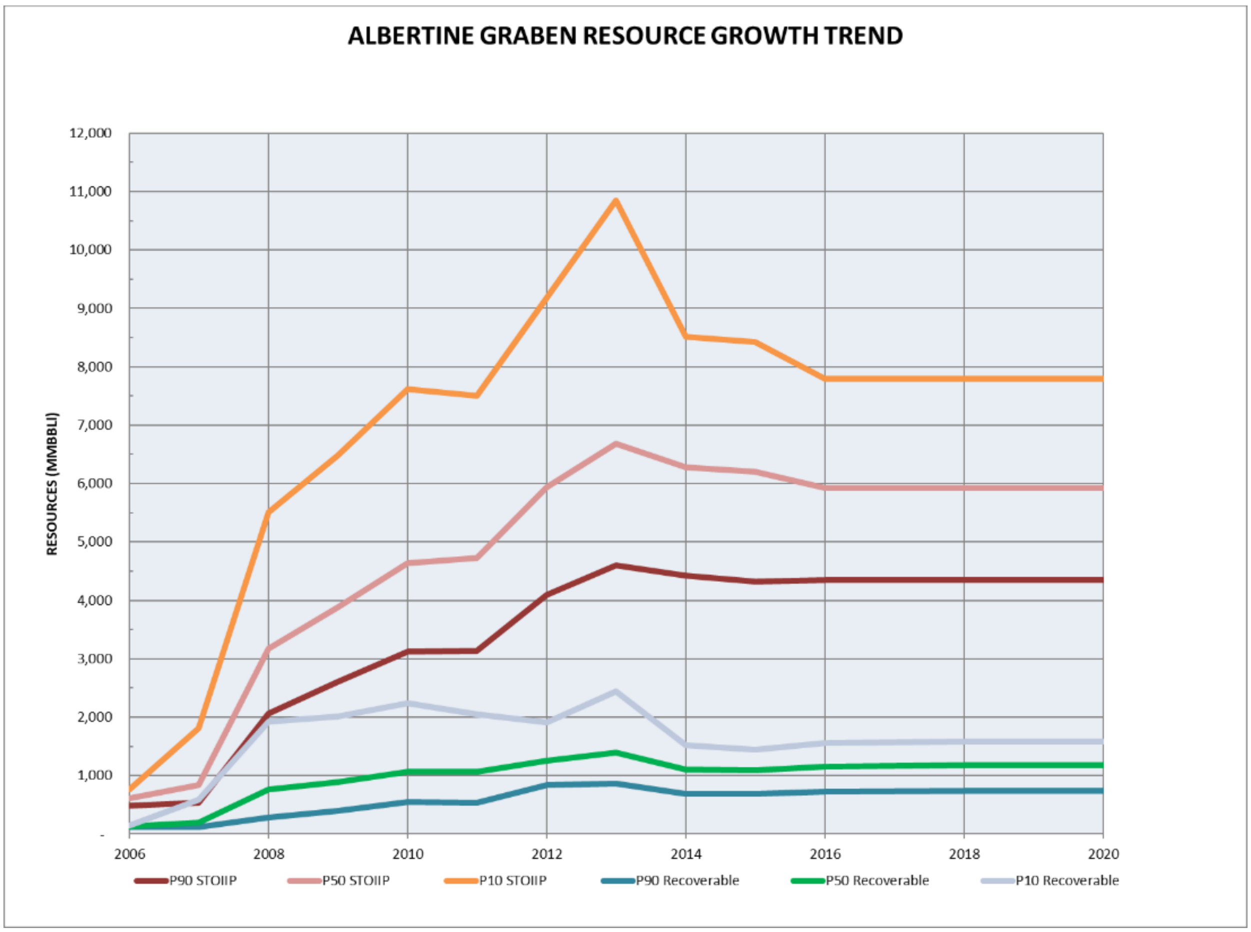
MINISTRY OF ENERGY AND MINERAL DEVELOPMENT
DIRECTORATE OF PETROLEUM

PETROLEUM EXPLORATION, DEVELOPMENT AND PRODUCTION DEPARTMENT



SUMMARY REPORT ON THE ANNUAL PETROLEUM RESOURCES AND RESERVES FOR 2019/2020

EXECUTIVE SUMMARY

The Ministry of Energy and Mineral Development through the Directorate of Petroleum has the overall mandate of coordinating the oil and gas sector to ensure that the National Oil and Gas Policy (NOGP) goal of using the Country's Oil and Gas Resources to Contribute to Early Achievement of Poverty Eradication and Creating Lasting Value to Society is realised most efficiently. In operationalising the NOGP and the attendant legislation on promoting and sustaining transparency in the sector, the Ministry has continued to update the public through publication of the Country's petroleum resources through Annual Resource Reports, among others.

This report is an abridged version of the Financial Year 2019/2020's Annual Resource Report on the Country's annual petroleum resources, reserves and prospective resources estimates together with ongoing exploration efforts to establish additional resources.

The petroleum resource base volume in the Country is estimated at 6.0 Bbbls, with 1.4 Bbbl recoverable. Gas volumes have been estimated at 329 Bcf of non-associated gas and 198 Bcf of dissolved gas, all in 21 oil and gas discoveries.

Contingent resources make up about 230.45 MMbbl of which, 31.6 MMbbl is under *Development Pending*, 198.45 MMbbls is under *Development on Hold* and 0.4 MMbbl is under *Development Unclarified*.

Unrecoverable resources volume attributed to hydrocarbons found within thin reservoir units of the fields currently earmarked for production which are not accessible by current technology have been estimated at about 208 MMbbl. This represents 3% of the Total STOIIP.

Reserves in the Albertine graben are currently estimated to be 1,075 MMbbl of oil at P50. This volume is attributed to the Kingfisher, Kigogole, Nsoga, Kasamene, Wahrindi, Jobi-Rii, Gunya and Ngiri fields which have had the Field Development Plans updated following the Front-End Engineering Design (FEED).

Polymer flood and water flood (EOR) methods have been considered during production. The incremental volumes of oil from EOR through implementation of a polymer flood is currently being assessed. International Oil Companies (IOC's) suggest an incremental recovery in the range of 3-10%, which translates to about 232 MMbbls. This accounts for 4% of the Total STOIIP.

To further establish additional volumes and add to the current reserves, prospective resources within undrilled prospects in the Albertine Graben amounting to approximate 867.5 MMbbls have been established by the Department through detailed resource assessment and basin analysis studies. In addition, Geophysical, Geological and Geochemical (GGG) surveys have been undertaken in the Moroto-Kadam basin. Approximately 4000 Km^2 of Geological and Geochemical data have been acquired while over 788 line- Km of Geophysical data have been acquired in the area. A petroleum working system has been confirmed, as exhibited by the presence of an oil seepage and reservoir rocks in the area. The work so far covered represents about 71% of the entire Moroto-Kadam basin.

Definitive exploration is being undertaken by licensed oil companies namely; Armour Energy Limited over Kanywataba Exploration Area and Oranto Petroleum Limited over the Ngassa Shallow and Deep Plays. It is expected that more companies will be licensed at the end of the ongoing Second Licensing Round to undertake further exploration in the country.

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ACRONYM

AEL	– Armour Energy Limited
Bbbl	– Billion barrels
Bcf	– Billion cubic feet
bopd	– Barrels of Oil Per Day
CA	– Contract Area
CNOOC	– China National Offshore Oil Corporation
CPF	– Central Processing Facilities
CO_2	– Carbon dioxide
CUL	– CNOOC Uganda Limited
EA1	– Exploration Area 1
EA2	- Exploration Area 2
EA3A	– Exploration Area 3A
EOR	– Enhanced Oil Recovery
FDP	– Field Development Plan
FEED	– Front End Engineering Design
FID	– Final Investment Decision
GIIP	– Gas Initially In Place
GIIP-Boe	– Barrels of oil equivalent of Gas Initially In Place
GIIP-FREE	– Free Gas Initially In Place
KFDA	– Kingfisher Development Area
Line-km	- Line Kilometres
Mbbl	– Thousand barrels
Mboe	– Thousand barrels oil equivalent
MMbbl	– Million barrels
MMboe	– Million barrels oil equivalent
OPL	– Oranto Petroleum Limited
PEDPD	– Petroleum Exploration, Development and Production Department
PL	– Production License
PRMS	– Petroleum Resources Management System

PRR – Petroleum Reservoir Report

PSA - Production Sharing Agreement

REC-Boe - Barrels of oil equivalent of Recoverable Free Gas

REC-FREE -Recoverable Free Gas

SCF – Standards Cubic Feet

SPE – Society of Petroleum Engineers

STB – Stock Tank Barrels

STOIIP – Stock Tank Oil Initially in Place

TEPU – Total E&P Uganda B.V.

TUOP – Tullow Uganda Operations Pty Limited

UNOC – Uganda National Oil Company

1.0 INTRODUCTION

In line with the Petroleum (Exploration, Development and Production) Act, 2013, the Petroleum Directorate is expected to among others carry out annual resource estimation for each of the discoveries in the country with the objective of facilitating the Government's reporting of the oil and gas resources in the country and quality checking resource estimates reported by licensed oil operators. The resources are assessed and reported on an annual basis as per the Petroleum Regulations. The reporting also covers an assessment of petroleum resources in the areas that are not under license and prospective areas such as the Moroto-Kadam basin.

For purposes of accurate estimation and reporting of resources, the Directorate adopted the industry standard, Society of Petroleum Engineers-Petroleum Resources Management System (SPE-PRMS), which is one of the widely used industry standard systems for estimating and reporting of petroleum resources. The resource classes reported within this system include both discovered (reserves and contingent resources) and undiscovered (prospective resources). The annual resource report is intended for publication as a public document.

There are four (4) upstream oil and gas operators currently licensed in the country namely;

1. Total E&P Uganda B.V.(TEPU) operating Production Licenses under the EA-1 PSA, named as Contract Area 1 (CA-1) 1) Production Licenses under EA2 PSA, named Contract Area 2 (CA2);
2. CNOOC Uganda Limited (CUL) operating the Kingfisher Development Area (KFDA) or Contract Area 3 (CA3);
3. Armour Energy Uganda Limited operating Kanywataba License Area; and
4. Oranto Petroleum Uganda Limited operating both Ngassa Shallow and Deep plays.

These licensees are required to submit data and forecasts of petroleum resources in the fields, discoveries, and prospects in the areas they are licensed to operate in, on an annual basis using the PRMS reporting system.

This report is therefore based on both the licensees' and Petroleum Exploration Development and Production Department's (PEDPD) independent assessments. The report presents total discovered resources, reserves and prospective resources in the Albertine graben. In addition, the report includes a reconciliation of the reported petroleum reserves and resource estimates for the current year against the corresponding estimates for the previous year, along with an explanation of any changes between the two.

2.0 RESOURCES

Resources refer to all quantities of petroleum (recoverable and unrecoverable) naturally occurring on or within the earth's crust, discovered and undiscovered. It also includes all types of petroleum (conventional or unconventional). Currently, the resource base of the Country is estimated In Place volume of 6.0 Bbbls, with1.4 Bbbl recoverable. The recoverable gas volumes have been estimated at 329 Bcf of non-associated gas (and gas cap) gas and 198 Bcf of dissolved gas, in 21 oil and gas discoveries (Figure 1 and Table 1 below).

Table 1: Petroleum Discoveries in the Albertine Graben

No.	Discovery	Hydrocarbon Type	Date of Discovery
1.	Turaco	Gas (80% CO_2)	Sep-2002
2.	Mputa	Oil	Jan-2006
3.	Waraga	Oil	Feb-2006
4.	Kingfisher	Oil	Aug-2006
5.	Nzizi	Oil and Gas	Nov-2006
6.	Ngassa	Oil and Gas	Nov-2007
7.	Taitai	Oil and Gas	May-2008
8.	Ngege	Oil and Gas	Jun-2008
9.	Karuka	Oil	Jul-2008
10.	Kasamene	Oil and Gas	Jul-2008
11.	Kigogole	Oil and Gas	Aug-2008
12.	Ngiri	Oil and Gas	Sep-2008
13.	Jobi	Oil and Gas	Nov-2008
14.	Rii	Oil	Jan-2009
15.	Nsoga	Oil and Gas	Apr-2009
16.	Wahrindi	Oil	Jun-2009
17.	Ngara	Oil	Jul-2009
18.	Mpyo	Oil	May-2010
19.	Jobi-East	Oil	Apr-2011
20.	Gunya	Oil and Gas	Jun-2011
21.	Lyec	Oil	Jan-2013

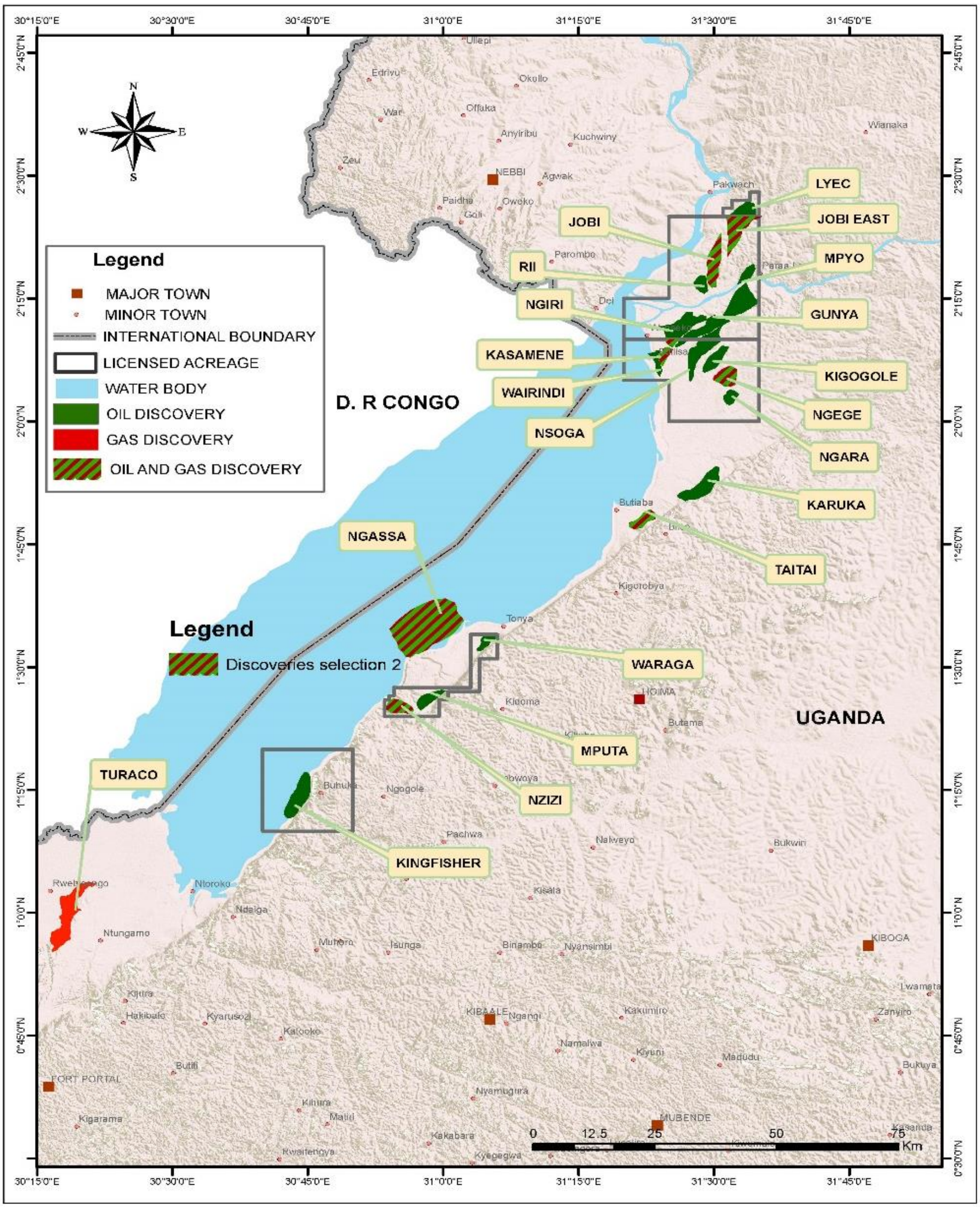

Figure 1: Map showing discoveries in the Albertine Graben

Previously, the total volume reported for the Albertine Graben had been aggregated without regard for project maturity. This was mainly because development projects had not yet been defined for the resources within most of the fields. Appraisal for most of the fields has now been completed and development projects have been largely defined. The resources in these fields have therefore been classified based on their level of maturity and according to SPE-PRMS.

A key strength of using a project-based system like SPE-PRMS is that it encourages the consideration of all possible technically feasible opportunities to maximize recovery even though some projects may not be economically viable when initially evaluated. These projects are still part of the portfolio and identifying and classifying them ensures that they remain visible as potential investment opportunities for the future.

In order to aggregate the resources within the different classes, a risk factor whose criteria has been defined as shown in Table 2, has been applied. It will now be possible to track the progress of resources development within the different classes.

Table 2: Criteria for choice of risk factor

Class	Risk Factor	Criteria
Reserves	1.00	The hydrocarbons are technically and commercially recoverable.
Development Pending	0.90	The main contingency remaining is award of a production license.
Development on Hold	0.80	The projects depend on the outcomes of previous phases or collection of additional data. It is therefore more likely than not, that the project will proceed.
Development Unclarified	0.70	Definition of a project depends on further appraisal. However, it is most likely that these volumes will become commercial.
Prospective	0.60	Definition of a project depends on discovery of commercial resources.
Improved Recovery Potential	0.50	Definition of a project depends on further studies/pilot project. There is a 50% chance that these volumes will become commercial.
Development Not Viable	0.00	Known resources, but no chance of commerciality.
Undeveloped STOIIP	0.00	Known resources, but no chance of commerciality.

The risk factor has been decided based on chance of commerciality within a given class as follows. Commerciality is defined by;

i. Reasonable time table for development;
ii. Reasonable assessment of future economics;
iii. Reasonable expectation that there will be a market;
iv. Production and transportation facilities are available or can be made available; and
v. Legal, contractual, environmental and other social-economic concerns allow for implementation of the project.

Table 3 and Figure 2 below show a breakdown of risked resources within the different classes in the Albertine Graben.

Table 3: Total risked hydrocarbon volumes in the Albertine graben as at December 2020

Class	Un risked Resource (MMBBL)			Risk Factor	Risked Resource (MMBBL)	Definition
	Low	Mid	High	Mid	Mid	
Reserves	713	1114	1475	1.0	1114	80%
Development Pending	13	32	41	0.9	28	2%
Development on hold	88	169	285	0.8	135	10%
Development unclarified	0	0	1	0.7	0	0%
Improved recovery Potential	126	232	289	0.5	116	8%
Development Not Viable	2	10	37	0	0	0%
Prospective resources	1	2	4	0.6	1	0%
Total	**944**	**1559**	**2130**		**1395**	**100%**

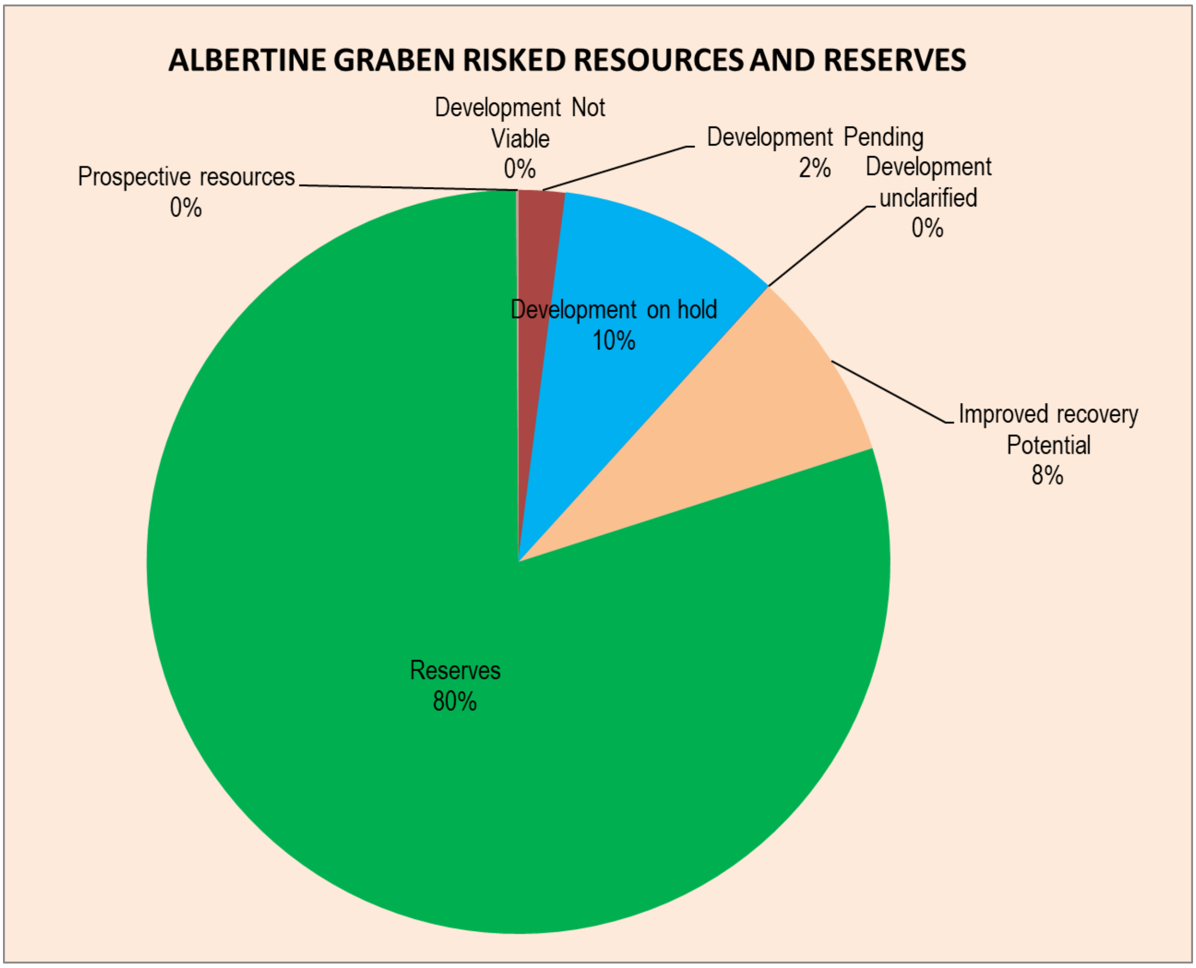

Figure 2: Breakdown of total risked recoverable hydrocarbon volumes in the Albertine Graben

2.1 Oil Resources

Oil resources in the Albertine graben have been classified into *reserves, contingent resources* and *prospective resources.*

2.1.1 Reserves

According to SPE-PRMS, reserves are those quantities of petroleum anticipated to be commercially recoverable by application of development projects to known accumulations from a given date forward under defined conditions.

In the Albertine Graben therefore, Reserves include the recoverable petroleum resources in fields for which the field development planning has been approved, production licenses awarded and Front-End Engineering Design (FEED) studies have been undertaken. The fields are only be pending Final Investment Decision (FID) before being put on production.

Reserves in the Albertine graben are currently estimated at 1,075 MMbbl, and this volume is attributed to; the Kingfisher, Kigogole, Nsoga, Kasamene, Wahrindi, Jobi- Rii, Gunya and Ngiri fields. Although Mputa, Nzizi, Waraga, Ngara and Ngege have production Licences, the recoverable resources therein are not considered reserves because they will only be brought on stream later after First Oil. The reserves (Table 4 below) make up about 80% of the total risked recoverable volume in the Albertine graben.

Table 4: Breakdown of Reserves in the Albertine Graben

Field	STOIIP (MMbbl)			Reserves (MMbbl)			%ge of Reserves	
	Low	Mid	High	Low	Mid	High		
Kingfisher	407	570	741	128	186	253	32.5%	16.7%
Mputa	80	104	140	9	10	13	9.9%	
Nzizi	16	32	54	0	1	1	2.5%	
Waraga	88	96	104	19	23	26	24.0%	
Kigogole	267	372	436	56	94	120	25.3%	
Nsoga	251	384	503	56	76	101	19.8%	24.3%
Ngara	11	16	33	2	3	4	16.3%	
Ngege	263	317	372	2	2	5	0.8%	
Kasamene	139	147	167	50	57	67	38.8%	
Wahrindi	17	28	46	0	5	8	17.9%	
Jobi Rii	1,215	1,698	2,296	159	308	424	18.1%	
Ngiri	609	756	886	161	245	325	32.4%	59.0%
Gunya	361	465	583	72	104	128	22.4%	
TOTAL	**3,725**	**4,985**	**6,362**	**713**	**1,114**	**1,475**	**22.3%**	**100%**

*Total reserves are 1075MMbbls exclusive of the 39MMbbls from Mputa, Nzizi, Waraga,Ngara and Ngege fields.

2.1.2 Contingent Resources

These are quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations by application of development projects but which are not currently considered to be commercially recoverable due to one or more contingencies. If it is clear that these cannot be overcome, the resources need to be assigned to the Unrecoverable class. Contingent resources are further subdivided into *Development Pending, Development on Hold, Development Unclarified* and *Development not Viable.* As presented in Table 3 above, the contingent resources make up about 12% of the total risked recoverable hydrocarbon volumes in the Albertine graben.

a) Development Pending

These are resources that have been planned for in the first phase of development of a given field and whose development is not dependent upon any outcomes from previous phases of development. The main contingency currently associated with these volumes is approval of an FDP. In our case these include resources attributed to Jobi-East, Mpyo and Lyec fields, with a total recoverable resource estimated at 31.6 MMbbl (Table 5).

b) Development on Hold

In the Albertine graben, there are projects that are considered to have at least a reasonable chance of commerciality but where there are major technical contingencies such as dependency of a given phase of development on the successful outcome of an earlier phase and further investigations will be carried out during development drilling to either prove hydrocarbon volumes or reduce specific remaining uncertainties before development of resources can be made firm. About 198.45 MMbbls of the resources fall under this category and is attributed to certain reservoir units and horizons in Mpyo, Jobi-East, Gunya, Ngiri, Jobi-Rii etc. (Table 6).

Table 5: Breakdown of Development Pending resources in the Albertine Graben.

<table>
<tr><th rowspan="2">Field</th><th colspan="3">STOIIP (MMbbl)</th><th colspan="3">Development-Pending (MMbbl)</th><th colspan="2">%ge of Development-Pending</th></tr>
<tr><th>Low</th><th>Mid</th><th>High</th><th>Low</th><th>Mid</th><th>High</th><th></th><th></th></tr>
<tr><td>Jobi East</td><td>495</td><td>698</td><td>1,020</td><td>11.8</td><td>29.5</td><td>37.7</td><td>4.2%</td><td rowspan="2">98.9%</td></tr>
<tr><td>Mpyo</td><td>108</td><td>179</td><td>257</td><td>1.1</td><td>1.8</td><td>2.4</td><td>1.0%</td></tr>
<tr><td>Lyec</td><td>9</td><td>14</td><td>30</td><td>0.2</td><td>0.36</td><td>0.5</td><td>2.6%</td><td>1.2%</td></tr>
<tr><td>TOTAL</td><td>612</td><td>891</td><td>1,307</td><td>13.1</td><td>31.66</td><td>40.6</td><td>3.6%</td><td>100%</td></tr>
</table>

Table 6: Development on Hold resources in the different fields in the Albertine Graben

<table>
<tr><th rowspan="2">Field / Discovery</th><th rowspan="2">Reservoir Unit</th><th colspan="3">STOIIP (MMbbl)</th><th colspan="3">Development-On Hold (MMbbl)</th><th colspan="2" rowspan="2">%ge of Undeveloped</th></tr>
<tr><th>Low</th><th>Mid</th><th>High</th><th>Low</th><th>Mid</th><th>High</th></tr>
<tr><td rowspan="3">Mputa</td><td>Mputa 4 H20 & H15</td><td rowspan="3">80</td><td rowspan="3">104</td><td rowspan="3">140</td><td>2.5</td><td>6.1</td><td>6</td><td rowspan="3">10.2%</td><td rowspan="3">9%</td></tr>
<tr><td>Mputa 1&3 H20 & H15</td><td>3.7</td><td>3.2</td><td>3.8</td></tr>
<tr><td>Mputa H10</td><td>0.7</td><td>1.2</td><td>1.1</td></tr>
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	Mputa H25				0	0.1	0.2		
Nzizi	Nzizi 2 H10 & H30; & N3 H10 (Add wells)	16	32	54	0	0	0.2	**0.0%**	
Kigogole	Kigogole 4	267	372	436	0	0	13.4	**0.0%**	
Nsoga	Nsoga 5 & others	251	384	503	0	0	17.1	**0.0%**	
Ngege	Ngege Phase 2 Ngege 2& 7 H30U, H30L & H25	263	317	372	0	6.3	13.7	**2.0%**	
	Ngege Phase 3 Ngege 2& 7 H30U, H30L & H26 +Ngege-1				0	0	4.3		
Kasamene	Kasamene H15	139	147	167	0.2	0.2	0.2	**0.1%**	
Jobi Rii	JobiRii Main + North H30U	1,215	1,698	2,296	11	22	27	**3.1%**	**91%**
	JobiRii Main H17 & H15L				6	12	16		
	JobiRii South (Rii-2 H30 & H27)				4	7	11		
	JobiRii South (Far South H30,H27&H25)				7	11	16		
Ngiri	Ngiri West H30	609	756	886	1	3	8	**2.4%**	
	Ngiri Terrace North Extension				6	15	21		
Gunya	Gunya H30 Gunya Deep	361	465	583	33	57	78	**12.3%**	
Jobi East	JE1/6 H30/15	495	698	1,020	1.7	3.5	4.6	**6.1%**	
	JE-2A				7	11	18		
	JE-5/7				5	8	13.5		
	JobiEast JE3/3A H30,H15				0.4	0.8	1.1		
	JobiEast H25 & H27 (36P,12I)				12	19	32		
Mpyo	Mpyo 3 H30	108	179	257	0	9	13	**6.7%**	
	Mpyo 1 H30/25				1.4	2.3	3.1		
	Mpyo 5 H30/25				0.46	0.75	1.02		
TOTAL		**3,804**	**5,152**	**6,714**	**103.06**	**198.45**	**323.32**	**3.9%**	**100%**

c) Development Unclarified

These are resources that are still under evaluation (e.g. a recent discovery) or require significant further appraisal to clarify the potential for development, and where the contingencies have yet to be fully defined. In such cases, the chance of commerciality may be difficult to assess with any confidence. The resources classified as Development Unclarified are estimated at 0.4 MMbbl and are negligible compared to the total discovered recoverable hydrocarbon volume in the Albertine Graben. This volume is attributed to the Mpyo-4 H30 and Mpyo-Central H27/25 panels in Mpyo field, where additional data is required to ascertain their potential.

d) Development Not Viable

These resources have been assessed, as of a given date, as being of insufficient potential to warrant any further appraisal activities or any direct efforts to remove commercial contingencies. Projects in this sub-class would be expected to have a low chance of commerciality.

Three sets of discoveries; Turaco (with 80% CO_2 content), Taitai-Karuka and Ngassa were considered sub-commercial by the respective licensees and relinquished back to Government in 2004, 2008 and 2014 respectively (Table 7).

Table 7: Breakdown of Development Not Viable resources in the Albertine Graben

Discovery	STOIIP (MMbbl)			Development-Not Viable (MMbbl)			%ge of Development-Not Viable	
	Low	Mid	High	Low	Mid	High		
Ngassa	15.2	46.8	112.2	2.3	9.4	33.7	20.0%	95%
Taitai	0.5	6.0	14.8	0.0	0.5	1.8	7.9%	5%
Karuka	0.1	0.3	4.0	0.0	0.1	1.2	20.0%	1%
TOTAL	**15.8**	**53.2**	**131.0**	**2.3**	**9.9**	**36.6**	**18.6%**	**100%**

e) Unrecoverable Resources / Undeveloped STOIIP

This is the portion of discovered petroleum initially-in-Place that is estimated, as of a given date, not to be recoverable. A portion of these quantities may become recoverable in future as commercial circumstances change, technological developments occur, or additional data is acquired. This volume has been estimated at about 208 MMbbl, which equates to about 3% of the Total STOIIP.

2.1.3 Prospective Resources

These are quantities of petroleum that are estimated, as of a given date, to be potentially recoverable from the yet to be drilled accumulations. Several prospects of this category have been identified in the Albertine Graben as shown in Figure 3 and the prospective volumes associated to them are shown in Table 8 below. Additional work is being undertaken by the Directorate of Petroleum to further refine and update all the prospective resources in the Albertine Graben currently amounting to approximately 867.5 MMbbls.

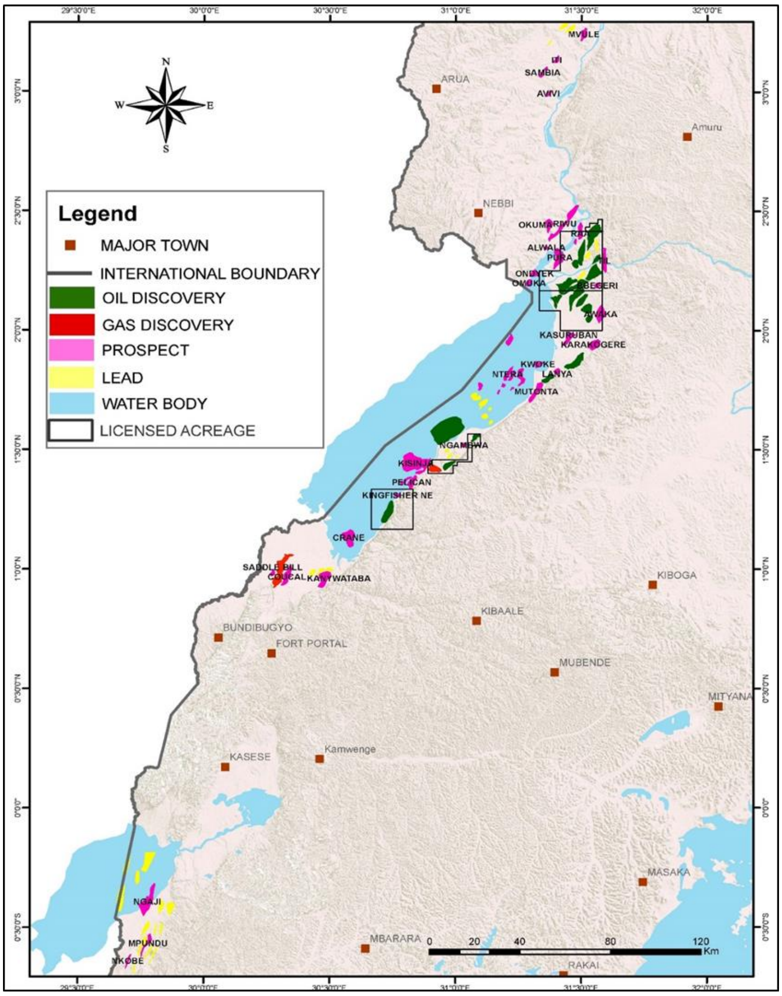

Figure 3: Map showing Prospects in the Albertine Graben

Table 8: Prospective Resources in the Albertine Graben Sub-Basins.

No.	Basin	Prospect	Area (Km²)	STOIIP (MMbl)		
				P50	Risk factor	Resources (MMbl)
1	Rhino Camp	Mvule	10.7	88	0.15	13.2
2		Iti	5.97	45	0.15	6.8
3		Avivi	3.3	35	0.15	5.3
4		Sambia	6.3	40	0.15	6.0
5	Pakwach	Riwu	32.4	57	0.15	8.6
6		Raa	13.5	55	0.15	8.3
7		Til	17.6	210	0.15	31.5
8		Ondyek	8.4	53	0.2	10.6
9		Alwala	2.5	11	0.2	2.2
10		Mparaki	2.3	24	0.2	4.8
11		Okuma	12.3	59	0.2	11.8
12		Omuka	7	71	0.2	14.2
13		Pura	25.9	24	0.2	4.8

14		Bbegeri	4.9	85	0.2	17.0
15	N. L. Albert	Awaka	21	26	0.2	5.2
16		Karakogere	5	25	0.2	5.0
17		Ntera	10	76	0.2	15.2
18		Kasuruban	14.7	25	0.2	5.0
19		Mtonta	4.5	10	0.2	2.0
20		Lanya	5.8	17	0.2	3.4
21	S. L. Albert	Kisinja	75.6	30	0.2	6.0
22		Pelican		28	0.2	5.6
23		Kanywataba	25.7	43	0.2	8.6
		Kingfisher-West	76	1240	0.32	396.8
24		Pelican-W	5.9	21	0.2	4.2
		Crane	24	37	0.2	7.4
		Ngambwa	2	3	0.2	0.6
27	Semiliki	Saddle Bill	12	763	0.15	114.5
		Turaco	11.5	464	0.2	92.8
		Ibis	2	37	0.2	7.4
		Squacco	1.5	28	0.2	5.6
		Coucal	20.6	38.6	0.22	8.5
28		Cuckoo	2	19	0.2	3.8
30	N.L Edward	Nkobe	3	9	0.22	2.0
31	S.L. Edward	Ngaji	40	68	0.22	15.0
32		Mpundu	20	37	0.22	8.1
TOTAL			**535.87**	**3901.6**	**7**	**867.522**

2.1.4 Enhanced Oil Recovery (EOR)

Enhanced Recovery is the extraction of additional petroleum beyond Primary Recovery, from naturally occurring reservoirs by supplementing the natural forces in the reservoir. It includes secondary processes, tertiary processes and any other means of supplementing natural reservoir recovery processes.

Polymer flood and water flood are the EOR methods that have been considered for fields in the Albertine graben. The potential for incremental volumes of oil from enhanced oil recovery through implementation of a polymer flood is currently being assessed. Laboratory experiments carried out on Kingfisher field by CUL; Ngiri, Jobi-Rii and Gunya fields by TEPU and Kasamene, Wahrindi, Mputa and Waraga fields by TUOP indicated an incremental recovery in the range of 3-10%, which translates to about 232 MMbbls. This accounts for 4% of the total resource volume.

Further analysis, assessment of field performance under EOR and implementation of a pilot will be required prior to execution of a full field EOR project. A comparison between water flood and polymer flood presented by the Licensees is shown in Figure 4 below with Polymer flooding having higher recovery factors.

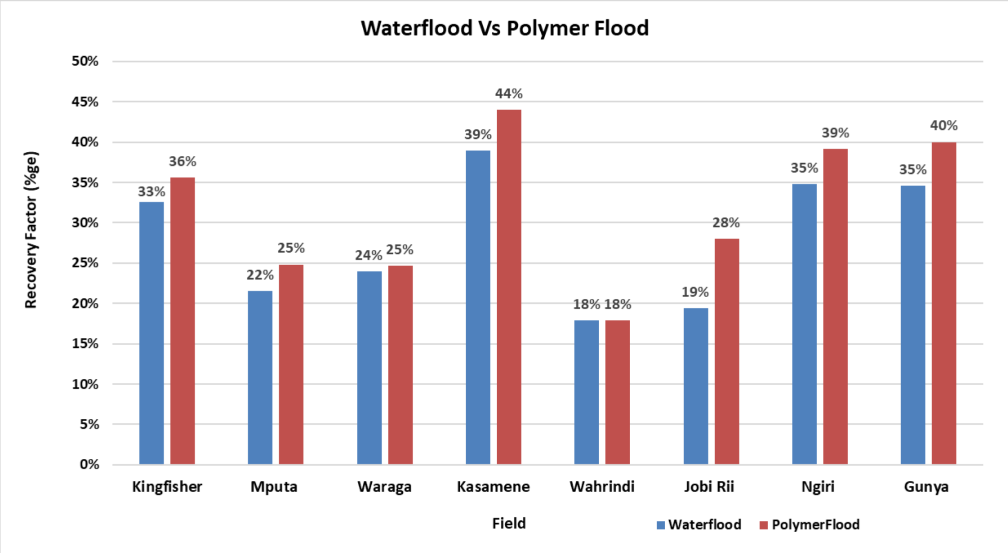

Figure 4: Recovery Factor of Water Flood vs Polymer Flood (Source: IOC Reports)

2.2 Gas Resources

Out of the 21 discoveries so far made, 13 fields namely; Turaco, Jobi-Rii, Ngiri, Ngege, Nzizi, Kasamene, Wahrindi, Jobi-East, Nsoga, Gunya, Taitai, Kigogole and Ngassa encountered gas. Two types of gas resources are existent in the Albertine Graben; associated gas (dissolved gas) and non-associated gas (free gas). Most of the gas in the Albertine Graben is non-associated gas.

2.2.1 Non-Associated Gas / Free gas

Gas cap volumes will not be produced until later in the production life of the field, due to its vital role in providing pressure support during oil production for oil and gas reservoirs. It should be noted that the plans for developing the gas reservoirs are yet to be undertaken. Approximately 329 Bcf of non-associated gas has been estimated in the Albertine Graben and a detailed breakdown of these gas resources is given in Table 6 below.

Table 9: Non-Associated Gas Volumes discovered in the Albert Graben

Field / Discovery	GIIP-FREE Bcf	Recovery Factor (%)	REC-FREE Bcf	GIIP-Boe MMbbl	REC-Boe MMbbl
Nzizi	14.6	55	8.0	2.6	1.4
Kigogole	0.2	80	0.1	0.0	0.0
Nsoga	2.6	60	1.6	0.5	0.3
Ngege	2.8	61	1.7	0.5	0.3
Kasamene	7.6	85	6.5	1.4	1.2
Ngassa	0.9	80	0.7	0.2	0.1
Taitai	1.3	80	1.0	0.2	0.2
Turaco	*342.0	80	*273.0	61.6	49.1
Jobi-Rii	32.0	75	24.0	5.8	4.3
Ngiri	16.0	68	10.9	2.9	2.0
Gunya	1.9	63	1.2	0.3	0.2
TOTAL	**422**		**328.7**	**76**	**59**

**Contains 80 % CO2*

2.2.2 Associated Gas

For the associated gas, the amount of gas available is dependent on the Gas Oil Ratio (GOR) and using the Gas Oil Ratios from the various fields, 198 BcF of dissolved gas has been estimated. The amount of associated gas produced will entirely depend on the oil production.

3.0 ONGOING ACTIVITIES

3.1 Reservoir Optimization studies

Reservoir optimization studies were undertaken by TEPU, CUL and TUOP in 2019 in close supervision by Government and a reservoir model optimization report was submitted by the Oil companies. Partial review and evaluation of the models has been undertaken by PEDPD however, more detailed works is still ongoing. This was aimed to de-risk the prospects and associated reservoirs.

And on this basis, there was a slight change in field reserves under development such as Gunya, Ngiri, Jobi-Rii and Kigogole fields.

3.2 Resource Assessment

Following the announcement of the Second licensing round by the Minister in May 2019, PEDPD embarked on a detailed and independent resource assessment of all the blocks under the Second licensing round. An understanding of the resources within the blocks on offer will enable effective negotiation of Production Sharing Agreements in regard to work programs proposed by successful bidders. In the reporting period, progress has been made on the Omuka block.

3.3 Exploration in Moroto-Kadam basin

To date, ten Geophysical, Geological and Geochemical (GGG) surveys have been undertaken in the Moroto Kadam basin. Approximately 4000 Km^2 of Geological and Geochemical data while over 788 line-km of Geophysical data have been acquired. This represents about 71% of the entire Moroto Kadam basin. The work undertaken has established that there is an existing working petroleum system (mature source rock, migration pathway, reservoir rock, trap and seal) and oil seepage has also been established which further proves a working petroleum system in the basin.

3.4 Exploration in Ngassa and Kanywataba Areas

Armour Energy Uganda Limited is undertaking exploration in Kanywataba License Area, while Oranto Petroleum Uganda Limited is undertaking exploration in Ngassa Shallow and Deep plays.

3.5 The Second licensing round

The Government of the Republic of Uganda through the Ministry of Energy and Mineral Development announced Uganda's Second Licensing Round, targetingfive (5) prolific Exploration Blocks namely: Avivi, Omuka, Kasuruban, Turaco and Ngaji. Four (4) companies namely; the Uganda National Oil Company (UNOC), Total E&P Uganda B.V.(TEPU), DGR Energy and PetroAfrik Energy resources East Africa Ltd were prequalified. The companies are currently evaluating available data in the respective blocks with a view of submitting their bid applications. Government will negotiate PSAs with successful bidders and grant exploration licenses to companies upon successful negotiation and approval by Cabinet for the grant of exploration licenses by December 2021.

4.0 CONCLUSION

The resource assessment so far done indicates an estimated In Place Volume of 6.0 Bbbls of oil, of which 1.4 Bbbl are recoverable. The recoverable gas volumes have been estimated at 329 Bcf of non-associated gas (including gas caps) and 198 Bcf of associated/dissolved gas. These estimates have a bearing on the planning of the projects to commercialize the oil and gas resources in the country.

Considering that the licensed area in the Albertine Graben is approximately 10%, more work remains to be done to further evaluate prospective resources and frontier basins in the country. Prospective resources if confirmed and brought to production will be useful in prolonging the production plateau of the current projected production profile.

Additional work to map and evaluate more prospective resources is currently being undertaken by the Directorate of Petroleum. In addition, with more data that will be acquired during the development and production phases over the already discovered fields, the volume estimates are subject to change and the Directorate will continue to update and report the estimates with due consideration of the changes.

Due to the shallow unconsolidated nature of formations in of some of the fields, the licensees have indicated that it will not be possible to apply pressure maintenance and EOR techniques in some fields hence resulting into very low recovery factors. The Directorate is seeking ways to undertake studies regarding injectivity and perhaps suggest ways of improving recovery from these fields.

With the sensitive nature of the environment in which these fields lie, the proposed development projects must ensure that there is minimal impact on the environment. The licensees together with Government are engaging in discussions to ensure that optimal technologies are deployed in order to optimally extract the resources without compromising the environment.

As the country enters into the development and production phase, a clear tracking of the resource estimates by both operators and Government is critical since it has a direct bearing on the economics of the projects plus the sharing of the revenues that will be generated from the production of the resource.

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