OCP Policy Center Conference series

The Booming Africa Oil and Gas Industry

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26 September 2014

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Africa Discoveries Distribution/hot Spots

World's Top 10 Discoveries In 2014 (Up to 29 August 2014)

Rank	Current Operators	Country	Discovery	On/Offshore	HC Type	MMboe (2C)
1	Eni	Gabon	Nyonie Deep 1	Offshore – Shelf	Gas,condensate	377
2	Statoil	Tanzania	Piri 1	Offshore -deep	Gas	318
3	Anadarko	Mozambique	Tubarao Tigre 1	Offshore -deep	Gas	303
4	Cobalt	Angola	Bicuar 1A	Offshore -deep	Oil,gas,cond	300
5	Sapura	Malaysia	Bakong 1	Offshore -deep	Gas,condensate	257
6	Santos	Australia	Lasseter 1	Offshore -deep	Gas,condensate	178
7	BG	Tanzania	Taachui 1ST	Offshore -deep	Gas	168
8	YPF SA	Argentina	Pampa de las Yeguas	Onshore	Shale Gas	168
9	BG E	Egypt	Notus 1	Offshore -shelf	Gas	125
10	VNG Norge AS	Norway	6406/12-03S (Pil)	Offshore - deep	Oil,gas	110

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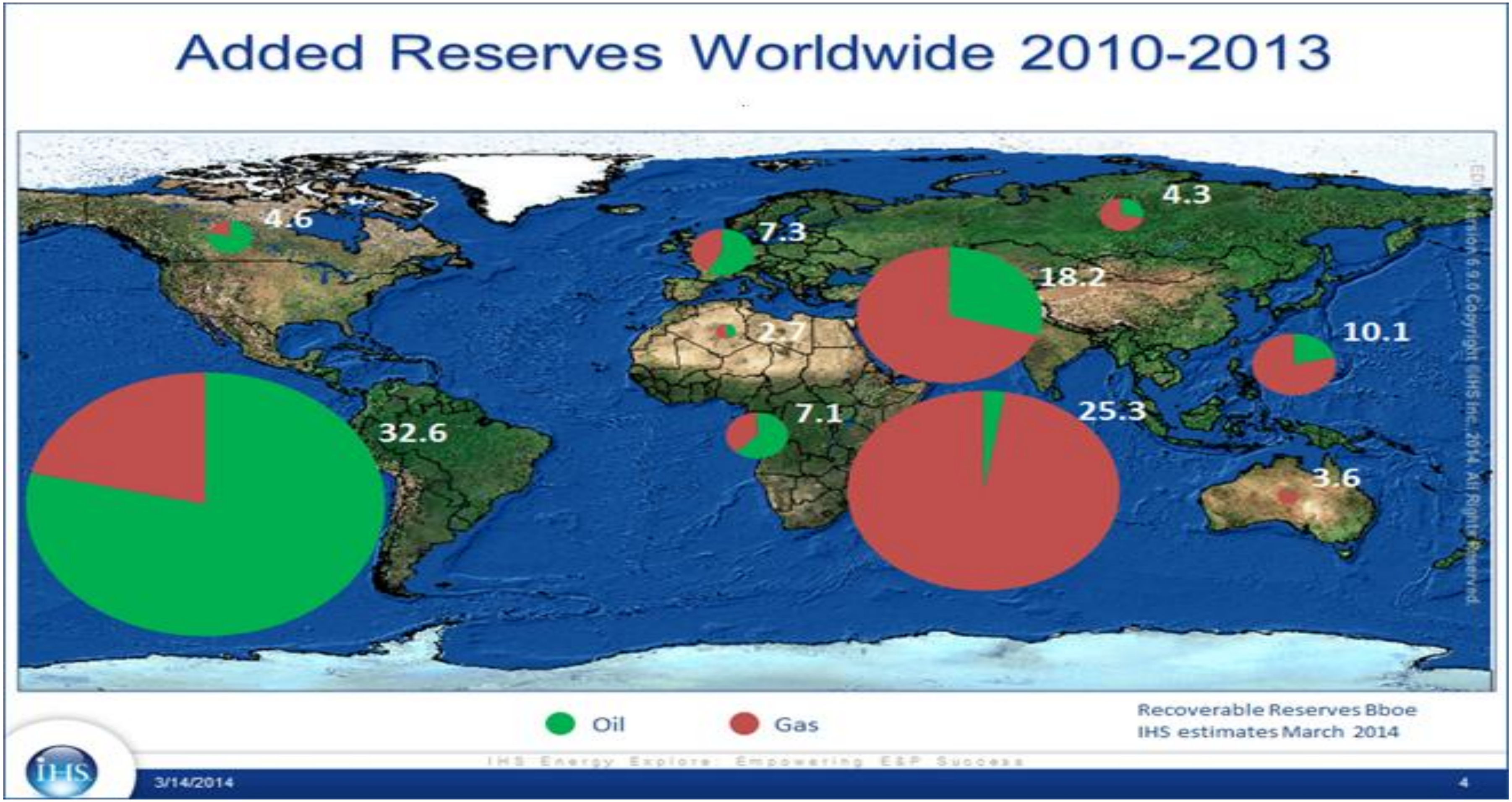
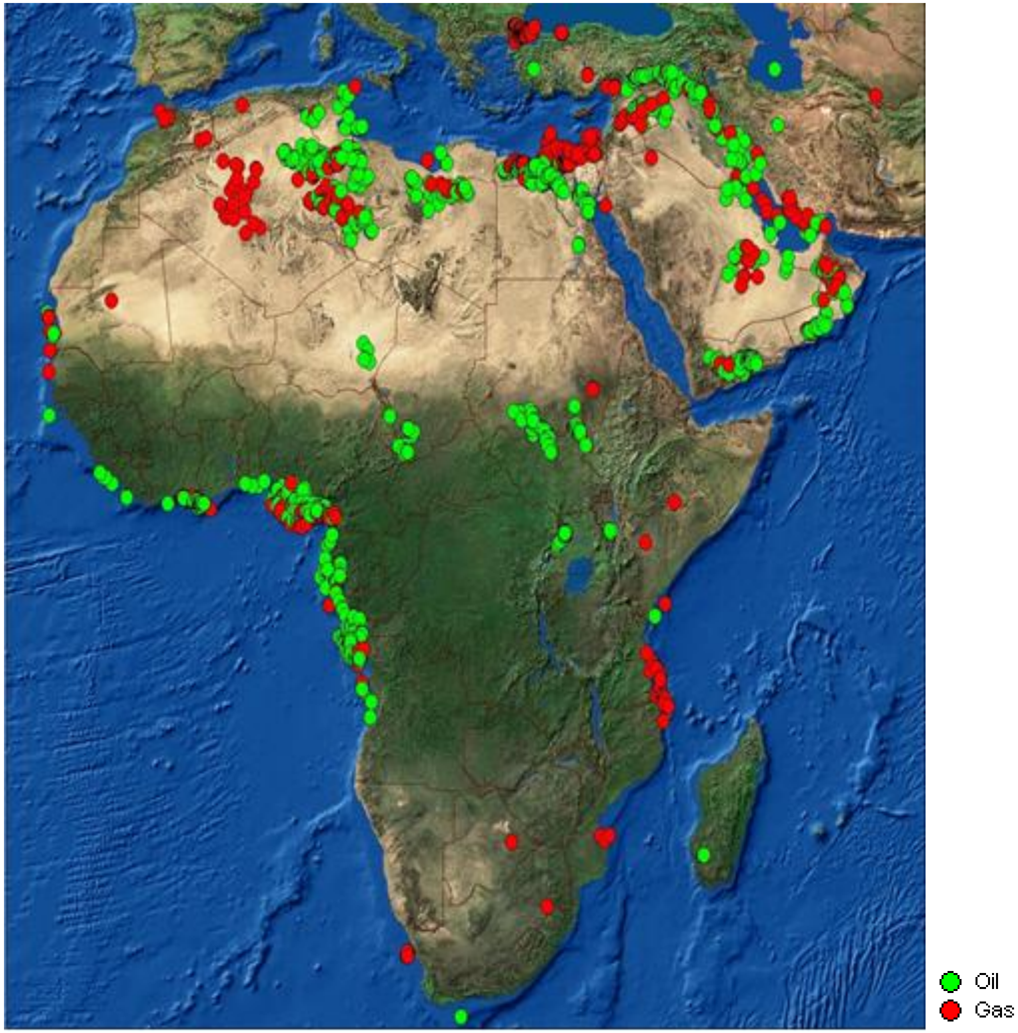
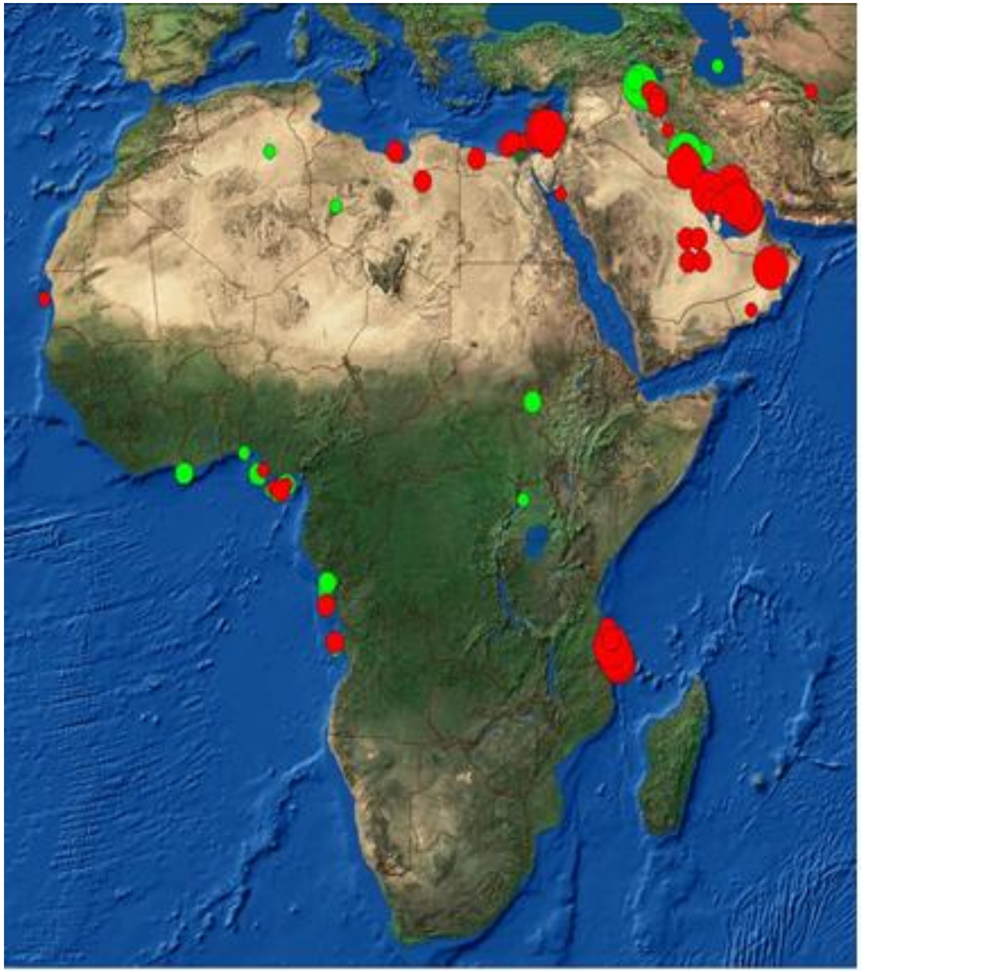
Africa taking a significant place in the world



Distribution of discoveries made between January 2000 and May 2014



Distribution of discoveries made between January 2000 and May 2014



Oil >=250 MMb
Gas >=1Tsc

East Africa New Eldorado

Where Are the Liquids in Offshore East Africa ?

East Africa

Holds two of the 2012 top five oil and gas plays

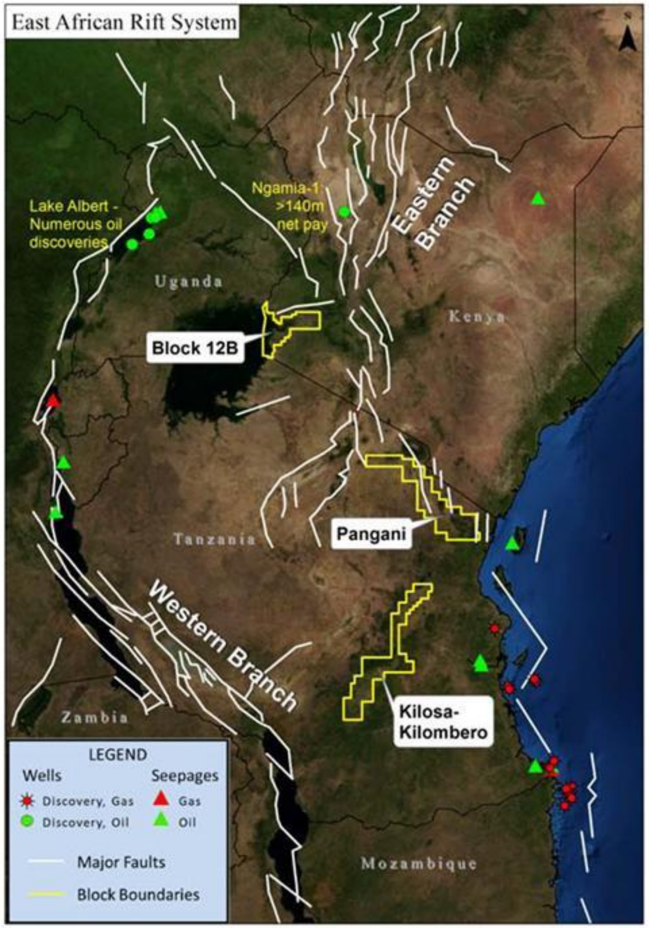
- **Kenya**

  Oil discovered in Ngamia-1 and Twiga-1 onshore wells

  Gas discovered Mbawa-1 offshore well
- **Bakken, North Dakota**

  Could yield some 4.3 Bbo (US Geological Survey) to 40 Bbo (operators working on the play).
- **Eagle Ford, South Texas**

  Eagle Ford is potentially the next Bakken
- **Levant Basin** (Mediterranean plays:Syria-Palestine-Israel-Cyprus-Lebanon)
- Estimated 122 Tcf of recoverable natural gas, and around 1.7 Bb recoverable oil.
- **Offshore Tanzania & Mozambique**
- Tanzania offshore with some 30 Tcf of gas
  Mozambique offshore with more than 95 Tcf of gas in offshore Rovuma Basin



High Impact Wells in East Africa 2014-2015

ONSHORE

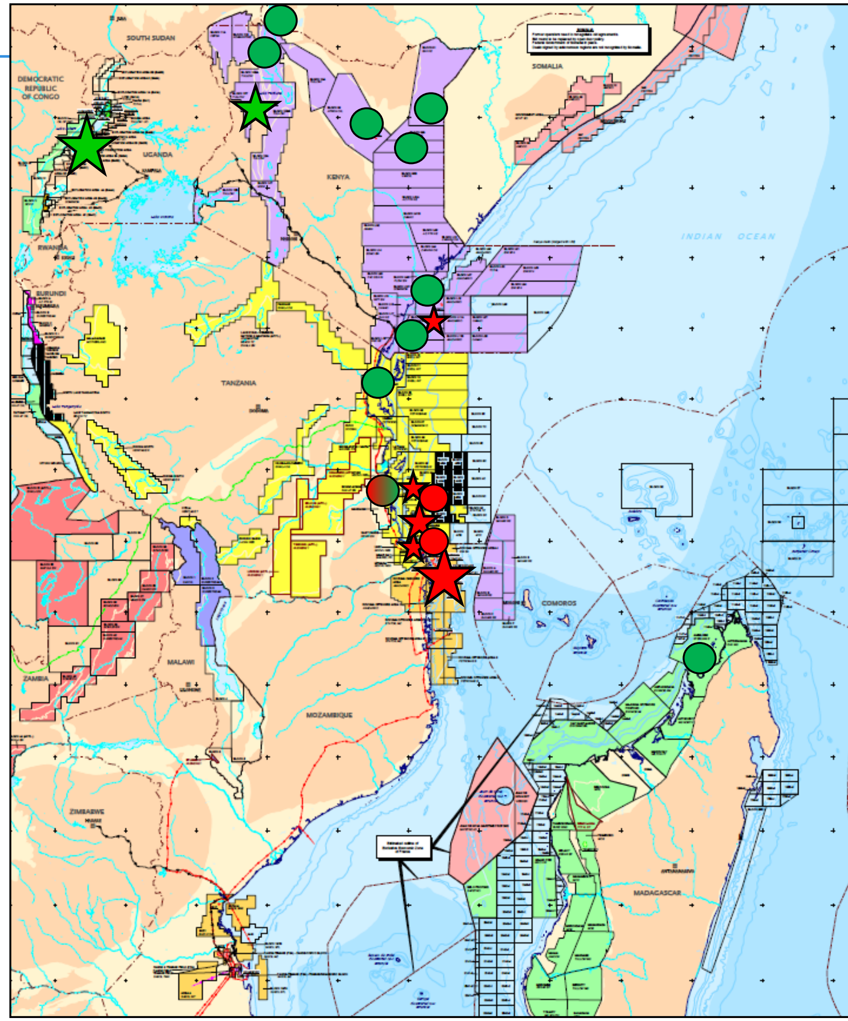
OFFSHORE

Tullow
- **Shimela** + **Kesami** prospects 1H 14 - 70 MMboe, EARS
- Four prospects (basin opener) **Turkana** Graben, rift-bounding fault play, EARS

Africa Oil
- **Sala** prospect, 400 MMboe, Q1 14, rift-bounding fault play, Anza Basin

Taipan
- **Badada** prospect, 200 MMboe mid 14, rift-bounding fault play, Anza Basin

Afren
- **Khorof** prospect, 390 MMboe Q3 14, 4-way dip closure, Somali Basin



BG Group
- **Sunbird 1 found HC in March 14** (play opener). First ever test of a Miocene Carbonate Reef off East Africa, oil-prone system

FAR, Ophir, Afren
- Planning wells in 2014-2015, looking at BG's Sunbird results

Ophir
- **Tende** prospect, 379 MMboe or 2.4 Tcf, 30-70% oil vs gas, mid 14

BG, Statoil
- Planning five offshore gas wildcats to maximize their acreage's value (Blocks 1, 2, 3, 4)

ExxonMobil, Afren
- Planning onshore & offshore wildcats in Ampasindava and Antsiranana permits

Proven Oil-prone area | Proven Gas-prone area | HI well (oil expected) | HI well (gas expected)

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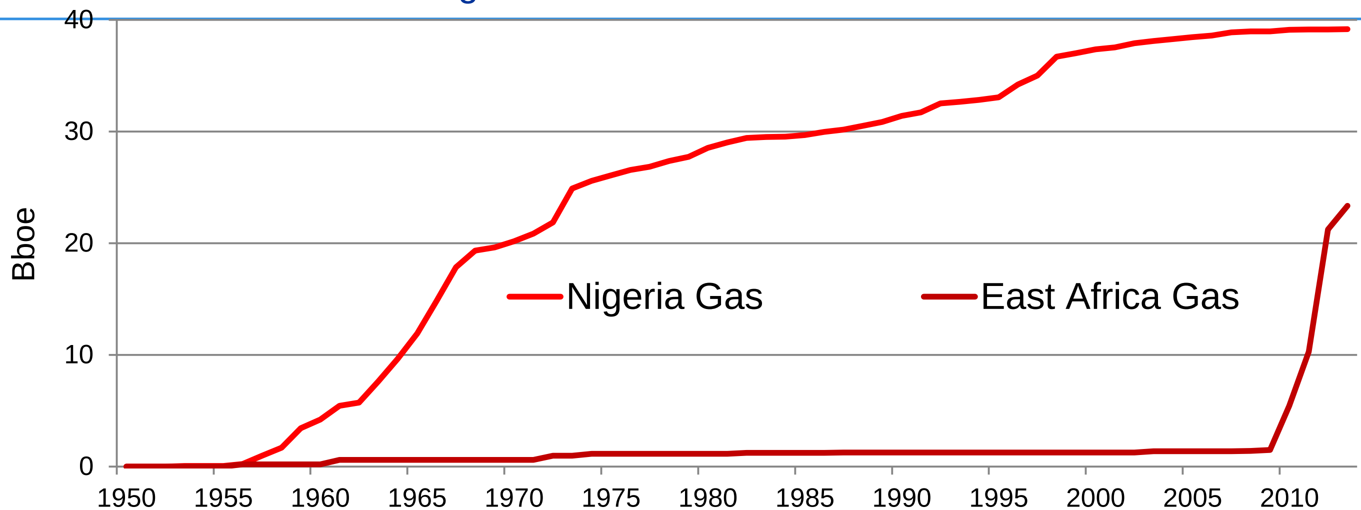
Gas Reserves Comparison

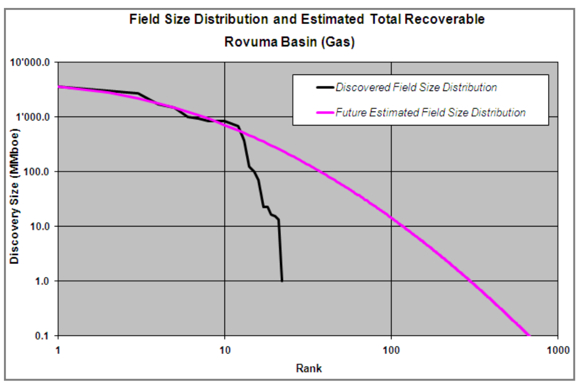
Creaming Curves – Gas Recoverable Reserves P+P

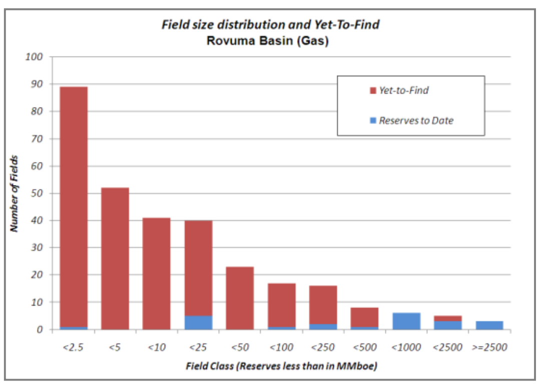


12 Bboe to be discovered in Rovuma Basin only, which will put East Africa gas volume as large as Nigeria

Source: IHS EDIN (2014)

Yet-to-Find Statistical Analysis – Rovuma Basin





	Reserves to Date		Estimated Total Recoverable		Yet-to-Find	
Reserve Size Categories (MMboe)	MMboe	Number of Fields	MMboe	Number of Fields	MMboe	Number of Fields
<1.0	0	0	146	699	146	699
>=1 and <2.5	1	1	142	89	141	88
>=2.5 and <5	0	0	185	52	185	52
>=5 and <10	0	0	293	41	293	41
>=10 and <25	91	5	640	40	549	35
>=25 and <50	0	0	822	23	822	23
>=50 and <100	71	1	1'224	17	[illegible]'153	16
>=100 and <250	225	2	2'581	16	[illegible]'356	14
>=250 and <500	380	1	2'842	8	[illegible]'462	7
>=500 and <1000	4'907	6	4'225	6	0	0
>=1000 and <2500	4'268	3	7'900	5	3'631	2
>=2500	9'423	3	6'478	2	0	0
Total MMboe	19'367	22	27'478	[illegible]98	11'739	97[illegible]

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To develop giant discoveries in Deep water Companies joining forces

- **Statoil** acquired 12% working interest in **Block 6**, offshore Tanzania from **Petrobras**

- **Total** signed of a farm-in agreement with **Petronas** for the acquisition of a 40% interest in the **Rovuma Offshore Areas 3 and 6**

- **Anadarko** and **Eni** signed an Agreement for the development of common natural gas reservoirs offshore Mozambique. Jointly plan and build common onshore liquefaction facilities in the Cabo Delgado province.

Asian cash-rich companies - Ideal partners

- **Statoil** farmed down a 25% interest in the **Rovuma Offshore Area 2/5** to Japan Inpex Corporation of Japan (Block relinquished)
- **Eni** sold 20% stake of its 70% interest in **Rovuma Offshore Area 4** to **CNPC**
- Indian state company ***ONGC*** and ***Oil India Ltd*** buying a 10% stake in ***Rovuma Area 1 Offshore Block***
- Japanese Prime Minister Shinzo Abe pledged to invest 70 billion yen ($672 million) in development projects in Mozambique during the next five years
- Thailand's ***PTT Exploration and Production (PTTEP)*** said it plans to invest $5.5 billion in 2014, an investment in ***LNG in Mozambique***.

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First movers rewarded for taking risk

East Africa Transaction price					
Country	**Year**	**Buyer**	**Seller**	**Price (USD million)**	**Type of Transaction**
Kenya	2009	**Africa Oil**	Turkana Resources	11.80	Corporate
Kenya	2010	**Africa Oil**	Platform Resources	2.70	Corporate
Kenya	2010	**Africa Oil**	Centrica Energy	58.80	Corporate
Kenya, Thiopia, Seychelles, Madagascar	2010	**Afren**	Black Marlin	110.00	Corporate
Uganda	2010	**Tullow**	Heritage	1,450	Asset acquisition
Kenya	2011	**Africa Oil**	Lion Energy	35.80	Corporate
Kenya	2011	**FAR Resources**	Flow Energy	25.00	Corporate
Tanzania, Uganda, DRC	2011	**Ophir**	Dominion	186.00	Corporate
Uganda	2011	**CNOOC and Total**	Tullow	2,900	Asset acquisition
Kenya	2012	**Taipan**	Lion Petroleum	5.70	Corporate
Mozambique, Kenya	2012	**PTT Exploration**	Cove	1,750	Corporate
Tanzania	2012	**Morel & Prom and Wentworth Resources**	Cove	31.80	Asset acquisition
Ethiopia	2012	**Marathon**	Agriterra	40-50	Asset acquisition
Tanzania	2013	**Statoil**	Petrobras	?	Asset acquisition
Tanzania	2013				
Mozambique	2013	**CNPC**	Eni	4,210	Asset acquisition
Mozambique	2013	**Statoil**	Inpex (Japan)	?	Asset acquisition

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Videocon, a conglomerate controlled by Indian tycoon Venugopal Dhoot

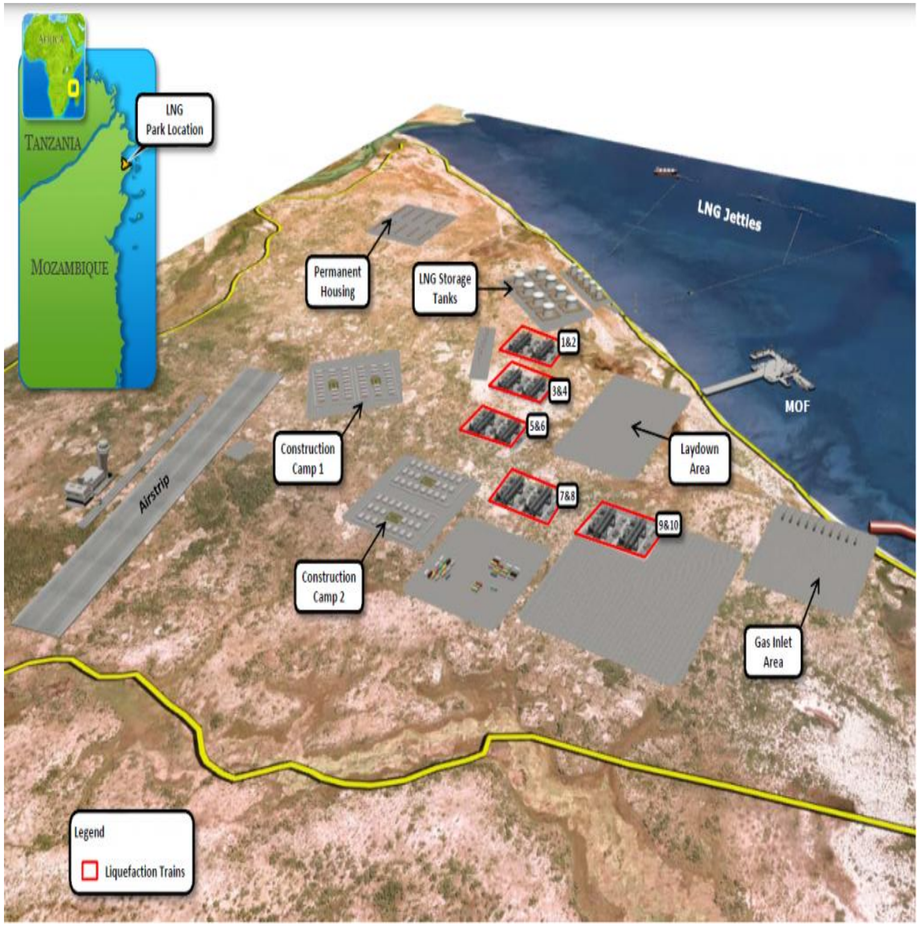
- ***Videocon Group*** sold its asset in the Rovuma 1 for USD 2.48 billion

  Videocon paid USD 75 million in 2008

Mozambique

Anadarko and Eni to built Afungi LNG Park phases

- Anadarko (area 1) and Eni (Area 4) to implementation of the giant project for the Liquefied Natural Gas (LNG) to be built at Afungi, in the northeast province of Cabo Delgado (Mozambique)
- Afungi LNG Park should have the capacity to host up to 10 LNG trains with 5 MMt/y capacity per LNG Train (five folds of two LNG each)
- GTL project with Shell
- First shipment from the Afungi LNG was expected in 2018
- On 26 June 2014, Mozambique Government approved the Master Plan for natural gas sector.
- A pipeline will connect the region of Palma (northern province of Cabo Delgado) to Maputo (South)
- Mozambique Presidential election period planned in September 2014 more likely to delay first shipment to 2019 or 2020.



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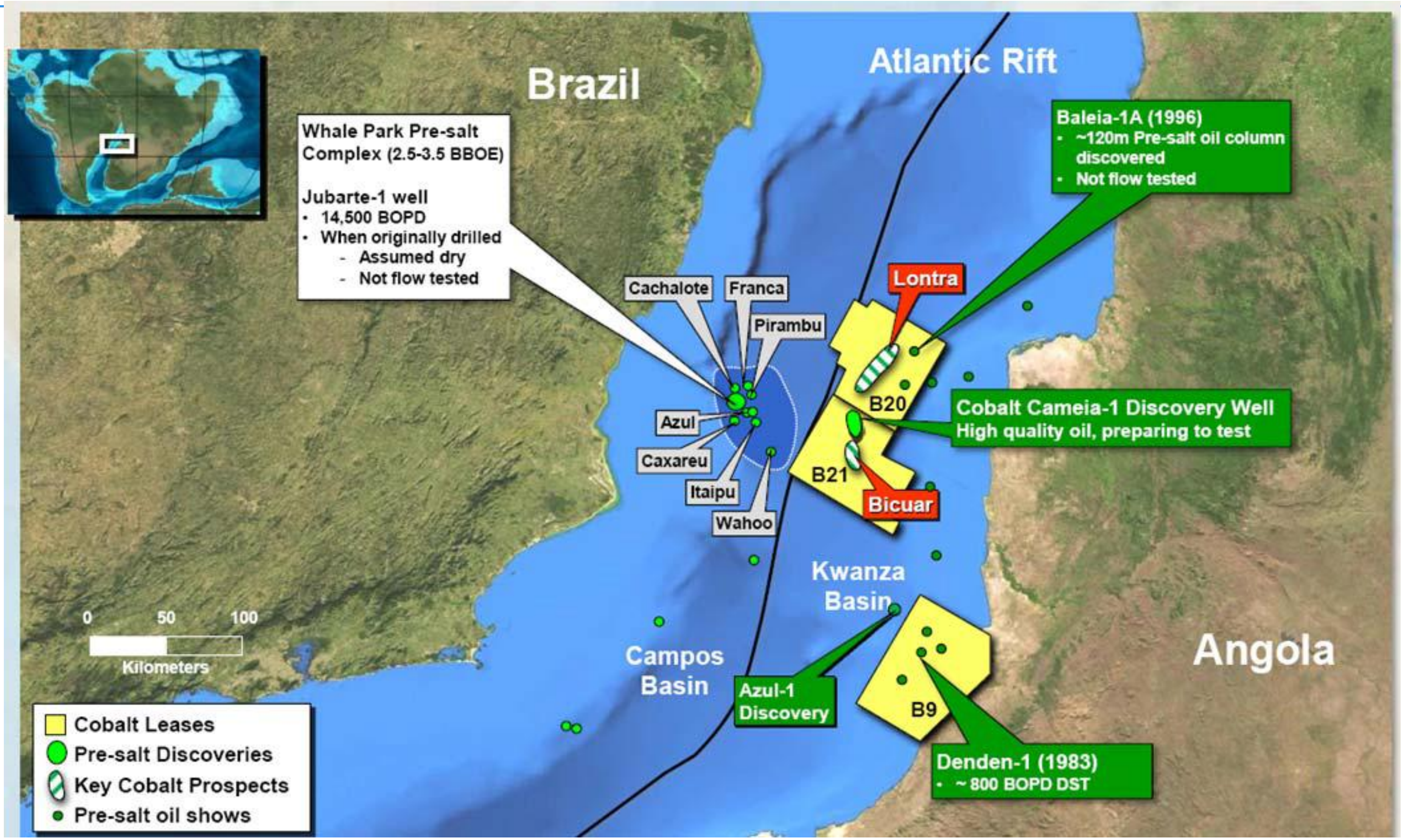
TANZANIA
To develop LNG project

- LNG Project to develop Natural Gas discovered in offshore/Deepwater blocks located 80-100 km away from the shore
- The project will be managed and operated jointly by BG/Ophir, Statoil/Exxon-Mobil and the Government of Tanzania
- The LNG plant has to be onshore
- The Natural Gas produced will be destined to both Domestic and External Markets
- Minimum gas requirements are based on a capacity 6.6 MT/year
- FEED study is scheduled in 2015-2016, with a Final Investment Decision in late 2016
- The first train of an initial two-train onshore LNG plant is scheduled to come on-stream by 2020-2021

Brazil and West Africa – pre-salt relationship



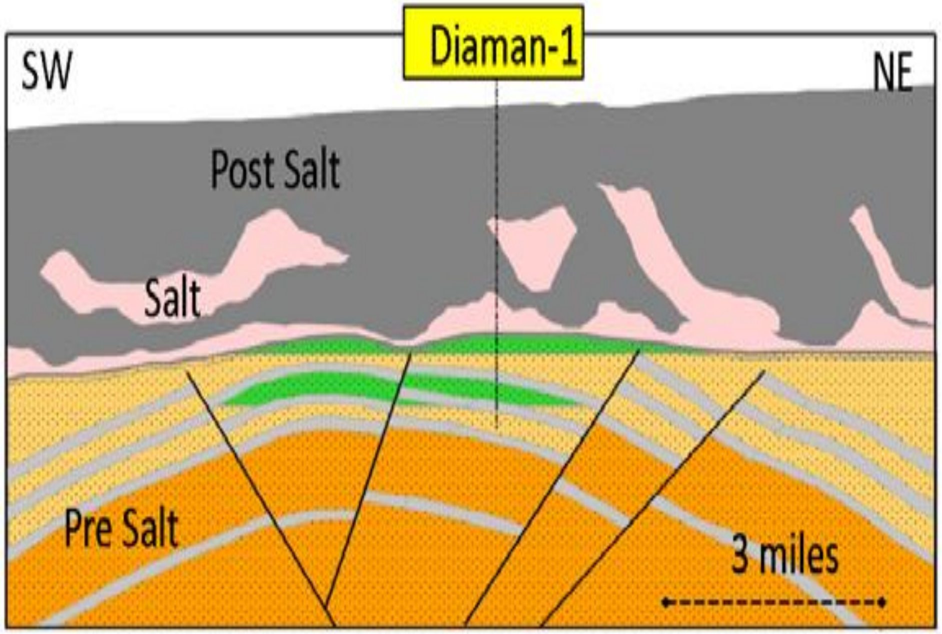
Source: Cobalt International Energy

Petroleum system working in Gabon Deep Offshore

Total

finds gas and condensate in the Diaman 1B wildcat in the Deep water Diaba Block

Reservoir quality?



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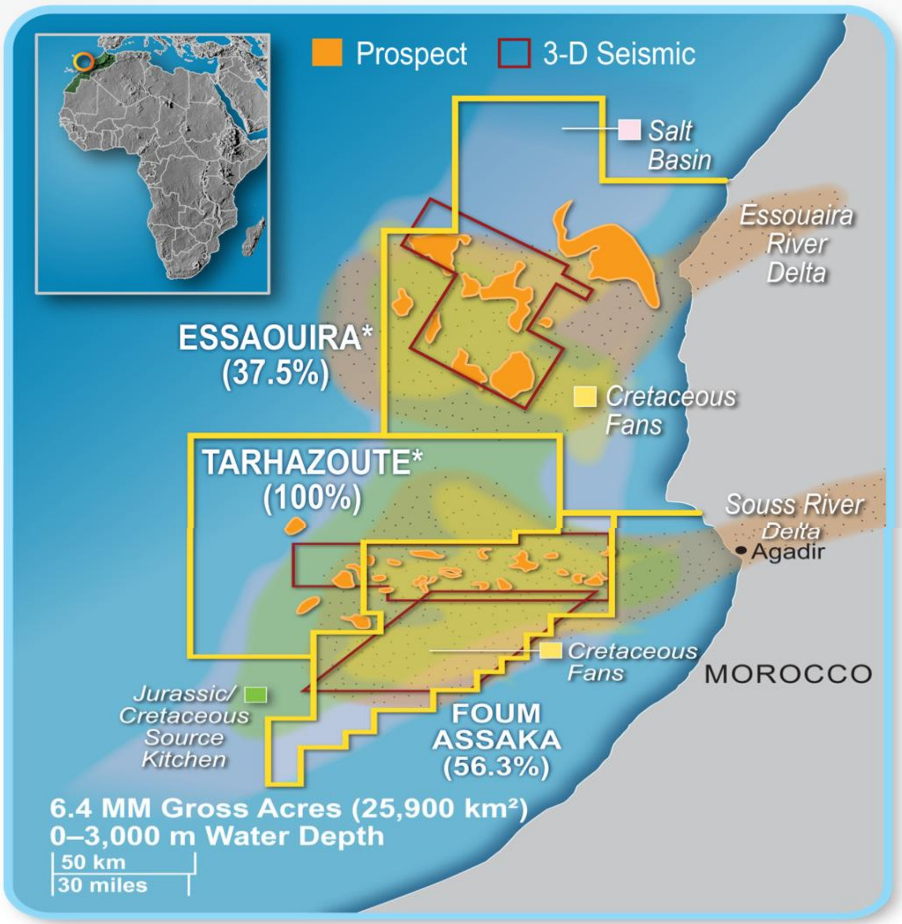
Northwest Africa, Morocco and Mauritania entered a new cycle of offshore drilling in 2014

North African Atlantic Margin
Morocco Deep Water

Offshore Agadir Basin Petroleum System

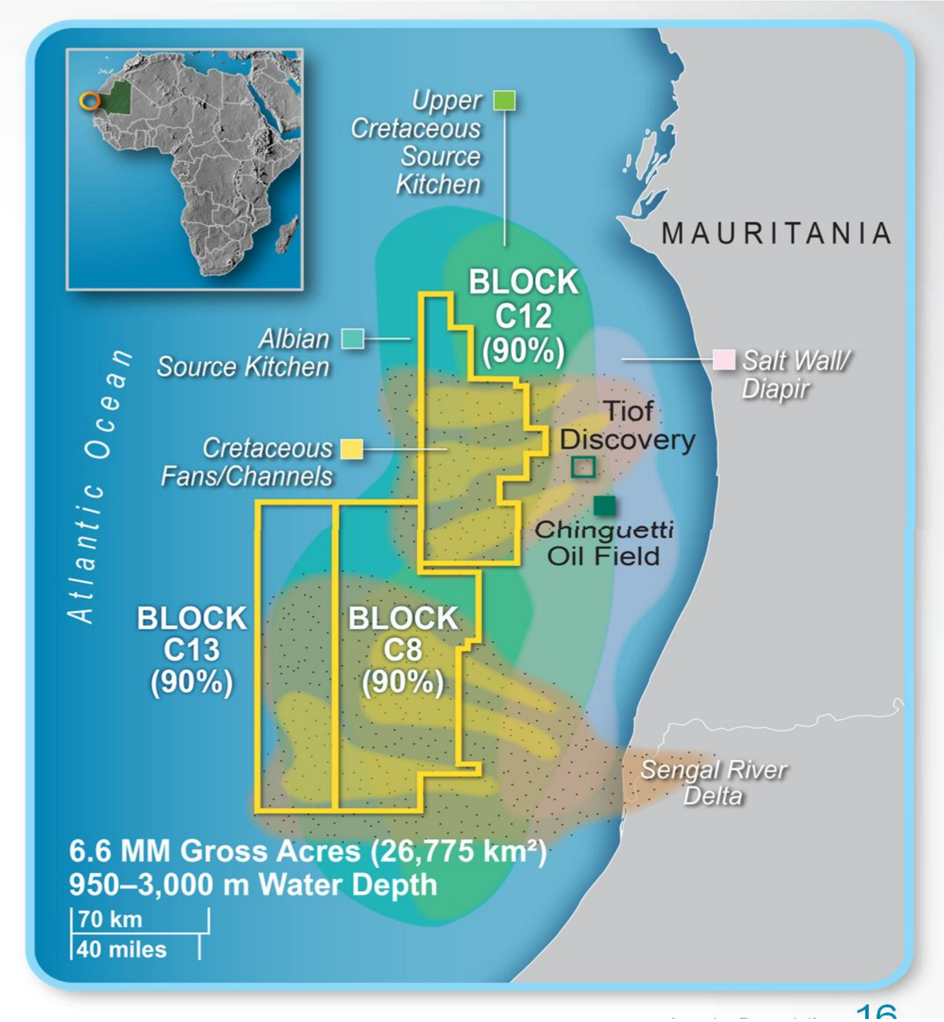


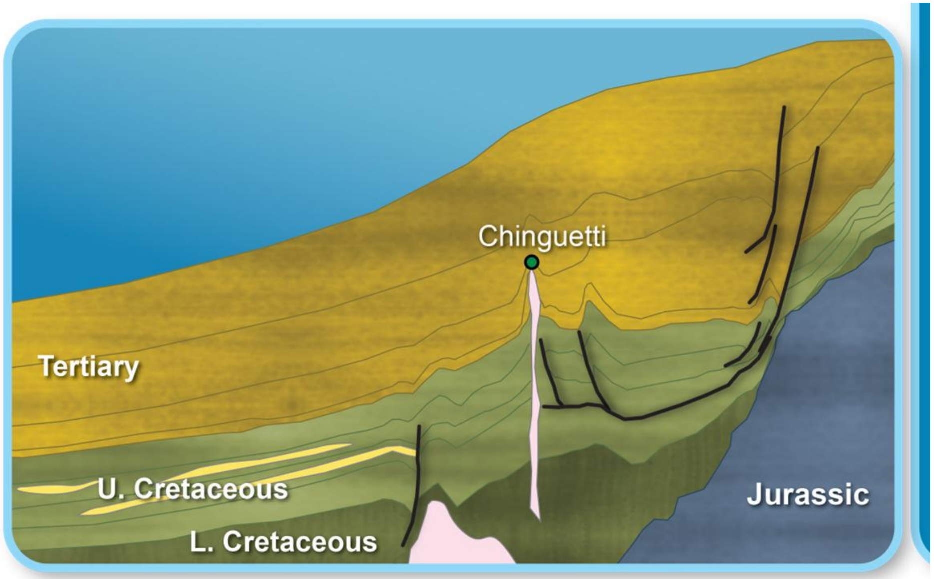
- ✓ Mesozoic-Tertiary 'post-rift' sub-basins above a 'syn-rift' Late Triassic-Early Jurassic salt basin.
- ✓ Main exploration targets: Structural and Stratigraphic 'post-rift' traps

Reservoirs include :

- ➢ Cretaceous slope fan channel systems and ponded turbidites.
- ➢ Prominent Late Jurassic carbonate shelf edge (heavy oil was found (Tarfaya MO-2).
- ✓ Mid Cretaceous organic-rich shales have been encountered in DSDP holes and could act as source rocks.
- ✓ Presence of reservoir quality sands is uncertain and traps may be breached or may lack updip seal

Offshore Mauritania
Any oil in the cretaceous fans/channels?



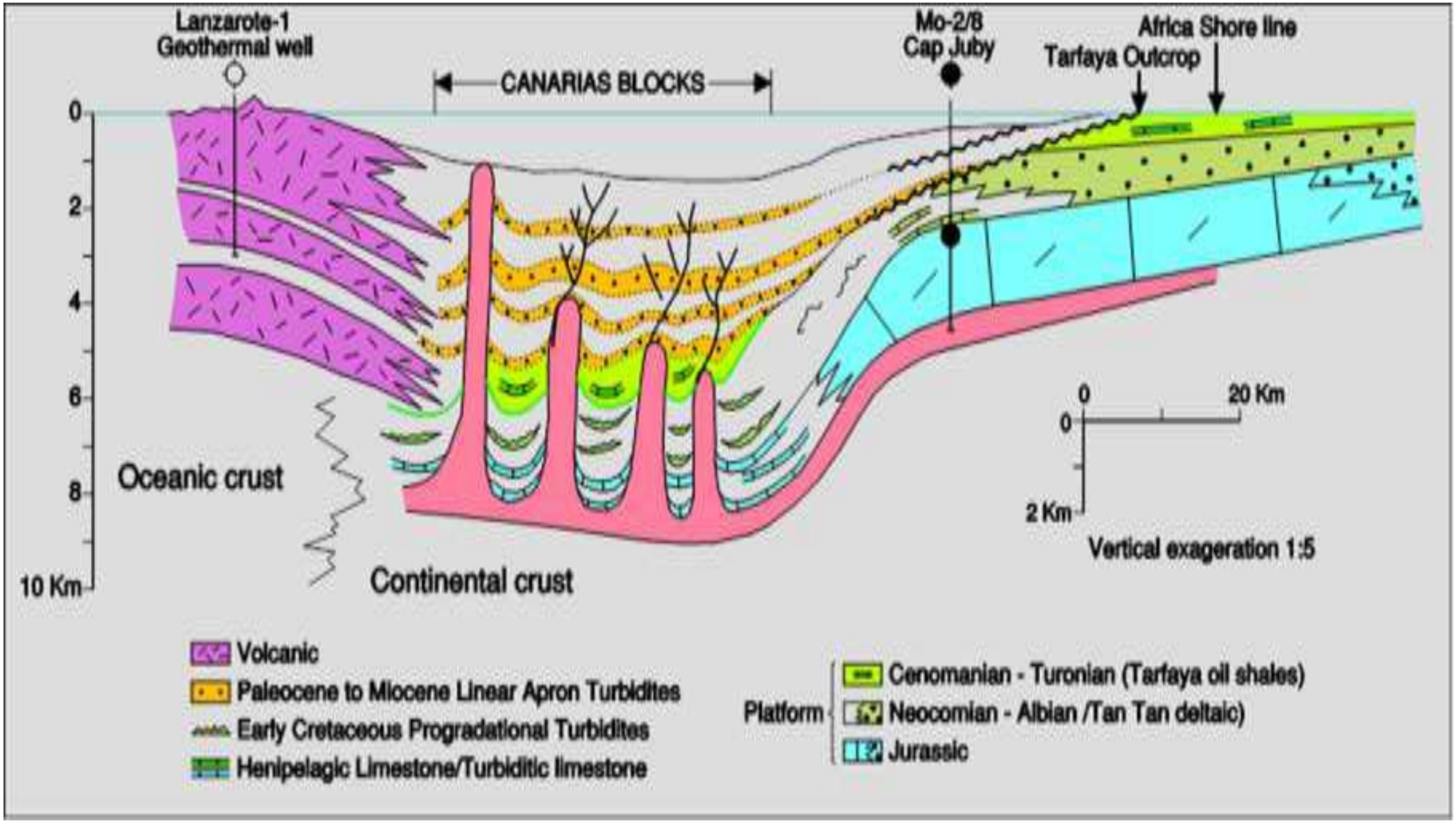


Source Kosmos

2 wells drilled by Tullow in 2014 failed to find commercial oil

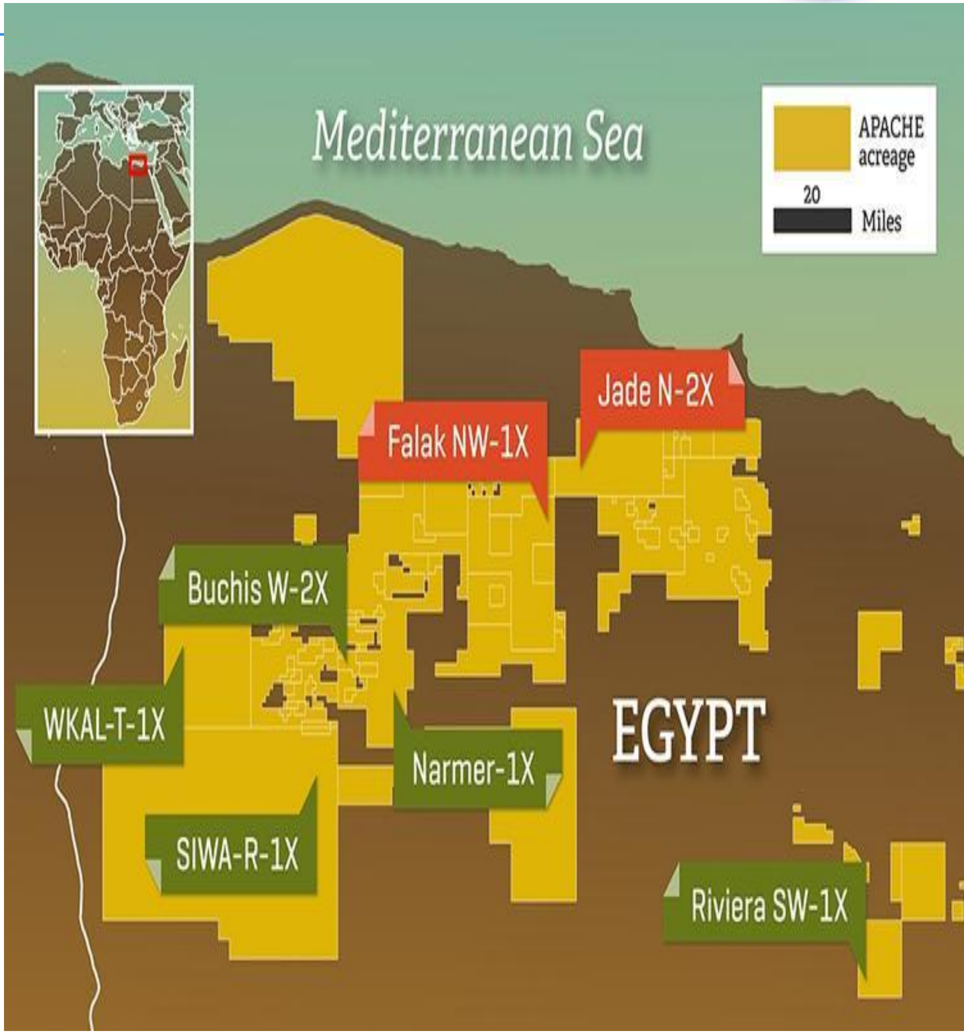
Fregate 1 well found oil shows in the cretaceous: petroleum system is working

Canary Island
Tertiary and Cretaceous targets



Egypt- Western Desert
Apache successful story continues

- Seven new discoveries (Jurassic play)
- Apache producing 215,000 bo/d and 900 MMcf/d in Egypt
- Apache sold 33% interest in assets for USD 3.1 billion to Sinopec of China
- Total Egypt asset value of USD 9.3 billion, higher than estimates around USD 7.7 billion



Egypt
Struggles to Pay Oil and Gas Bill

More than USD 6 billion owed to BP, BG, Apache...

Company	Debt in USD million
BP	3,000
BG	1,300
Petronas	800
Edison	400
TransGlobe	200
Dana Gas	200
Kuwait Energy	164
PetroCeltic	120

ALGERIA

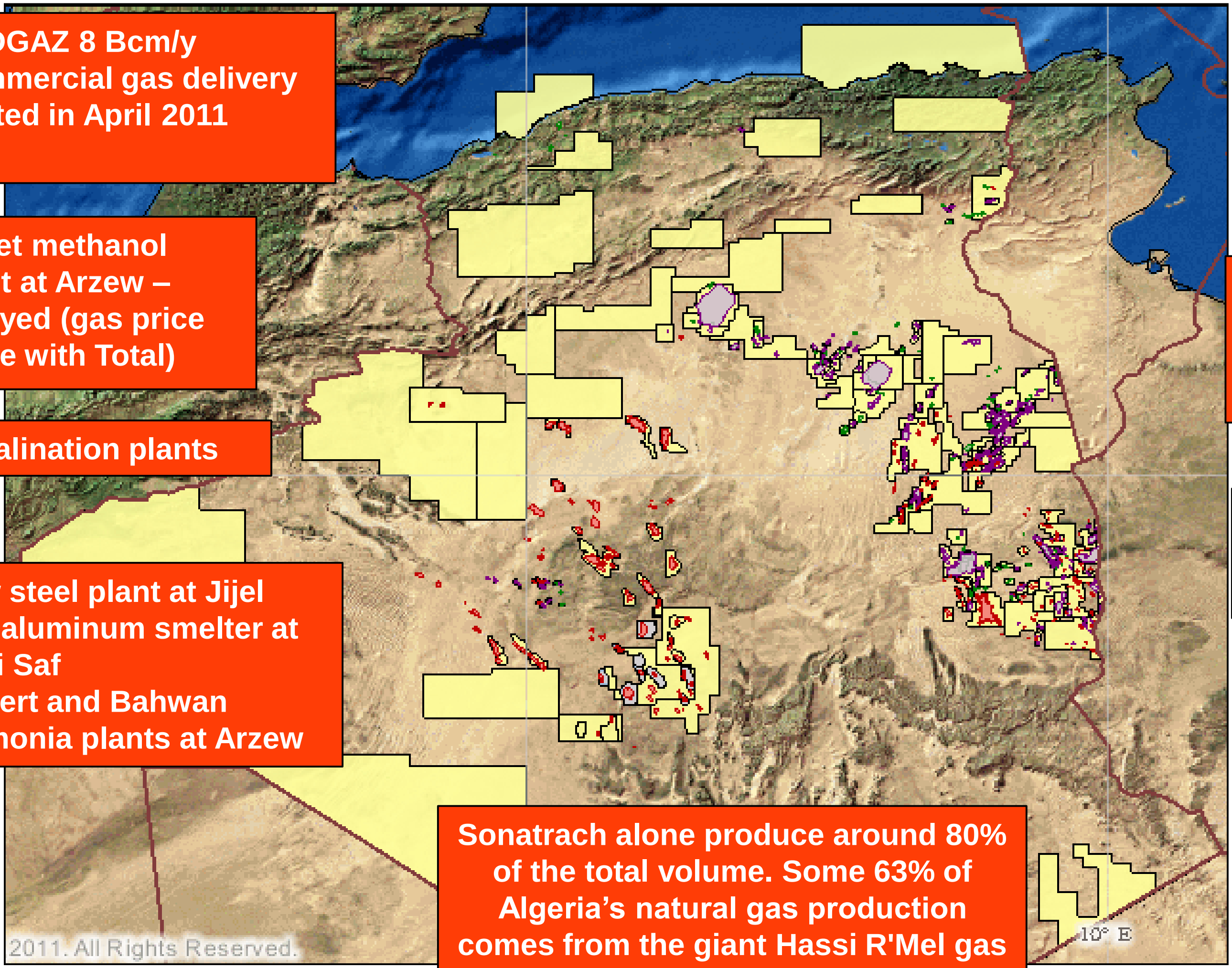
Is there enough gas to meet export plans and the increasing domestic demand?

MEDGAZ 8 Bcm/y Commercial gas delivery started in April 2011

Almet methanol plant at Arzew – delayed (gas price issue with Total)

Desalination plants

New steel plant at Jijel and aluminum smelter at Beni Saf
Sorfert and Bahwan ammonia plants at Arzew



Only 55% of the produced gas in Algeria is marketed as gas is needed for re-injection projects

Gas production is declining and large projects are not expected to come onstream before late 2013 or 2014

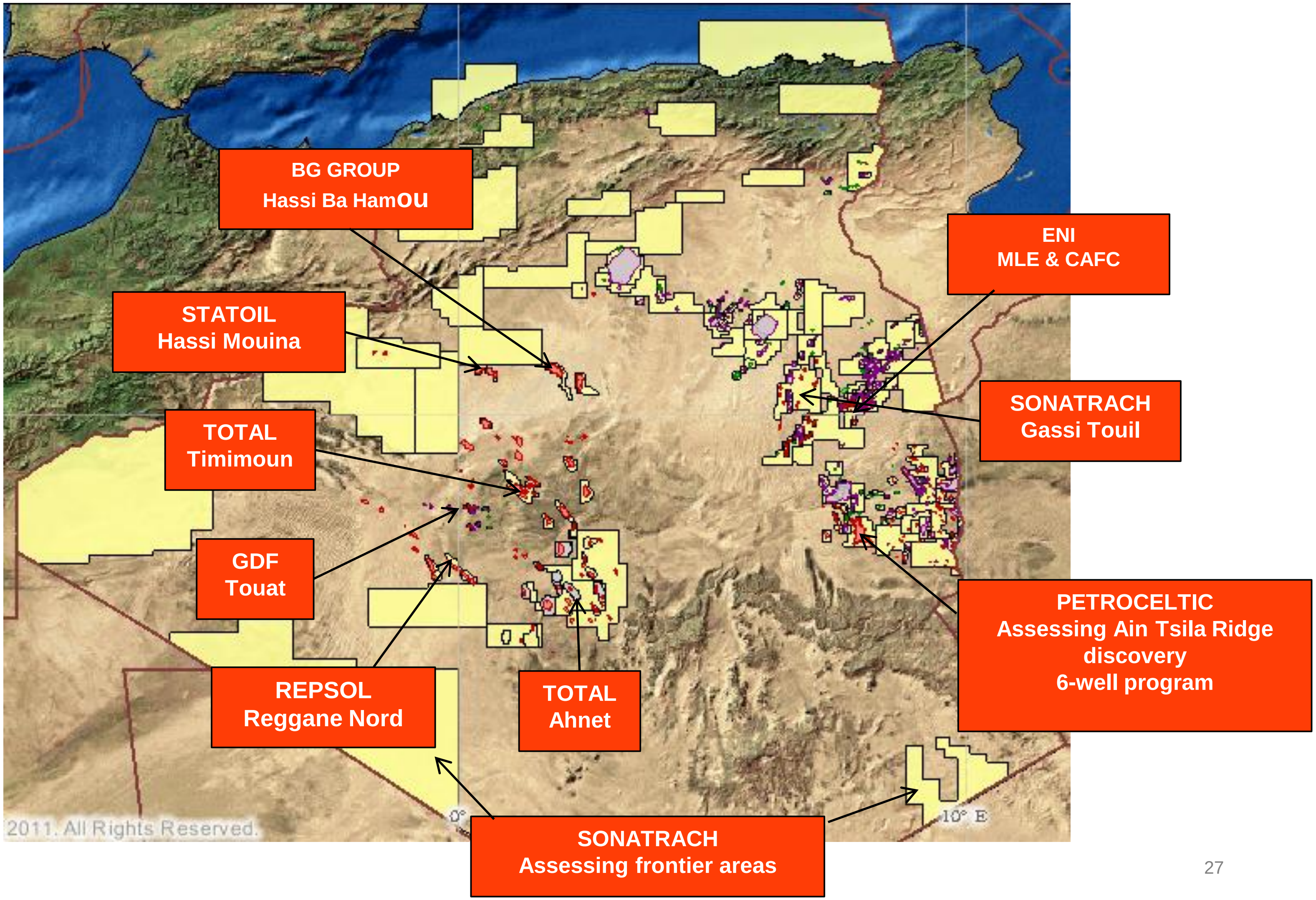
frontier areas are being intensively assessed by state company Sonatrach

unconventional resources are being evaluated

Sonatrach alone produce around 80% of the total volume. Some 63% of Algeria's natural gas production comes from the giant Hassi R'Mel gas and condensate field.

ALGERIA

Main Gas Projects

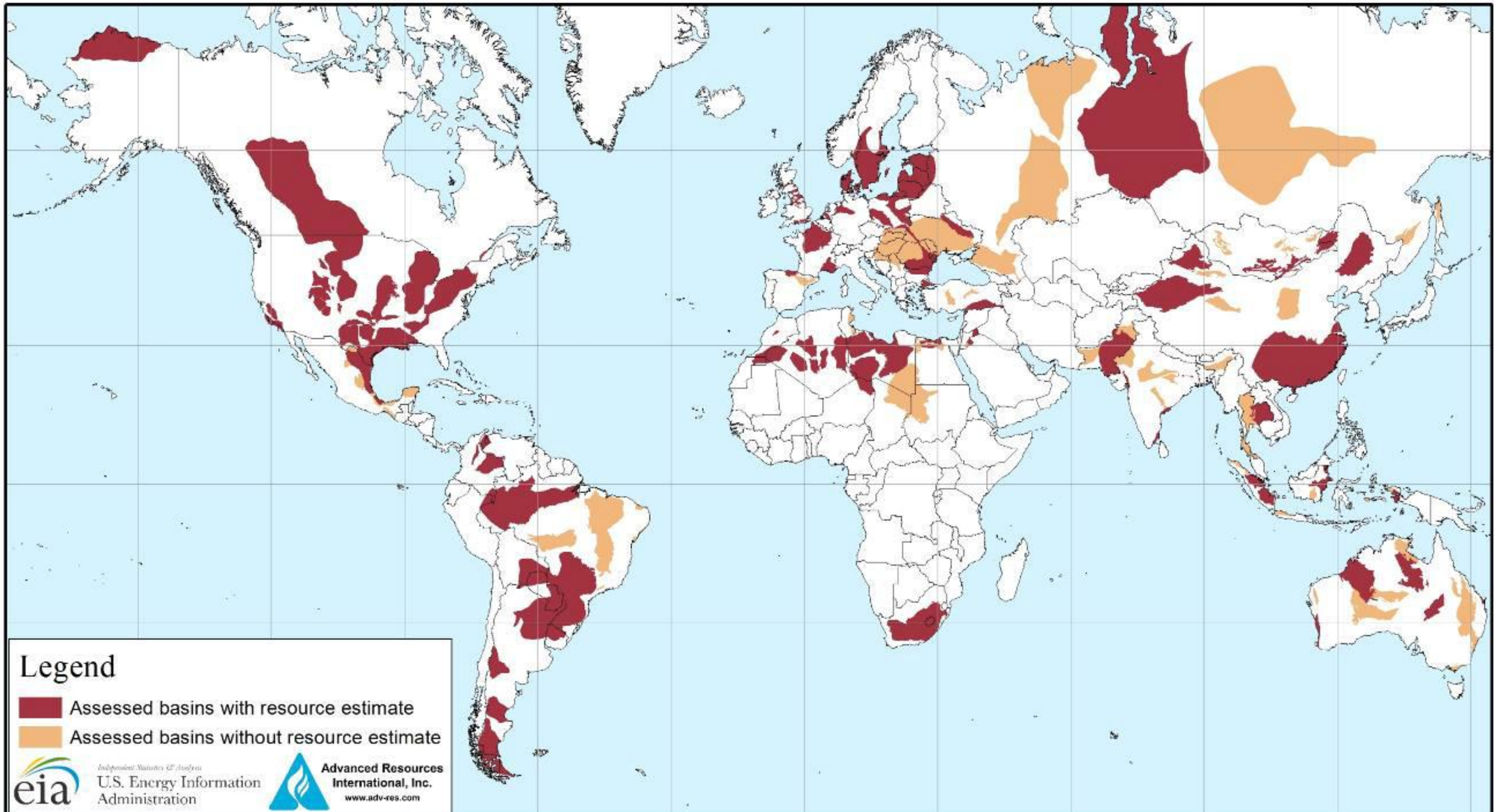


Why IOCs are interested in developing North Africa potential shale gas resources?

World shale gas resources

In-place: 35,782 Tcf

Technically recoverable: 7,795 Tcf



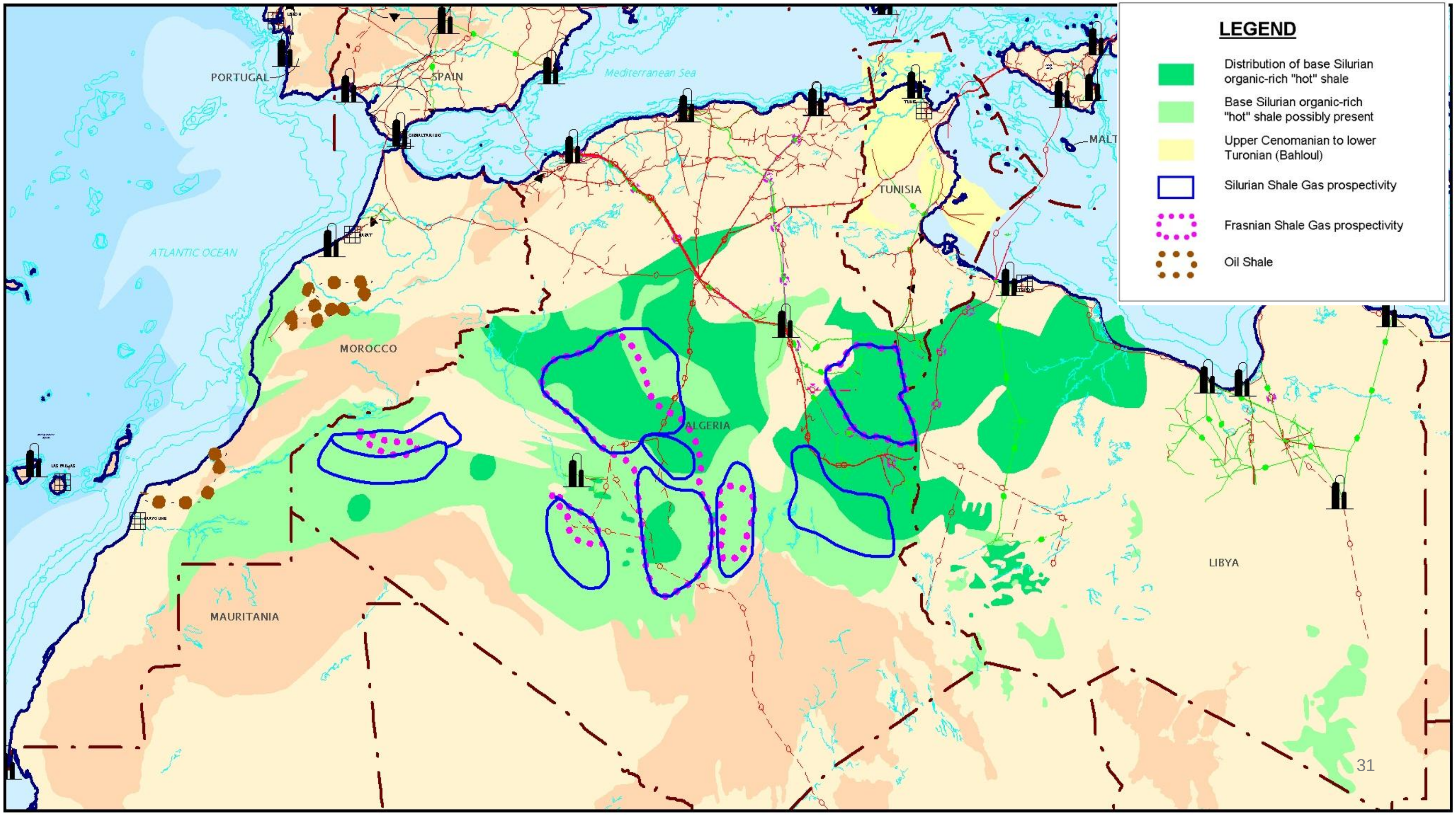
Source: United States basins from U.S. Energy Information Administration and United States Geological Survey; other basins from ARI based on data from various published studies (May 2013)

Africa Shale Gas Resources

(Energy Information Administration (EIA) estimates)

Country	Technically Recoverable Resource (Tcf), EIA 2011	Technically Recoverable Resource (Tcf), EIA 2013
Libya	290	122 (Silurian)
Algeria	231	**707** (Silurian-Devonian)
Morocco	18	20 (Silurian-Carboniferous)
Tunisia	18	23 (Silurian)
Egypt	0	100 (Jurassic)
South Africa	485	390 (Permian-Triassic) (Karoo)

Unconventional resources in North Africa



Some key factors required to replicate the US shale gas experience in other parts of the world

- ✓Favorable geology
- ✓Attractive fiscal terms
- ✓Supportive regulatory framework
- ✓Rig and services available
- ✓Large Hydrocarbon market
- ✓Extensive pipeline network
- ✓Low population density in development area

Land acquisition and environment concerns

- In USA, the ground and underground belong to the owner of the land : Easy to negociate with land owners
- Europe and other parts of the world: The underground belong the state
- Concerns about environment issues raising among populations

Geological parameters to be checked

- Surface (must be significant)
- Thickness (minimum of 10m)
- Depth (too deep-high cost)
- Reservoir Pressure
- Average TOC
- Thermal maturity (Ro)
- Clay Content (permeability)

Shale gas resources are unpredictible Reserves estimates are almost by well

- **USA** : ressources technicaly recoverable were estimated by US Energy Information Administration (EIA) at 827 Tcf in April 2011. The number dropped to 482 Tcf in 2012. (Marcellus shale from 410 Tcf to 141 Tcf)

- The EIA now says only 600 million barrels can be recovered from the play, down from 13.7 billion barrels (shale oil)

- **Poland** : After the rush in 2008-2009 companies were desappointed after drilling in 2012 : Drop from 187 Tcf (EIA) 0 to 27 Tcf after drilling few wells.

- **Algeria** : The Algerian Authorities announced 25,000 Tcf in 2011, the figure was corrected shortly to 2,500 Tcf and now after furhter studies the estimates are 600 Tcf. The government estimated that it would take seven to 13 years for the country's shale gas potential to be correctly determined. To do that, it will need investment from exploration and development companies with experience in hydraulic fracturing. Reports say Algeria intends to invest heavily in shale gas exploration during its 2012-16 investment plan and that Sonatrach plans to drill 160 wells during that period.

- **China** : From 1,275 Tcf (IEA) to 230 Tcf (Chinese Authorities)

African oil and gas industry is booming

Shale Gas/North Africa

Ordovician/cambrian
Illizi Basin

Morocco Offshore

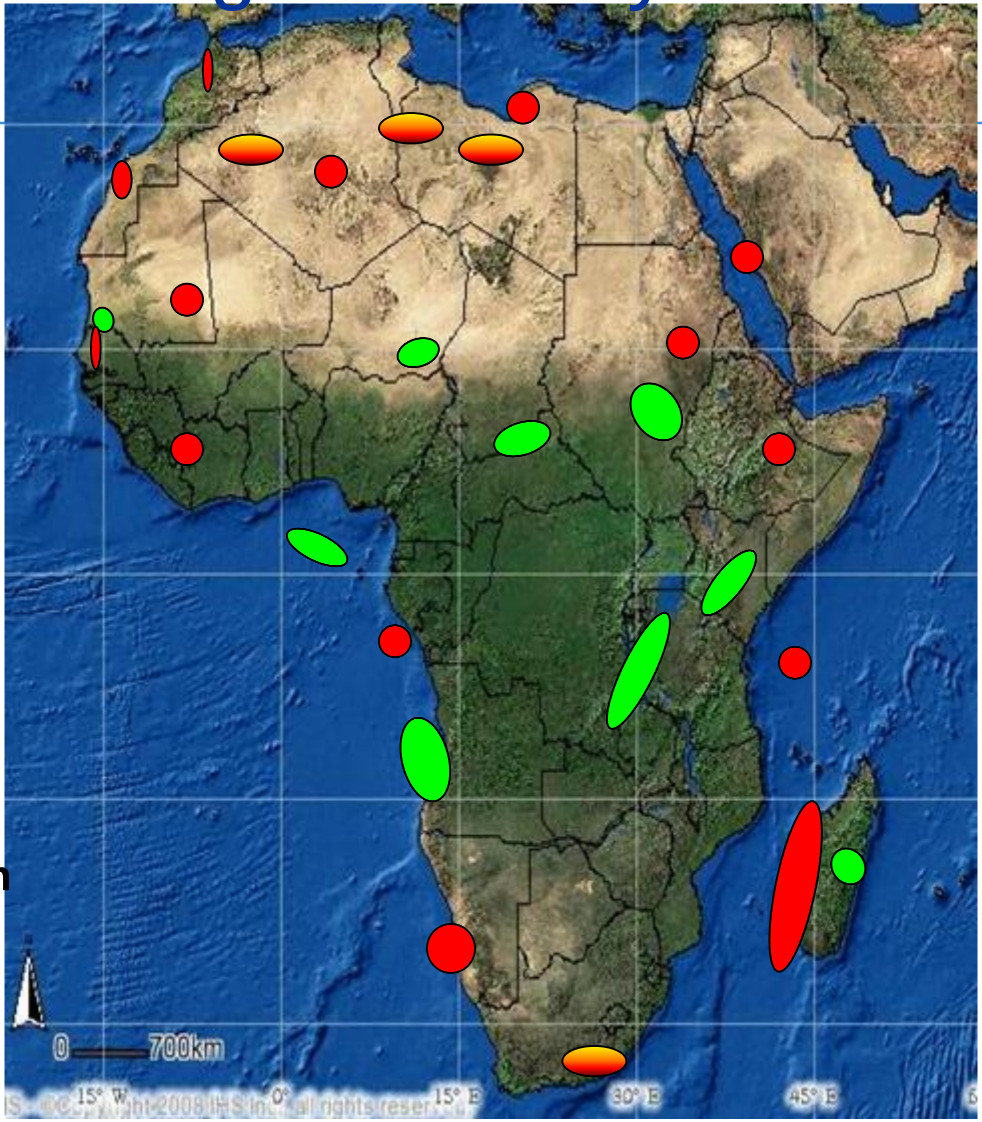
Taoudeni Basin

Mauritania/Senegal
Offshore

WATM Offshore
Cretaceous play

Pre-salt plays DW
Angola, Congo, Gabon

Orange Basin
Namibia/South Africa



Sirte Offshore

Pelagian Basin
Tunisia/Libya

SaudiArabia/Sudan
Red Sea

Sudan Blue Nile
Cretaceous play

Ethiopia Rift Basins
and Ogaden

DRC - Lake Albert

East Africa Offshore

Madagascar Offshore

Shale Gas (South
Africa)

THANK YOU

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