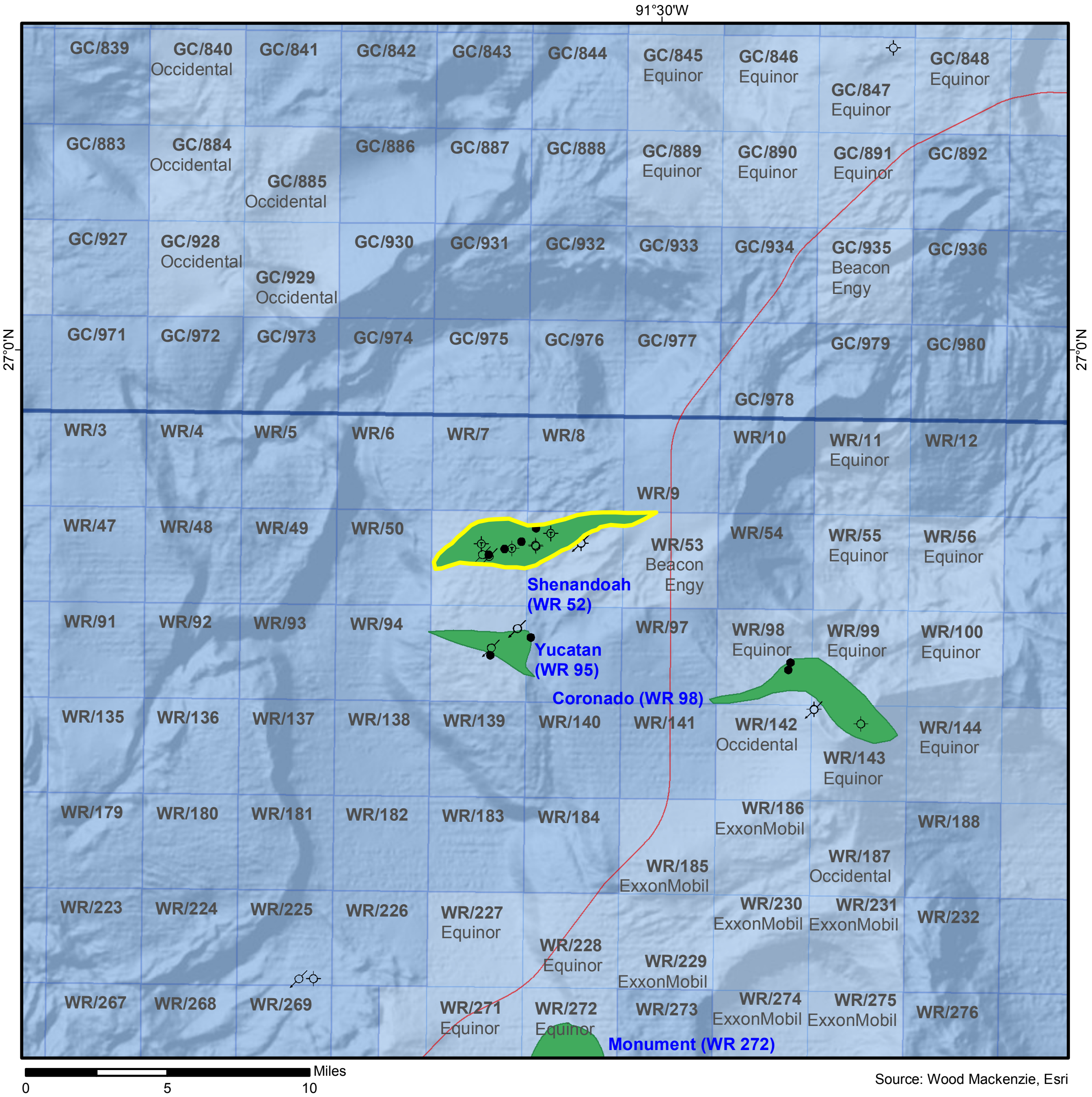
Technology capable of handling such pressure and temperature when the initial discoveries were made was not available. Development of 20-kpsi drilling and production systems began with the BP-led Project 20K, and the Anadarko-led Project 20A, but the depressed oil price slowed efforts considerably. While some of the larger companies were able to absorb the downturn and continue investing in developing 20-kpsi technology, the smaller companies have lagged, resulting in gaps in their supply chain. Chevron-operated Anchor, sanctioned in December 2019, was the first field requiring 20-kpsi technology to reach FID, paving the way for the industry. We expect the Shenandoah field to be developed with EXMAR's OPTI production platform design with a hub-n-spoke model to tieback surrounding fields as well.

Location maps

Index Map

Source: Wood Mackenzie, Esri

Field Map



Source: Wood Mackenzie, Esri

Participation

Participation

Company	(%)
Navitas Petroleum	49.00
Beacon Offshore Energy	31.00*
HEQ Deepwater	20.00
Total	**100.00**

Source: Wood Mackenzie

** Operator*

Shenandoah is thought to lie over blocks WR 51, 52 and 53.

Unitisation

A Federal Unit was awarded in April 2014, over Blocks WR 52 (as G25232), WR 53 (as G28148) and WR 51 (as G31938). The leases over the three blocks is under a Suspension of Production (SOP) extension through 30 June 2020. Another SOP extension through August 2021 was approved in July 2020.

WR 52

The current lease over WR 52 was awarded (as G25232) to Kerr-McGee (now Anadarko) following Lease Sale 185 in 2003 for a gross bonus of US$0.3 million. Effective 1 June 2003, the lease has a primary term of 10 years. Marathon farmed out of the block, effective 1 January 2016, resulting in the current participation: Anadarko (33% and operator), ConocoPhillips (33%), Venari (17%), and Cobalt (20%). The lease was expected to expire effective 31 May 2014, but is being held under unit operations. In April 2018, the interest changed to LLOG (operator, 30.95%), Beacon Offshore (15.95%), Navitas (23.10%), and Venari (30.00%). In March 2020, the interest changed to LLOG (operator, 30.95%), Beacon Offshore (15.95%), Navitas (53.10%). In December 2020, the interest changed to Beacon Offshore (46.9%), and Navitas (53.10%). In August 2021, the interest changed to Beacon Offshore (31%), Navitas (49%) and HEQ Deepwater (20%)

WR 51

The current lease over WR 51 was awarded (as G31938) to ConocoPhillips during Lease Sale 205 in October 2007 for a gross bonus of US$51.1 million. Effective 1 December 2007, the lease has a primary term of 10 years. Prior to the spud of the Shenandoah discovery well, Anadarko and ConocoPhillips swapped interests across the two blocks. At this juncture, participation over both blocks was Anadarko (30% and operator) and ConocoPhillips (70%). ConocoPhillips farmed-out 20% interest in both blocks to Cobalt in May 2008, another 10% to Marathon in June 2008, and another 10% to Venari Resources in June 2012.Marathon farmed out of the block, effective 1 January 2016,resulting in the current participation: Anadarko (33% and operator), ConocoPhillips (33%), Venari (17%), and Cobalt (20%). In April 2018, the interest changed to LLOG (operator, 30.95%), Beacon Offshore (15.95%), Navitas (23.10%), and Venari (30.00%). In March 2020, the interest changed to LLOG (operator, 30.95%), Beacon Offshore (15.95%), Navitas (53.10%). In December 2020, the interest changed to Beacon Offshore (46.9%), and Navitas (53.10%). In August 2021, the interest changed to Beacon Offshore (31%), Navitas (49%) and HEQ Deepwater (20%)

WR 53

The current lease over WR 53 was awarded (as G28148) to Hunt Oil following Lease Sale 198 in 2006 for a gross bonus of US$0.3 million. Effective 1 May 2006, the lease has a primary term of ten years. Effective 1 February 2013, Anadarko acquired a 100% interest in the block. ConocoPhillips, Venari, and Marathon farmed into the block in February 2014. Marathon farmed out of the block, effective 1 January 2016, resulting in the current participation: Anadarko (33% and operator), ConocoPhillips (33%), Venari (17%), and Cobalt (20%). The lease was expected to expire effective 30 April 2016, but is being held under unit operations. In April 2018, the interest changed to LLOG (operator, 30.95%), Beacon Offshore (15.95%), Navitas (23.10%), and Venari (30.00%). In March 2020, the interest changed to LLOG (operator, 30.95%), Beacon Offshore (15.95%), Navitas (53.10%). In December 2020, the interest changed to Beacon Offshore (46.9%), and Navitas (53.10%). In August 2021, the interest changed to Beacon Offshore (31%), Navitas (49%) and HEQ Deepwater (20%)

Geology

Reservoir quality in the Wilcox trend is a key technical challenge. The reservoirs are buried to extreme depths where preservation of adequate porosity and permeability is far from certain. However, the Shenandoah partners believe the reservoir properties to be highly favourable. An estimated GOR of 1,100 scf/bbl, close to 1,000 ft of pay in certain trends and high permeability support their 380 mmboe reserves estimate.

The gravity of crude in the 'Outboard' areas has generally been lower than that found in most Gulf of Mexico fields. However, it is thought that the crude quality improves in the 'Inboard' areas, although wide ranges have been reported. The quality of the oil is believed to vary greatly with a gravity ranging between 32° and 40° API

Well data

Well Name Type	Operator	Spudded Completed	TMD(m) WD(m)	Result	Discovery Field	Comment
WR 52 #1 (G25232) Exploration	Anadarko	04 Jun 2008 23 Jun 2008	5,086 1,774			Mechanically sidetracked as WR 52 #1ST1.
WR 52 #1ST1 (G25232) Exploration	Anadarko	03 Jul 2008 20 Oct 2008	7,746 1,772			Mechanically sidetracked as WR 52 #1ST2.
WR 52 #1ST2 (G25232) Exploration	Anadarko	11 Nov 2008 04 Feb 2009	9,156 1,772	+ Oil	Shenandoah (WR 52)	Encountered 91 metres (300 feet) of net oil pay in the Wilcox sands. Suspended.
WR 51 #1 (G31938) Appraisal	Anadarko	29 Jun 2012 06 Sep 2012	3,985 1,779	Tight Hole		Plugged and abandoned before reaching target TD.
WR 51 #2 (G31938) Appraisal	Anadarko	17 Sep 2012 29 Jan 2013	9,572 1,779	Oil		Targeted structure down-dip of the discovery well. Encountered over 305 metres (1,000 feet) of net oil pay in Lower Tertiary sands.
WR 52 #2 (G25232) Appraisal	Anadarko	29 May 2014 08 Nov 2014	10,127 1,790			Mechanically sidetracked as WR 52 #2ST2. Tested the down-dip and lateral extent of the Shenandoah discovery.
WR 52 #2ST1 (G25232) Appraisal	Anadarko	07 Dec 2014 19 Dec 2014	9,670 1,790	Dry Hole		Tested the down-dip and lateral extent of the Shenandoah discovery.
WR 51 #3 (G25232) Appraisal	Anadarko	26 May 2015 28 Aug 2015	9,539 1,785	Tight Hole		Tested the up-dip extent of the reservoir

WR 51 #3ST1 (G31938) Appraisal	Anadarko	08 Sep 2015 16 Oct 2015	9,786 1,785		Mechanically sidetracked as WR 51 #3ST2
WR 51 #3ST2 (G31938) Appraisal	Anadarko	26 Oct 2015 14 Dec 2015	9,682 1,785	Oil	Encountered 189 metres (620 feet) of net oil pay
WR 51 #3ST3 (G31938) Appraisal	Anadarko	21 Dec 2015 02 Jan 2016	9,038 1,785		Acquired 168 metres (550 feet) of core samples from the reservoir
WR 51 #4 (G31938) Appraisal	Anadarko	14 Mar 2016 05 Jul 2016	9,479 1,782	Oil	Shenandoah appraisal well #4. Encountered 305 metres of net pay (1000 ft). Approx 24 metres (80 ft) of core obtained from the upper Wilcox.
WR 52 #3 (G25232) Appraisal	Anadarko	16 Dec 2016 07 Feb 2017	9,768 1,772	Tight Hole	Shenandoah appraisal well #5. Targeted the oil-water contact on the eastern extent of the field.
WR 52 #3ST1 (G25232) Appraisal	Anadarko	18 Feb 2017 02 Mar 2017	9,349 1,772	Dry Hole	Shenandoah appraisal well #5, sidetrack of WR 52 #3. Encountered wet Wilcox sands and was sidetracked.
WR 52 #3ST2 (G25232) Appraisal	Anadarko	08 Mar 2017 20 Mar 2017	9,416 1,772	Dry Hole	Shenandoah appraisal well #5, sidetrack of WR 52 #3ST1. Encountered wet Lower Tertiary sands. Appraisal activity is currently suspended as Anadarko evaluates options going forward.

Source: Wood Mackenzie

+ Commercial Discovery

Exploration

The first exploration well, WR 52 #1, was spudded in early-June 2008 using Noble's *Paul Romano* semi-submersible rig. The initial borehole was bypassed twice before reaching a TD in February 2009.

The first appraisal well at Shenandoah was expected in Q4 2010, but was delayed due to the 2010 deepwater drilling moratorium. It is understood that seismic reprocessing was conducted to better image the structure and determine the location of the next well.

The first appraisal well, WR 51 #1, was spudded in June 2012 using the ENSCO *8505* semi-submersible rig. The well was suspended in September after two months of drilling due to mechanical failures. A replacement well, WR 51 #2, was spudded in September 2012, also using the *8505.* The well targeted the structure 518 metres (1,700 feet) down-dip of the discovery well and encountered oil pay in Lower Tertiary sands. The well was drilled about 0.6 kilometres (1 mile) southwest of the discovery well and confirmed the reservoir qualities. Additionally, the well did not reach the oil-water contact.

On 29 May 2014, Diamond Offshore's *Ocean BlackHawk* drillship commenced drilling operations at the Shenandoah WR 52 #2 appraisal well. The WR 52 #2 well follows-up on the successful WR 51 #2 well, which encountered about 305 metres (1,000 feet) of net pay inin Inboard Lower Tertiary sands. The WR 52 #2 well tested the down-dip and lateral extent of the Shenandoah discovery, attempting to encounter the oil/water contact of the reservoir. The well was mechanically sidetracked before being plugged and abandoned in December 2014. In January 2015 it was announced that the well did not discover the oil/water contact downdip, and additional appraisal drilling will take place later in the year.

The WR 51 #3 appraisal well was spud in May 2015 to test the up-dip extent of the reservoir. The well was then sidetracked as WR 51 #3ST1 which was then bypassed as WR 51 #3ST2. In October 2015, the JV announced that the well encountered 189 metres (620 feet) of net oil pay, after which operations to obtain whole-core samples continued. The WR 51 #4 appraisal well was spud in March 2016, using the Diamond *Ocean Blackhawk*, with a target just east of the discovery well. The well was completed in July 2016 and encountered 305 metres (1,000 feet) of net oil pay. Approximately 24 metres (80 feet) of core were obtained from the Upper Wilcox after the well reached an undisclosed TD.

The WR 52 #3 well was spud in December 2016, using the *Ocean Blackhawk*, to target the oil-water contact on the eastern flank. Its sidetrack was spud in February 2017, reached TD in March 2017, and encountered wet sands in the Wilcox. A second sidetrack was completed in April 2017 but was also dry.

The JV announced in May 2017 that further appraisal activities at Shenandoah had been suspended.

Reserves and resources

As operator, Anadarko initially published estimated reserves for Shenandoah at over 240 million barrels of oil equivalent. However, LLOG (operator until 2020) revised these estimates significantly upwards. Our current estimates are provided in the accompanying table.

Reserves (2P) at 01/01/2021

	Init Oil (mmbbl)	Init Gas (bcf)	Rem Oil (mmbbl)	Rem Gas (bcf)
Shenandoah (WR 52)	317	365	317	365

Source: Wood Mackenzie

Production

Wood Mackenzie assumes first production from Shenandoah in 2024 from four wells.

Our model incorporates some risk for downtime arising from issues such as maintenance, hurricanes, equipment failure, etc. In addition, the annual average does not reflect daily or monthly production troughs and peaks, which can be substantially lower or higher.

Production (2024-2033)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Oil Phase 1 ('000 b/d)	4	94	87	73	57	43	32	24	19	20
Oil Phase 2 ('000 b/d)	-	-	-	-	14	25	29	23	17	12
Total Liquid ('000 b/d)	**4**	**94**	**87**	**73**	**71**	**68**	**61**	**47**	**36**	**32**
Gas Phase 1 (mmcfd)	5	108	100	83	65	49	37	28	21	23
Gas Phase 2 (mmcfd)	-	-	-	-	16	29	33	27	19	14
Total Sales Gas (mmcfd)	**5**	**108**	**100**	**83**	**81**	**78**	**70**	**55**	**40**	**37**

Source: Wood Mackenzie

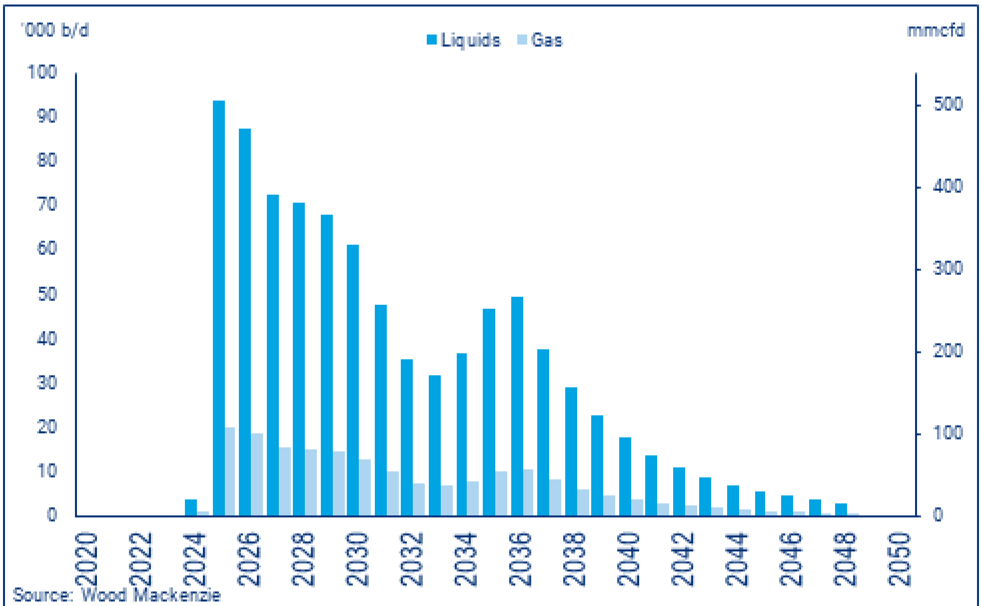
Production (2034-2043)

	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Oil Phase 1 ('000 b/d)	28	32	31	25	19	15	12	10	8	6
Oil Phase 2 ('000 b/d)	9	14	18	13	10	7	5	4	3	2
Total Liquid ('000 b/d)	**37**	**47**	**49**	**38**	**29**	**23**	**18**	**14**	**11**	**9**
Gas Phase 1 (mmcfd)	32	37	36	28	22	18	14	11	9	7
Gas Phase 2 (mmcfd)	10	16	21	15	11	8	6	5	3	3
Total Sales Gas (mmcfd)	**42**	**54**	**57**	**44**	**34**	**26**	**20**	**16**	**13**	**10**

Source: Wood Mackenzie

Please refer to our Upstream Data Tool (UDT) for life of field production data.

Production Profile



Source: Wood Mackenzie

Development

Key Development Metrics

Shenandoah will be developed with a semi-submersible facility built by Hyundai Heavy Industries. TechnipFMC was awarded the contract for subsea trees in 2019.

Wells

- Shenandoah will be developed with seven wells and five late life sidetracks.
- We expect the first four wells to be drilled between 2022 and 2023.
- Estimated IP oil rates per well to range from 12 - 25 kb/d.
- Wells will cost roughly US$180 million to drill on average.
- The wells will be developed via subsea trees and tied back to the facility via 4-slot manifolds.
- The sidetracks will be drilled between 2033 and 2036.
- The sidetracks will cost roughly US$90 million each to drill.

Semi-submersible Summary

- Processing capacity: 100,000 b/d of oil & 140 mmcfd of gas

We expect Beacon to develop the field with EXMAR's OPTI semi-submersible platform design which was also used for Who Dat and Delta House.

Additional exploration successes have been realised in the Shenandoah 'mini-basin' in northwestern Walker Ridge. On 25 March 2013, Chevron announced a discovery at its Coronado prospect in Walker Ridge block 98, about 19 kilometres (12 miles) from the Shenandoah discovery well. The well encountered 122 metres (400 feet) of pay in the same Lower Tertiary trend as Shenandoah. The Yucatan field was discovered by Shell in May 2013, encountering over 37 metres (120 feet) of net oil pay in Lower Tertiary sands. Yucatan is syncline-separated from Shenandoah (WR 52) and located less than 7 kilometres (4 miles) to the south. The leases over Yucatan expired in late-2017and were picked up by LLOG in 2018. It is likely that these fields will be developed in conjunction with Shenandoah to a single platform. In March 2020, Equinor had success with the Monument prospect, which lies 20 kilomenres (13 miles) to the south. Equinor plans to appraise the discovery in 2021.

Infrastructure

We assume an oil export route via third-party owned pipelines connecting to the Southeast Keathley Canyon oil pipeline (SEKCO), which is 37 kilometres (23 miles) from the field.

The gas export pipeline will connect to the Keathley Canyon Connector, which is six kilometres (4 miles) away. In June 2021, Beacon awarded Williams the contract to provide gas gathering, transport, and processing.

Costs

Exploration and Appraisal Costs

The cost to drill the discovery well is estimated to have been US$215 million between 2008 and 2009, in nominal terms. Well WR 51 #1, which was prematurely abandoned in September 2012, cost about US$66 million. Appraisal well WR 51 #2 cost approximately US$192 million, and appraisal well WR 52 #2 and WR 52 #1ST1 combined to cost approximately US$221 million. Appraisal wells WR 51 #3, WR 51 #3ST1, WR 51 #3ST2, WR 51 #4, WR 52 #3, WR 52 #3ST1, and WR 52 #3ST have combined to cost approximately US$390 million.

All bonuses, exploration and appraisal costs have been excluded from Wood Mackenzie's cash flow analysis.

Capital Costs

The Shenandoah JV has not released any capital guidance for the project. We assume that the total project capital cost is estimated to be US$3.0 billion.

Capital Costs Pre-2021 to 2029 (US$ million)

	Pre-2021	2021	2022	2023	2024	2025	2026	2027	2028	2029
Product. Facilities	-	50.0	150.0	150.0	50.0	-	-	-	-	-
Process. Equip.	-	25.0	75.0	50.0	50.0	-	-	-	-	-
Phase 1 Subsea	-	-	28.3	119.9	166.5	30.3	-	-	-	-
Phase 2 Subsea	-	-	-	-	-	-	25.4	104.8	142.3	27.2
Phase 1 Dev. Drilling	-	-	88.2	357.7	279.3	-	-	-	-	-
Phase 2 Dev. Drilling	-	-	-	-	-	-	-	181.3	181.3	181.3
Other Capex	-	-	50.0	-	-	-	-	-	-	-
Total	**-**	**75.0**	**391.5**	**677.6**	**545.8**	**30.3**	**25.4**	**286.1**	**323.6**	**208.5**

Source: Wood Mackenzie

Nominal to 2021 and real (in 2021 terms) thereafter.

Capital Costs 2030 to Post-2038 (US$ million)

	2030	2031	2032	2033	2034	2035	2036	2037	2038	Post-2038
Product. Facilities	-	-	-	-	-	-	-	-	-	-
Process. Equip.	-	-	-	-	-	-	-	-	-	-
Phase 1 Subsea	-	-	-	-	-	-	-	-	-	-
Phase 2 Subsea	15.1	-	-	-	-	-	-	-	-	-
Phase 1 Dev. Drilling	-	-	-	88.2	88.2	88.2	-	-	-	-
Phase 2 Dev. Drilling	-	-	-	-	-	88.2	88.2	-	-	-
Other Capex	-	-	-	-	-	-	-	-	-	-
Total	**15.1**	**-**	**-**	**88.2**	**88.2**	**176.4**	**88.2**	**-**	**-**	**-**

Source: Wood Mackenzie

Nominal to 2021 and real (in 2021 terms) thereafter.

Please refer to our Upstream Data Tool (UDT) for life of field capital expenditure data.

Operating Costs

We have made assumptions for direct field fixed costs, variable operating costs (which are calculated as a function of throughput), and transport tariffs. We estimate tariffs for the transportation of produced oil and gas to shore will cost US$4.30/bbl of oil and US$0.80/mcf of gas, all in 2021 terms.

Operating Costs 2024 to 2033 (US$ million)

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Phase 1 Field Fixed	8	16	16	16	16	16	16	16	16	16
Phase 2 Field Fixed	-	-	-	-	4	8	12	12	12	12
Phase 1 Field Variable	3	71	66	55	43	32	24	18	14	15
Phase 2 Field Variable	-	-	-	-	10	19	22	18	13	9
Tariff Oil	6	147	137	114	111	107	96	75	55	50
Tariff Gas	1	31	29	24	24	23	21	16	12	11
Total	**18**	**265**	**248**	**209**	**208**	**205**	**191**	**155**	**122**	**113**

Source: Wood Mackenzie

Nominal to 2021 and real (in 2021 terms) thereafter.

Fiscal and regulatory

The leases over block WR 52 and WR 53 were issued with a gross royalty rate of 12.5%, and the lease WR 51 was issued with a gross royalty rate of 16.67%. Because the leases were awarded after November 2000 under the provisions of royalty suspension legislation, the first 12 million barrels of oil equivalent from each lease is eligible to be produced royalty-free, as long as oil and gas prices remain below price thresholds set by the BOEM.

Economic assumptions

A cash flow has been prepared for Shenandoah, using the following economic assumptions. It has been run on a stand-alone basis using Wood Mackenzie's **Global Economic Model (GEM)**. It does not reflect corporate synergies. These are included in company valuations, which can be produced in GEM and also in Wood Mackenzie's **Upstream Data Tool (UDT)**.

Cash Flow

The following cash flow is in nominal terms.

Discount rate and date

Wood Mackenzie's discount rate is 10% nominal. The discount date is 1 January 2021.

Inflation rate

Wood Mackenzie's inflation rate is 2.8% in 2021 and our long term assumption of 2.0% remains unchanged from 2022 onward.

Oil price

Wood Mackenzie's LLS price assumption is US$64.84/bbl in 2021, US$63.20/bbl in 2022, US$60.54/bbl in 2023, US$55.56/bbl in 2024 and US$50.53/bbl in 2025

Crude that is considered sour and with API gravity from 32.0-40.0 is assumed to trade at a 6% discount to LLS.

Gas price

Wood Mackenzie's Q3 2021 Henry Hub gas price assumption (nominal terms) is US$3.02/mcf in 2021, US$2.86/mcf in 2022, US$2.69/mcf in 2023, US$2.79/mcf in 2024 and US$2.98/mcf in 2025 inflated at 2% per annum thereafter. This equates to a long-term Henry Hub price assumption of US$2.75/mcf (real, 2021 terms) from 2025 onward.

Global Economic Model (GEM) file

The corresponding GEM file name is **Shenandoah (WR 52)**.

Economic analysis

Cash flow

Year	Production		Gross	Op	Capital	Royalty	State	Federal	Total Field
	Liquids	Gas	Revenue	Costs	Costs		Taxes	Tax	Cash Flow
	000b/d	mmcfd	US$M	US$M	US$M	US$M	US$M	US$M	US$M
2020	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2021	0.0	0.0	0.0	0.0	75.0	0.0	0.0	0.0	-75.0
2022	0.0	0.0	0.0	0.0	399.3	0.0	0.0	0.0	-399.3
2023	0.0	0.0	0.0	0.0	705.0	0.0	0.0	0.0	-705.0
2024	4.0	4.6	84.1	19.7	579.3	9.1	0.0	0.0	-523.9
2025	93.7	107.7	1,922.8	287.2	32.7	205.8	0.0	54.6	1,342.4
2026	87.4	100.5	1,829.8	274.5	28.1	198.4	0.0	209.0	1,119.8
2027	72.6	83.5	1,550.2	235.6	322.2	174.3	0.0	186.4	631.6
2028	70.6	81.2	1,537.9	238.8	371.8	172.9	0.0	177.2	577.1
2029	68.1	78.4	1,514.4	240.7	244.3	170.3	0.0	167.8	691.3
2030	61.2	70.3	1,386.7	228.1	18.1	155.9	0.0	185.1	799.5
2031	47.7	54.9	1,103.4	189.0	0.0	124.1	0.0	148.8	641.5
2032	35.3	40.6	832.1	151.6	0.0	93.6	0.0	113.2	473.7
2033	31.6	36.3	759.5	142.1	111.9	85.4	0.0	83.3	336.7
2034	36.6	42.1	897.6	162.2	114.1	100.9	0.0	105.2	415.2
2035	46.6	53.6	1,167.1	200.8	232.8	131.2	0.0	129.2	473.1
2036	49.5	56.9	1,262.9	215.0	118.7	142.0	0.0	164.7	622.5
2037	37.9	43.5	985.6	176.8	0.0	110.8	0.0	142.5	555.5
2038	29.2	33.5	774.5	147.9	0.0	87.1	0.0	110.4	429.1
2039	22.6	26.0	612.5	126.0	0.0	68.9	0.0	85.4	332.3
2040	17.6	20.3	487.2	109.2	0.0	54.8	0.0	65.9	257.3
2041	13.9	15.9	390.4	96.4	0.0	43.9	0.0	51.0	199.1
2042	10.9	12.6	314.5	86.6	0.0	35.4	0.0	39.6	153.0
2043	8.7	10.0	254.8	66.7	0.0	28.7	0.0	33.3	126.2
2044	6.9	8.0	207.6	54.4	0.0	23.3	0.0	27.3	102.6
2045	5.6	6.4	170.2	41.6	0.0	19.1	0.0	23.0	86.5
2046	4.5	5.2	140.4	34.5	0.0	15.8	0.0	18.9	71.2
2047	3.7	4.2	116.2	24.7	0.0	13.1	0.0	16.5	62.0
2048	3.0	3.4	96.8	17.0	0.0	10.9	0.0	14.5	54.4
2049	0.0	0.0	0.0	0.0	231.7	0.0	0.0	0.0	-231.7
2050	0.0	0.0	0.0	0.0	106.6	0.0	0.0	0.0	-106.6
Totals:	**317.2**	**364.8**	**20,398.9**	**3,567.0**	**3,691.4**	**2,275.7**	**0.0**	**2,352.6**	**8,512.2**
PVs		Total PV	7,684.9	1,266.1	2,070.1	852.8	0.0	813.4	2,682.5
		Rem PV	7,684.9	1,266.1	2,070.1	852.8	0.0	813.4	2,682.5

Source: Wood Mackenzie

Discounted at 10.0% from 01/01/2021

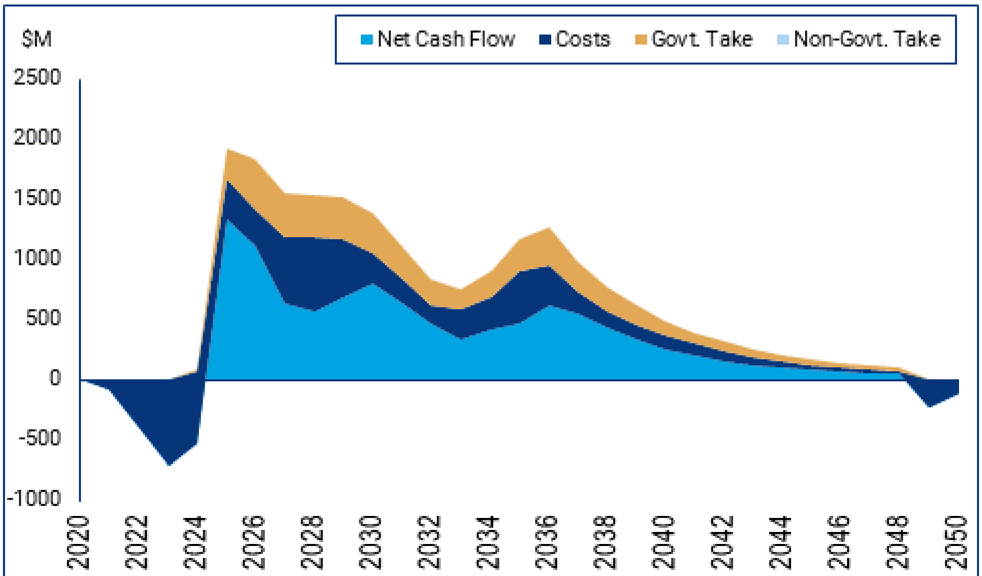
Discount Rate %	Total PV Post-Tax US$M	Total PV Pre-Tax US$M	Remaining PV Post-Tax US$M	Remaining PV Pre-Tax US$M	Remaining PV/boe Post-Tax US$	Remaining PV/boe Pre-Tax US$	Total Gov. Take US$M	Total Gov. Take %	Remaining Gov. Take US$M	Remaining Gov. Take %	P/I Ratio	Capex Boe US$	Opex Boe US$
0.0	8,512.1	13,140.5	8,512.1	13,140.5	22.32	34.45	4,628.3	35.2	4,628.3	35.2	3.3	9.68	9.35
5.0	4,683.3	7,349.0	4,683.3	7,349.0	12.28	19.27	2,665.7	36.3	2,665.7	36.3	2.8	6.93	5.33
7.0	3,733.7	5,923.6	3,733.7	5,923.6	9.79	15.53	2,190.0	37.0	2,190.0	37.0	2.6	6.24	4.37
8.0	3,340.5	5,334.3	3,340.5	5,334.3	8.76	13.99	1,993.8	37.4	1,993.8	37.4	2.5	5.94	3.97
9.0	2,992.1	4,812.3	2,992.1	4,812.3	7.84	12.62	1,820.3	37.8	1,820.3	37.8	2.4	5.67	3.63
10.0	2,682.5	4,348.7	2,682.5	4,348.7	7.03	11.40	1,666.2	38.3	1,666.2	38.3	2.3	5.43	3.32
11.0	2,406.7	3,935.7	2,406.7	3,935.7	6.31	10.32	1,529.0	38.8	1,529.0	38.8	2.2	5.20	3.05
12.0	2,160.5	3,566.8	2,160.5	3,566.8	5.66	9.35	1,406.3	39.4	1,406.3	39.4	2.1	5.00	2.80
15.0	1,564.6	2,673.2	1,564.6	2,673.2	4.10	7.01	1,108.6	41.5	1,108.6	41.5	1.9	4.47	2.21
25.0	493.4	1,053.9	493.4	1,053.9	1.29	2.76	560.5	53.2	560.5	53.2	1.4	3.28	1.14

Source: Wood Mackenzie

Discount Date	Jan-2021
Remaining Liquid Reserves (mmbbl)	317.2
Remaining Gas Reserves (bcf)	364.8
Total Remaining Reserves (mmboe)	381.4
Total Reserves (mmboe)	381.4
Project IRR (post tax)	37.21%
Company IRR (post tax)	37.21%
Pre-tax IRR	48.02%
Payback Period (years)	5.3
Liquid Breakeven Price at 10% (US$/bbl)	22.48

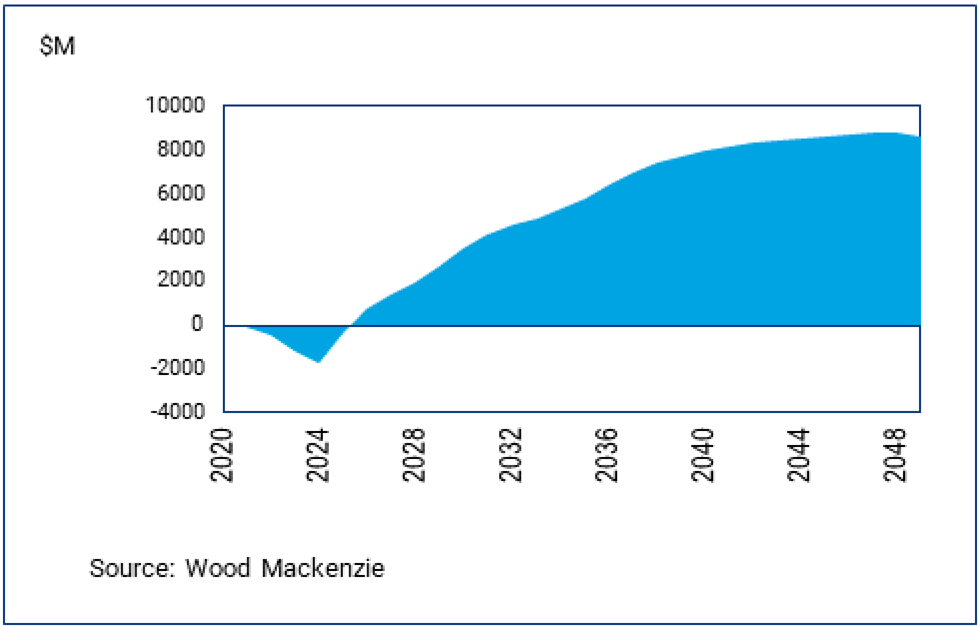
Source: Wood Mackenzie

Split of Revenues

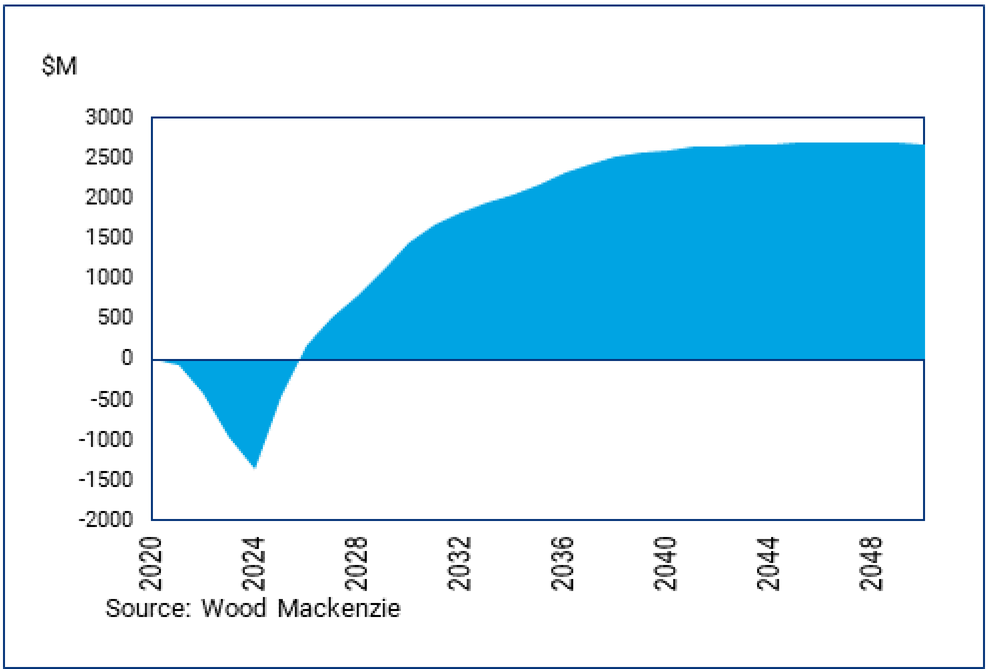


Source: Wood Mackenzie

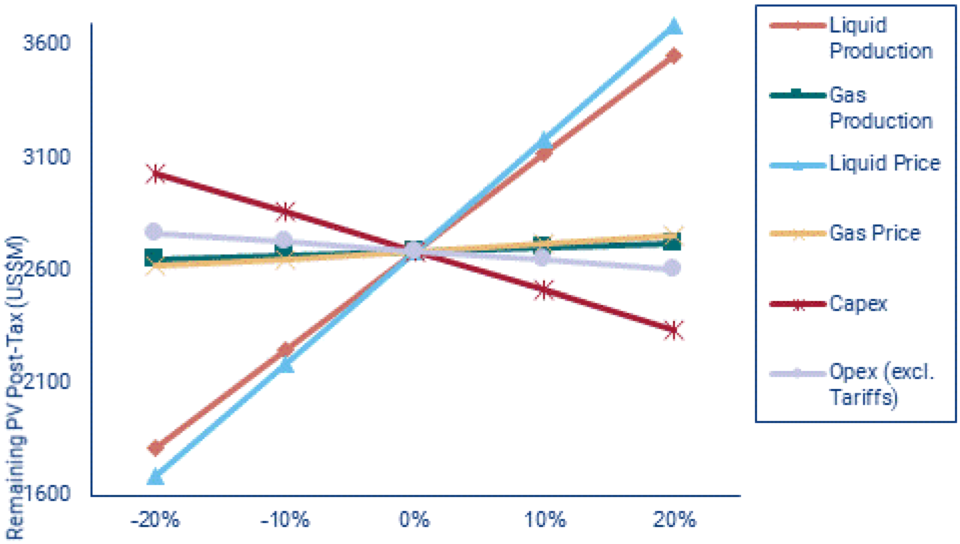
Cumulative Net Cash Flow - Undiscounted



Cumulative Net Cash Flow - Discounted at 10% from 01/01/2021



Remaining PV Price Sensitivities



Source: Wood Mackenzie

Client Helpdesk:

Europe +44 131 243 4477
Americas +1 713 470 1700
Asia Pacific +65 6518 0888
Email support@woodmac.com
Website www.woodmac.com