EDISON

Exploration watch

Senegal basin: Senegal and beyond

Back-to-back oil discoveries offshore Senegal in 2014 have opened up a new basin in the Atlantic Margin. Cairn/FAR's SNE-1 well was one of the largest discoveries in the world last year and a stream of newsflow is expected from Q415 when a follow up, three-well exploration and appraisal campaign is due to commence. The MSGBC basin is not limited to Senegal, however, and Kosmos Energy's 8tcf gas discovery in Mauritania has further highlighted the potential of a region that also includes Gambia and Guinea-Bissau. Other companies with acreage in the basin are now taking another look to identify analogous prospects and hope to drill in the near term. Smaller companies with exposure to the region include FAR, African Petroleum and Cap Energy.

2015 drilling in Senegal and Mauritania

With 2C resources of 330mmbbls in SNE, Cairn/FAR will now focus on establishing commerciality with a drilling campaign of two appraisal wells on the structure, together with a further shelf-edge exploration well due to kick off in 2015. Meanwhile Kosmos is planning an appraisal well on its Tortue (renamed as Ahmeyim) gas discovery and an exploration well further north at Marsouin, commencing in Q315. We expect the drilling will be closely watched with both areas having the potential to become larger hubs in the case of success.

Further analogues in Gambia and Guinea-Bissau

While **FAR** is focusing on its Senegal drilling campaign, it is also present in Guinea-Bissau where it will be drilling an appraisal well on the Sinapa discovery at the end of the year and is evaluating its SNE look-alike prospect Atum on 3D seismic. Other independents present in the region include African Petroleum and Cap Energy. Both are looking to drill here in 2016/17 if farm-in partners can be secured and we expect an increased industry interest given the proximity to the 2014 exploration successes.

African Petroleum holds interests in Senegal and Gambia where its licences surround the Cairn/FAR blocks. The company's prospects have been de-risked by the SNE-1 and FAN-1 discoveries and in total, the blocks hold independently assessed net unrisked prospective resources of 1.4bnbbls in Senegal and 1.9bnbbls in Gambia.

Cap Energy's acreage in Senegal sits immediately to the east of the discoveries and holds a number of prospects of leads with the largest being the 220mmboe P50 prospective resources in Antelope. Work is further advanced on its licences in Guinea-Bissau, assessed as containing 7.7bnbbls of P50 prospective resources, with at least two prospects analogous to the FAN-1 and SNE-1 discoveries.

3 July 2015

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COMPANIES IN THIS REPORT

African Petroleum

Cairn Energy

Cap Energy

Elenilto

FAR

Kosmos Energy

Oryx Petroleum

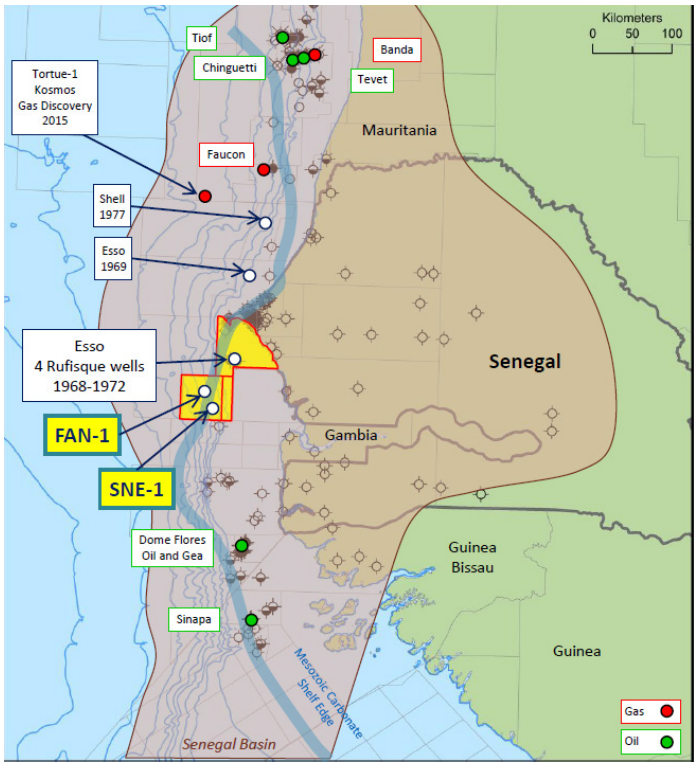
EXPLORATION WATCH
A periodic look ahead from our in-house petroleum engineer, Elaine Reynolds, looking at interesting exploration activities with significant potential impact on E&P equities.

Senegal basin discoveries open up new hot spot

The offshore sector in Senegal is currently a focus of interest for the industry in the wake of Cairn Energy/FAR's success with back to back independent oil discoveries in 2014. The FAN-1 and SNE-1 wells have opened up a new Atlantic Margin basin with an estimated full block potential of gross mean risked resources in excess of 1bn bbls in Cairn/FAR's acreage alone. But the MSGBC Basin also extends into Mauritania, Gambia and Guinea-Bissau where a range of companies hold significant positions and are gearing up to drill in the near term. Kosmos Energy's 8tcf Tortue/Ahmeyim gas find announced in April 2015 is located in Mauritanian waters. However, the Greater Tortue Complex is believed to extend to the south and into Senegal where the company farmed into two blocks in late 2014 on the basis of its Mauritanian 3D seismic survey. Small cap independents including FAR, Cap Energy and African Petroleum also hold assets in the basin with similar geology and prospects analogous to the FAN- 1 and SNE-1 discoveries. To date, the involvement of majors is limited to ConocoPhillips, partnering Cairn/FAR in Senegal and Chevron, partnering Kosmos in Mauritania.

The basin has the potential to be the next successful offshore African basin since the Rovuma discovery offshore Mozambique in 2010, which has so far proved up 185tcf of natural gas resources. Other African regions, for example Namibia, are also attracting large companies such as BP and Shell, but are at an earlier stage of the process having yet to establish the presence of all the elements necessary for a successful reservoir in one location.

Exhibit 1: Senegal basin map

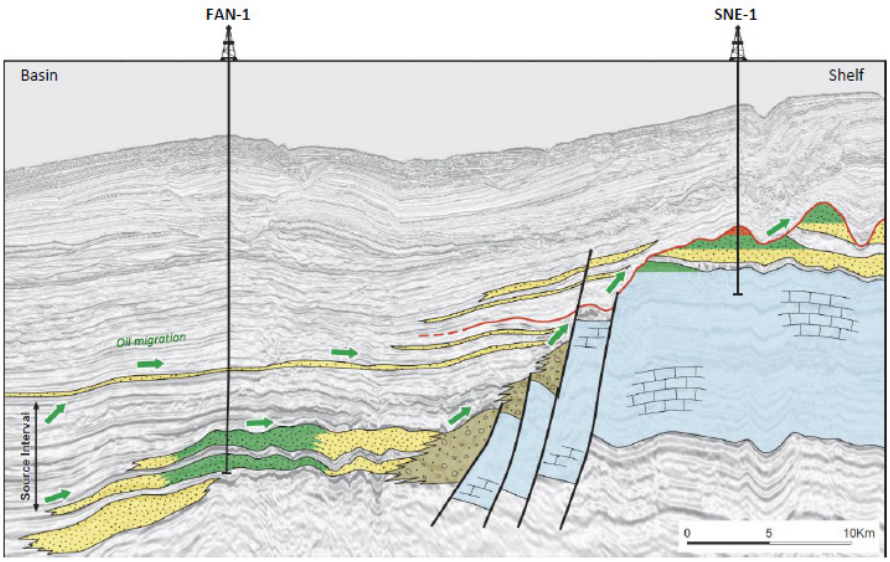


Source: Cairn Energy

The offshore area is under explored, with the Cairn/FAR wells being the first deepwater wells drilled in Senegalese waters and the first offshore wells to be drilled for over 20 years. The region is vast with Cairn/FAR holding almost 7,500km^2 in their blocks. African Petroleum covers over 15,700km^2, while Kosmos holds 18,000km^2 offshore Senegal.

Exploration here has only become feasible relatively recently as a result of advances in 3D seismic and the availability of deepwater drilling rigs. Four wells drilled between 1968 and 1970 by Esso did however demonstrate the presence of oil on the shelf, while a number of Deep Sea Drilling Project wells found thin Cretaceous source rocks.

Exhibit 2: 2D seismic schematic



Source: Cairn Energy

The basin is characterised by a wide carbonate platform formed during the Jurassic and Early Cretaceous, overlain by sandstones interbedded with shales. The geology can be differentiated into two structural areas separated by the shelf edge that extends north into Mauritania and south to Gambia and Guinea-Bissau. Between the coast and the shelf edge, as delineated in Exhibit 1, the water depth varies from 100m up to around 1,000m. To the west of the shelf edge, the carbonate shelf drops off steeply to the basin floor and water depths can reach 3,000m. The Cairn/FAR wells tested both of these areas, with FAN-1 targeting multiple Cretaceous deepwater stacked fans and stratigraphic traps and the shelf-edge SNE-1 targeting structural traps in the Albian sandstone and Aptian Carbonate. As a result of these successes, further drilling is planned from Q415, with three firm and three optional appraisal and exploration wells and additional 3D seismic acquisition to help more fully map the area. Meanwhile, other operators are reassessing their leads and prospects to establish the presence of analogous structures in their acreage.

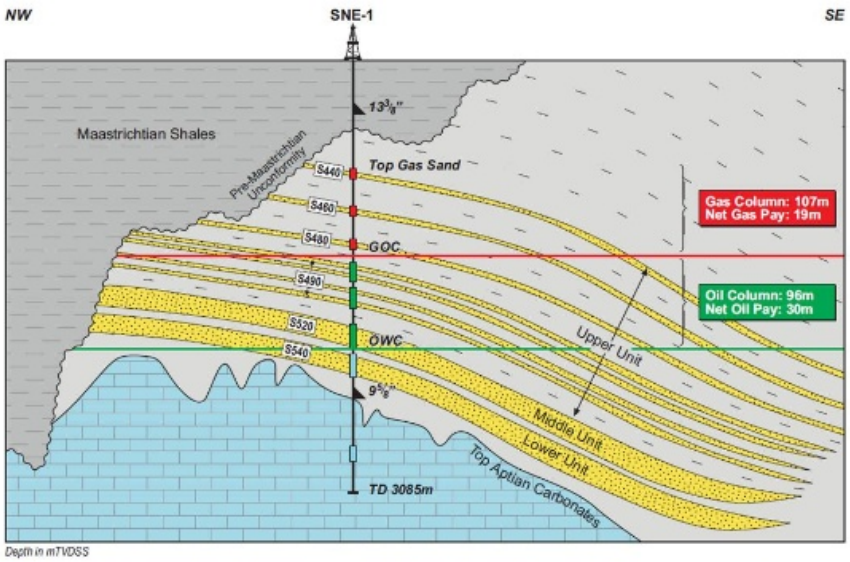
FAN-1: Proved world-class source rocks

The FAN-1 well was drilled in 1,427m of water and encountered net pay of 29m in a gross 500m thick hydrocarbon-bearing interval interpreted as a stacked series of oil columns. Distinct oil types ranging from 28^{o} to 41^{o} API were found in the well, indicating that the sands are charged from multiple source rocks. No oil water contact (OWC) was encountered in the well and this uncertainty has driven the wide range in the gross STOIIP of P90-P50-P10 of 250-950-2,500mmbbls. In addition, contingent resources have not been allocated to the discovery. This is a reflection of the fact that the reservoir is large and complex and will need further evaluation, initially through interpretation of reprocessed 3D seismic expected in late 2015. The focus will be on developing geological models to identify improved reservoir thickness and quality, either within the FAN prospect or in another fan along the trend. While the reservoir quality here is still under assessment, the key outcome of FAN-1 is that the presence of world-class source rocks in the region has been established. Further appraisal of the deepwater prospects could be included in the three potential wells that the JV has an option to drill in 2016 following on from its three firm wells on the shelf edge.

SNE-1: largest offshore oil discovery in 2014

SNE-1 was drilled on the shelf edge around 100km offshore and in 1,100m of water. The well encountered 32° API oil in 30m of net oil-bearing reservoir in a gross reservoir interval of around 100m in the target Albian sandstone. No hydrocarbons were found in the deeper secondary target, the fractured and karstified Aptian Carbonate. The discovery confirmed Cairn/FAR's interpreted migration path from source rocks in the basin up onto the shelf (Exhibit 3), while reservoir quality in the well is excellent with an average porosity of 24% and very good permeability reported from the modular formation dynamics tester (MDT) points taken across the sands.

Exhibit 3: SNE-1 schematic



Source: Cairn Energy

The company was able to take good pressure points across the entire sand intervals and establish a pressure profile with a clearly defined gas oil contact (GOC) and oil water contact (OWC) within the well (Exhibit 3). The oil within the reservoir is distributed across a number of sands varying in thickness between around one metre to tens of metres, with all the sands in pressure communication. 2C resources have been independently audited by ERC Equipoise and are estimated to be 330mmbbls.

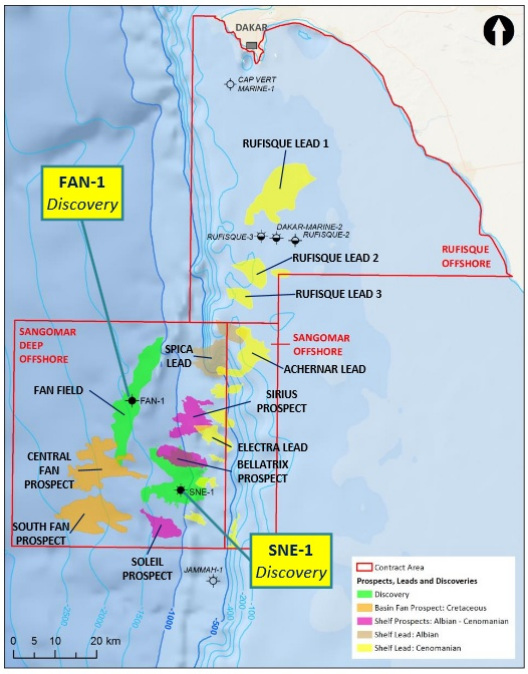
The discovery will be appraised with a firm three-well programme planned in Q415 and consisting of two appraisal wells together with an exploration well to target a further shelf prospect. The programme may be extended to include three further optional wells, which at this stage could include further SNE evaluation and/or FAN exploration, depending on the firm well results and the ongoing FAN-1 studies. With the SNE structure containing a relatively thin oil column spread over a 60-100km^2 area, the appraisal programme will look to establish connectivity and continuity across the reservoir. There is no evidence from seismic data of any obvious faulting and pressure data points to good vertical communication, however there could be a variation in reservoir quality across the large area of the structure and the distribution of the thin and thick sands could also vary. To try to establish connectivity, the appraisal programme will include interference testing, where a pressure response in one well is monitored following a deliberate transient change in another. The programme is also likely to include the testing of individual sands to establish the range of deliverabilities across the thin and thick sands.

Cairn/FAR currently estimate a 1C to 3C range of 150-670mmbbls and will also be looking to reduce the uncertainty range with the appraisal programme. Key risk on volumetrics is commonly driven by uncertainty in OWC, however with this clearly defined in SNE-1 the volumetric uncertainty here is due to the complex geology that overlies the field and complicates the seismic time to depth

conversion, giving varied results. Getting to grips with this will be key, so the appraisal wells should allow de-risking by providing extra data points for seismic calibration.

The JV has a number of appraisal targets identified and has yet to decide on the exact locations, but will try to pair the two wells in order to obtain the optimal information to establish field commerciality. The threshold economic gross field size is estimated to be c 200mmbbls, and if justified following appraisal, first oil is anticipated between 2021 and 2023. This would give a discovery to first oil timeframe of six to eight years, at the lower end of the average timeframes of seven to 10 years seen historically in West Africa. The preliminary development concept is around 30 wells producing 50,000-100,000bopd through a standalone FPSO, though clearly this will depend on the volumes, connectivity and productivity determined during appraisal.

Exhibit 4: Discoveries, prospects and leads



Source: Cairn Energy

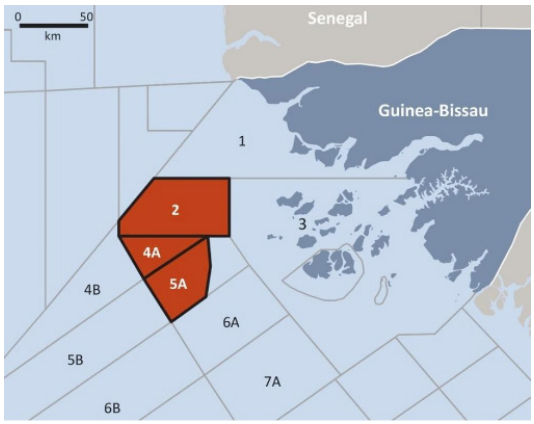
At least one exploration well will be drilled in H116 and this will focus on shelf-edge prospects in the vicinity of SNE-1. Likely candidates include Bellatrix, located on the northern flank of the SNE-1 discovery with estimated gross mean recoverable resources of 157mmbbls in Cenomanian to Albian reservoirs and Sirius with gross mean recoverable resources of 177mmbbls. According to FAR, a further six prospects have been identified. A 3D seismic survey will be carried out this summer covering the shallow water shelf-edge area in the Sangomar Offshore and Rufisque Offshore blocks.

Companies with exposure to Senegal and beyond

FAR

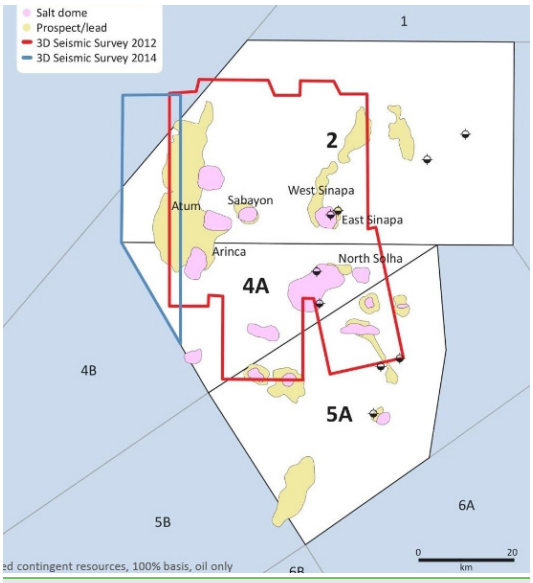
With a 15% stake in the FAN-1 and SNE-1 discoveries, FAR is focusing on its appraisal and exploration programme into 2016 in Senegal. The company also holds 15% WI in three blocks offshore Guinea-Bissau, containing the 13.4mmbbls gross 2C Sinapa discovery. Operated by Svenska Petroleum, a drilling campaign is being planned for 2016. In the light of the SNE-1 discovery, the existing 3D seismic is being reassessed to identify any analogous shelf-edge prospects, with one look-alike prospect, Atum, already identified and being evaluated with new 3D seismic.

Exhibit 5: FAR Guinea-Bissau acreage



Source: FAR

Exhibit 6: FAR Guinea Bissau prospects/leads

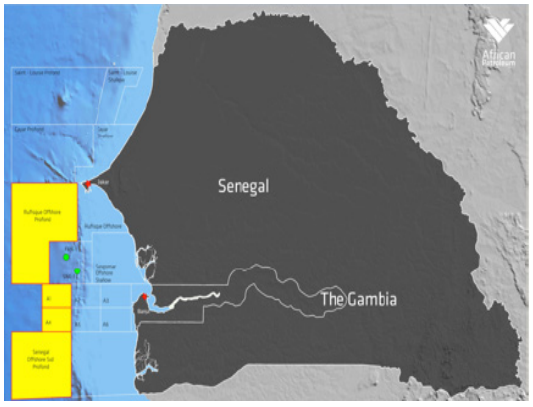


Source: FAR

African Petroleum

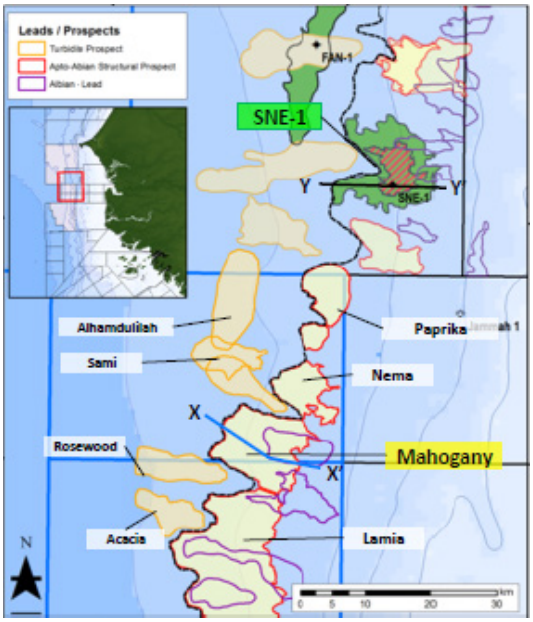
African Petroleum (APLC) holds large interests in four blocks in Senegal and Gambia surrounding the block containing the discoveries by Cairn/FAR at FAN-1 and SNE-1. In Senegal, APCL has identified one lead, Baobab, in the Rufisque Offshore Profond licence (ROP), which it is confident is similar to FAN-1 and this prospect is currently being matured. As in ROP, its Senegal Offshore Sud Profond (SOSP) licence to the south of Gambia is expected to contain deepwater basin fans, but crucially some shelf-edge prospects more analogous to that encountered in the SNE-1 discovery should also be present. In its two Gambian licences, A1 and A4, immediately to the south of Sangomar a number of prospects have been identified on the shelf edge and in the deepwater basin.

Exhibit 7: APCL Senegal/Gambia acreage



Source: APCL

Exhibit 8: APCL Gambian prospects



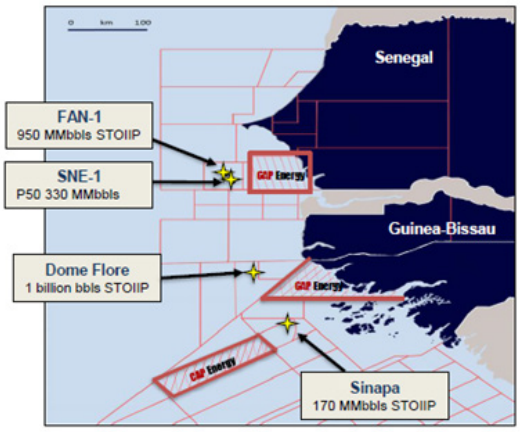
Source: APCL

The FAN-1 and SNE-1 discoveries have de-risked APCL's prospects and an independent audit of prospective resources released in March 2015 indicate best estimate gross unrisked prospective resources of 1.4bnbbls in the Senegalese blocks and 1.9bnbbls in Gambia. The company is currently looking to farm-down its blocks with a view to drilling in 2016/17 and the proximity to the 2014 exploration successes is likely to increase industry interest in this process.

Cap Energy

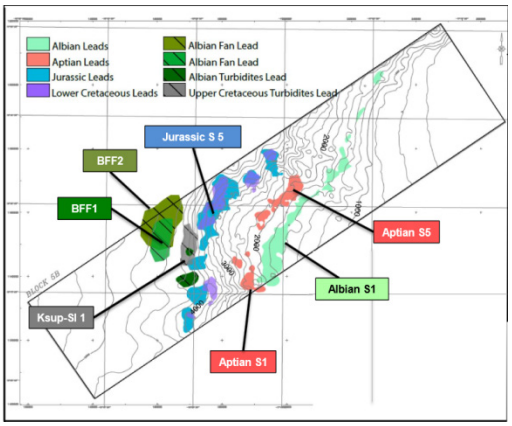
Cap owns non-operated working interests in one block offshore Senegal and two licences offshore Guinea-Bissau. Although its Djiffere block offshore Senegal is directly to the east of the Cairn/FAR discoveries and holds a number of prospects and leads, it is the company's Block 5B in Guinea-Bissau that is the main focus of interest in the near term. The 4,800m^2 deepwater block lies around 100km from the coast at water depths of 1,200-3,500m, and presents a variety of geological plays ranging from shelf-edge structural plays to basin floor fans.

Exhibit 9: Cap acreage



Source: Cap Energy

Exhibit 10: Cap leads in Block 5B



Source: Cap Energy

Existing 2D seismic data has been independently assessed and recoverable prospective P50 resources are estimated at 7.7bnbbls. In particular, two prospects have been identified as analogous to the Senegal discoveries with one similar to FAN-1 and the other to SNE-1. Each prospect is targeting around 400-500mmboe recoverable resources with a GCoS of around 20%. A 3D seismic survey was shot in Q414 and full interpretation results are expected in August. Cap's other Guinea-Bissau licence is the shallow water Block 1, which contains a number of shelf-edge prospects with recoverable resources in the order of 70-80mmbbls.

The Djiffere block offshore Senegal is located on the shelf in shallow water (10-250m) and Cap has identified 11 structural leads and prospects in the block, totalling more than 587mmboe of Pmean recoverable resources. The biggest prospect is Antelope, estimated to contain 220mmboe of P50 recoverable prospective resources with a GCoS of around 25%. These resources are predominantly located in Campanian sands which are younger than the Cenomanian and Albian-age reservoirs at FAN-1 and SNE-1.

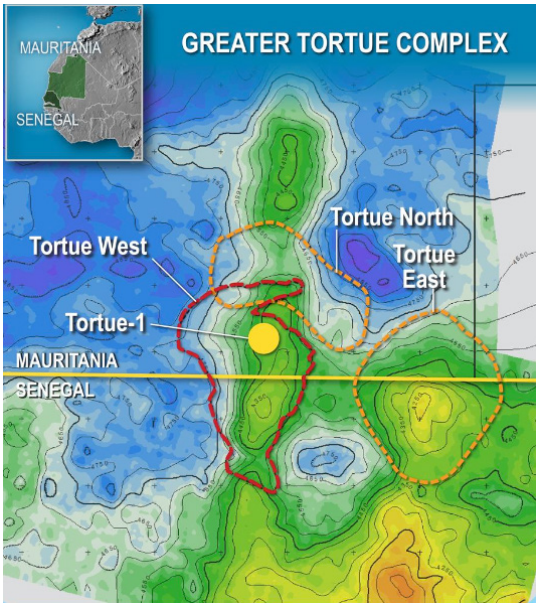
Cap will look to secure a farm-in partner to fund drilling from 2017. We expect this process will not commence until the Guinea-Bissau 3D interpretation is available in August.

Kosmos Energy

The April 2015 Tortue-1 gas discovery sits in Block C8 in Mauritania and only 2km from Senegalese waters. The $125m well was testing Tortue West, one of a series of structural/stratigraphic traps which make up the Greater Tortue Complex. The well encountered 88m of gas pay with excellent porosity and permeability in the Lower Cenomanian while the deeper secondary Albian target

contained 10m of gas pay. From a preliminary review, the company estimates that Tortue West contains significant gross resources of 8tcf.

Exhibit 11: Kosmos Tortue-1 discovery



Source: Kosmos Energy

From Exhibit 11, it can be seen that the complex extends into the St. Louis Offshore Profond Block in Senegal where Kosmos holds a 60% WI. A follow-on appraisal well is being planned on the complex in Q415 and may test other prospects in the Greater Tortue Complex, including Tortue East and Tortue North. An exploration well is also scheduled for Q315 when the Marsouin prospect to the north of Tortue will be tested. In May 2015, Kosmos announced that the discovery area had been renamed as Ahmeyim. In support of the drilling programme, a 3D seismic survey acquired over the Senegal blocks in Q414 is currently being processed and interpreted.

In addition to the C8 block, Kosmos also held 90%WI in contiguous blocks C12 and C13 covering a total area of 27,000km^2. In March 2015, the company farmed-down 30% WI in its Mauritian licences to Chevron. Chevron has an option to elect to participate at a 30% interest in Ahmeyim, subject to paying a disproportionate share of their costs related to the Tortue-1 exploration well.

Elenilto

Private UK-based oil and mining company Elenilto owns an interest in the Senegal Offshore Sud Shallow Block (SOSSB), some 100km south of Cap's Djiffere block and immediately east of African Petroleum's SOSP block. An independent report by Beicip-Franlab in 2014 estimated STOIIP potential of 1.9bnbbls based on reprocessed 2D seismic, of which 400-700mmbbls is in first priority leads. Around half of the leads are analogues to SNE-1 (shelf-edge plays) or to existing shallow-water salt dome discoveries: Dome; Flore/Dome; and Gea (Oryx Petroleum-operated) in the AGC zone and Sinapa Dome (Svenska-operated) in Guinea-Bissau. As of May 2014, Elenilto was planning to begin a 3D seismic survey in the following months; however, it is unclear whether the survey has started yet.

Oryx Petroleum

Oryx Petroleum (OXC) operates the AGC Shallow and AGC Central blocks with an 80% WI (AGC is the joint petroleum exploitation zone established by Senegal and Guinea-Bissau). The blocks are directly adjacent and north of Cap's shallow-water Block 1 in Guinea-Bissau. OXC has identified three structures in AGC Shallow, of which two are drill-ready prospects, and plans to drill an

exploration well in 2016. In the deepwater AGC Central block, OXC has identified shelf-edge plays similar to SNE on seismic data, and expects to acquire new seismic data in 2016.

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