



Partnership in Discovered Resources and Advanced Exploration

R.K Srivastava , Director Exploration, ONGC

16th November, ADIPEC-2021







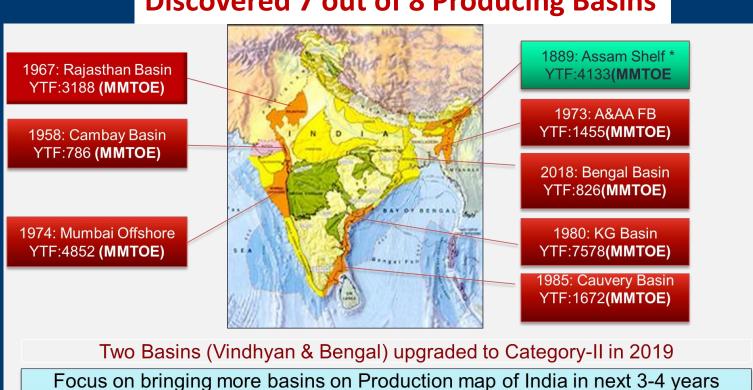




Preamble



- ONGC (Oil & Natural Gas Corporation) : A national Oil Company Engaged in E&P Business.
- Humble Beginning in 1954, evolved as integrated energy Company.



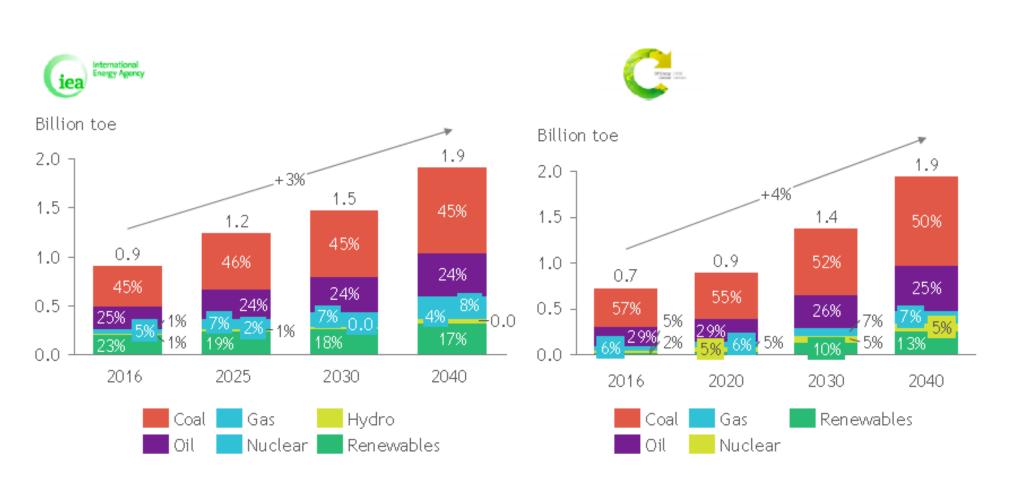
Discovered 7 out of 8 Producing Basins

- **Established 10 billion tonnes In-place volume of Hydrocarbon in domestic basins** ۲
- **Realized Cumulative Production of 2 Billion tons of Oil Equivalent** •





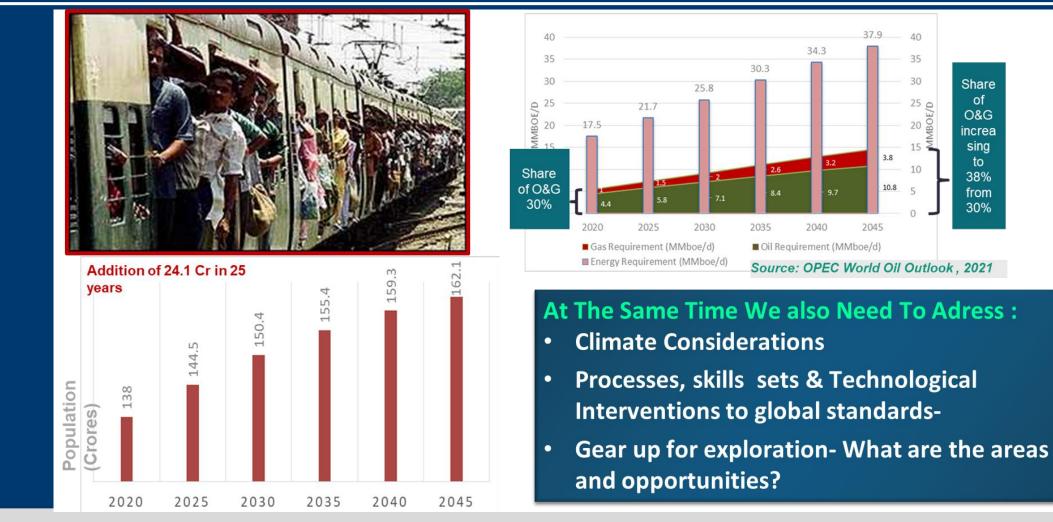
India's energy demand : 1 to become 2x+ by 2040, at a strong CAGR of ~3-4%



Source: IEA energy outlook, BP energy outlook



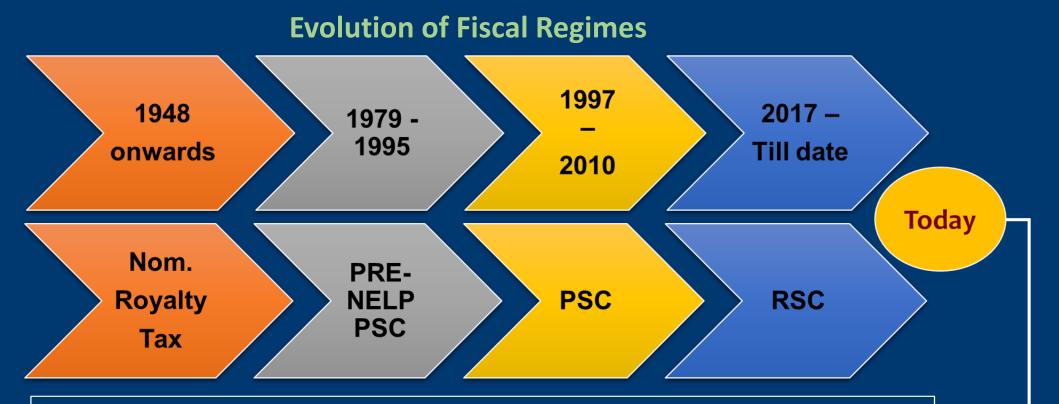




- Growth & Demand Scenario Provide right environment for Participation.
- Positively oriented Government Policy & Operative Fiscal Regime are another Drivers for entry.







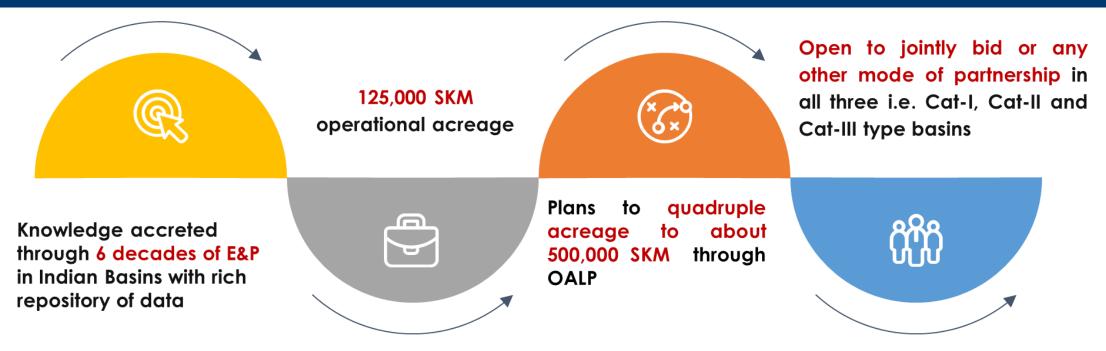
- Shift to 'Enhanced Production Primacy' by the Govt. of India.
- Complete marketing and pricing freedom on produce.
- No Govt take in Cat-II & III basins.
- Choice of block to bid open to operator. Easy exit option.
- System fast moving towards a Single window clearance



Preamble: Indian Context



Renewed Exploration Thrust



Plans in Place for :

- Acquisition of ~ 9000 LKM of 2D data
- 340,00 SKM of 3D High Quality Seismic
- Drilling of about 550 Exploratory Wells besides 5 new Basin Opening wells
- At an Exploration Expenditure of about US \$6 Billion







International Outreach at Highest Level

- Risk sharing,
- Technology Sharing
- As an Strategic Instrument
- Handling Transition:

Transformation of the core itself. We Believe partnerships built on mutual understanding and symbiotic relationships are the best alternative to M&A for partners to free some capital while still retaining their individual focus, core competence and independence.

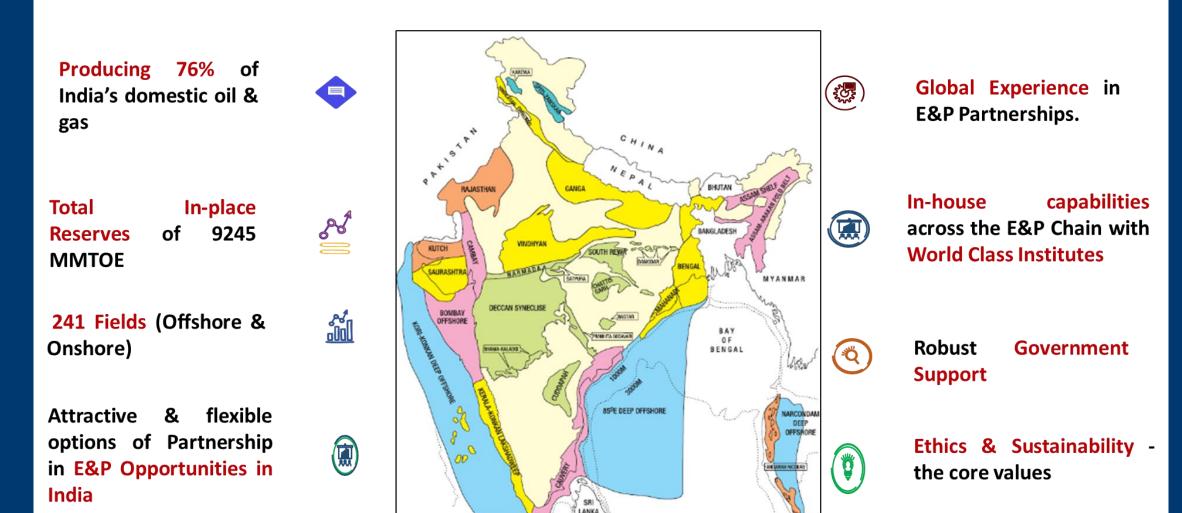
Models for partnership include :

- Joint Bidding for new Exploration acreages
- Farm-Out in discovered & matured fields
- Mutual transfer of technology
- International partnerships through ONGC Videsh Ltd.





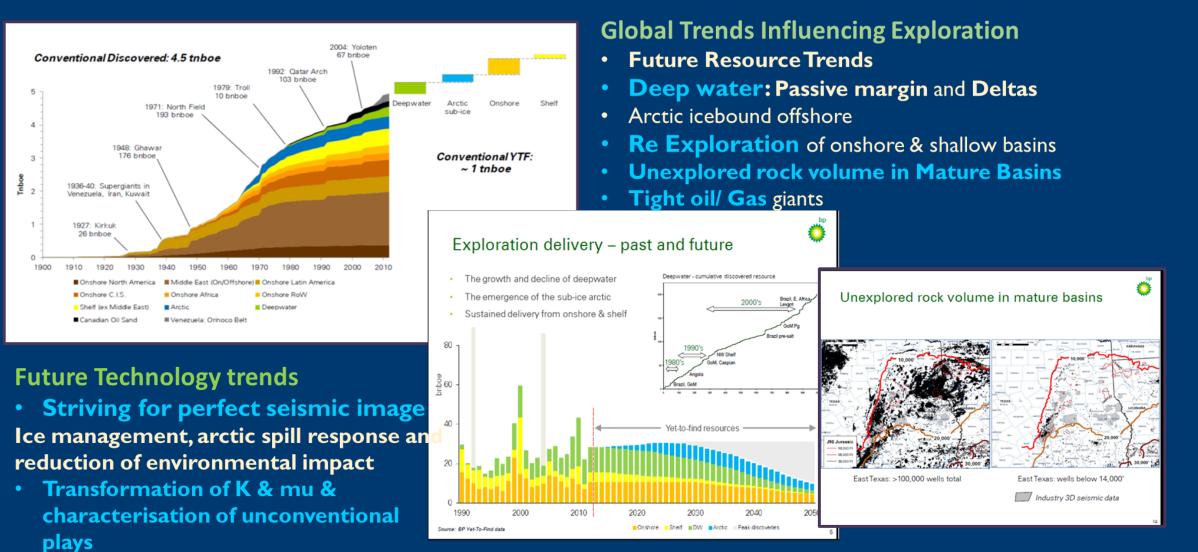
ONGC: Competitive Advantage to be a Preferred Partner





Key Drivers: Global Similarities





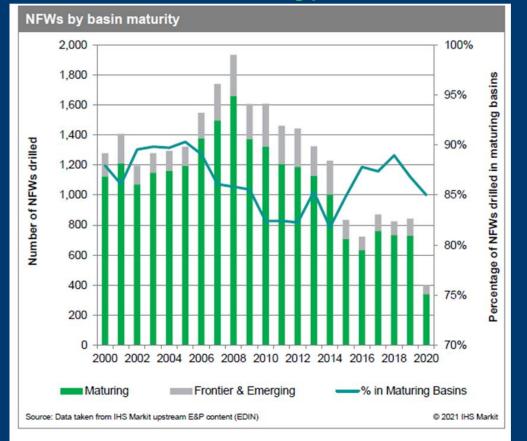
Future Geopolitical trend.



Key Drivers: Global Similarities

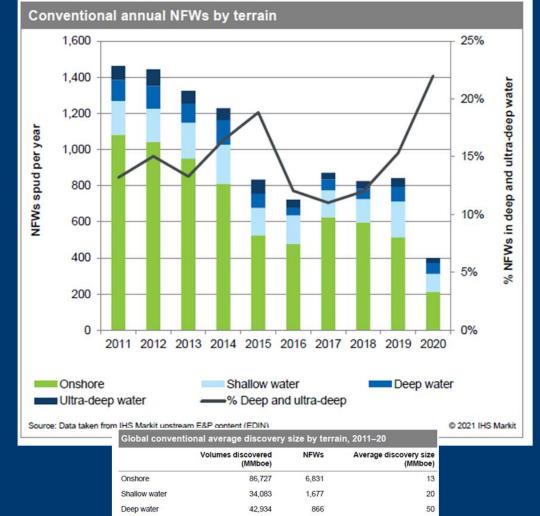


Global exploration activity remains focused toward Maturing phase basins



Average discovery size (million boe)		
	Last 10+ years	2020
Frontier/Emerging phase	86	164
Maturing phase	12	12

Deepwater exploration is making something of a comeback



71,114

Ultra-deep water Source: IHS Markit 578

123

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Discovered **Opportunity Basket** Resources **YTF Resources** Technology

A rapidly growing • 10 billion Tons of Established Inplace nation and the **Volume in Producing Basins** available basket Potential for Maximizing Recovery offers a challenge & an opportunity for everyone around here Huge Potential: 29.78 Btoe in Cat-I **Basins : Re-Exploration** Cat-II & III Basins : Consolidation & **Opening New areas** Technological Intervention: System & **Efficiency improvement**



Discovered Resources



	PRODUCTION (1887.23MMtoe)				Petroleum Resource/Project maturity Sub-classes	
	e)	580.52	720.57	777.61	On Production	
DISCOVERED PIIP (8236.27MMtoe 2P)	COMMERCIAL (777.61MMtoe)	MMtoe F	MMtoe MMtoe		Approved for Development & under Implementation	
	COI	1	P 2	P 3P	Justified & Approved for Development Development	
	SUB-COMMERCIAL (609.30 MMtoe)	AERCIAL AMtoe)	447.93 609.30		Development Pending	
			MMtoe	MMtoe	Barrala and an hald	
		CONTING	NTINGENT RESOURCES		Development on hold Development unclarified Development not viable	
		1	C 2	C 3C	Development not viable	
	UNF	RECOVERAE	BLE (4962.1	3 MMtoe)	-	
	Range of Uncertainty					
CONCEPTUAL DIAGRAM DEPICTING ONGC DISCOVERED PETROLEUM RESOURCE CLASSES & CATEGORIES				1		

- Producing Basins :3.5 BT in-place oil
- (that can be targeted for EOR)
- Potential to raise RF beyond 40%.
- IOR/EOR incremental oil of ~300 MMt.
- 53 on-land reservoirs Screened under ER policy & projects taken up.

Sub Commercial : HP-HT & Tight Reservoirs

- Technological interventions could make it a big business opportunity.
- Govt. of India seriously supports this resource has brought a specific policy.



Discovered Resources



HP-HT Fields : Vast Potential				
Established Inplace	350 MMT O+OEG			
Potential Inplace	900 – 1100 MMT O + OEG			
Production Potential	70 MMT in 15 years			
Large Pay Thickness	(50)-600 m			
Good Areal Extent of Fields	(10) – 35 Sq. Km			
High Inplace Volume of Field	(50) - 100 MMT			

Immense promise for development and production : implementation of fit for purpose technology and services

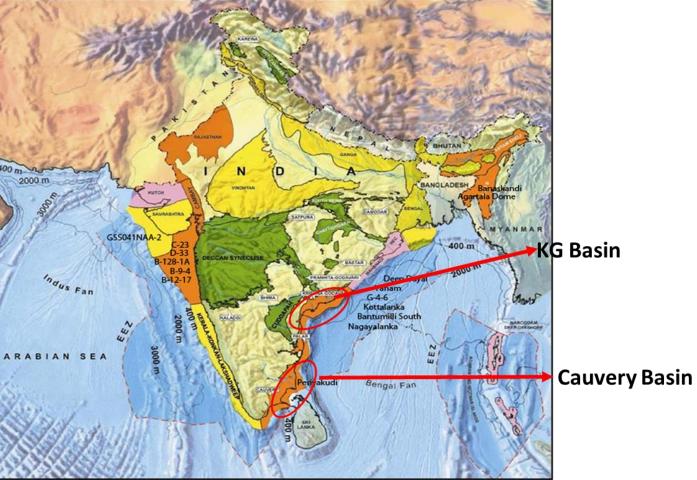


Discovered Resources



HP-HT wells drilled till date: 61 KG & 5 Cauvery

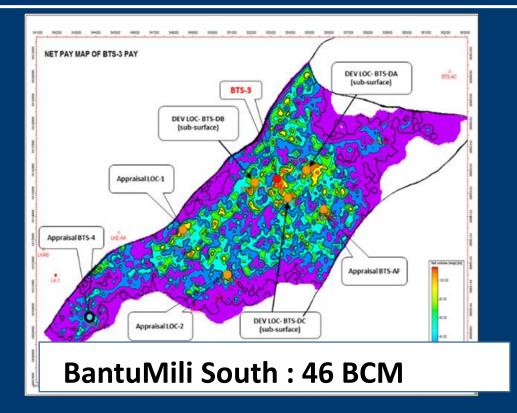
				(top)
Basin	Onland		Offshore	1
KG	26	35 (includes Deen Dayal)		
Cauvery	5	-		400 m 20
Total	31	35		
Basin	In-pla (MMT)		Ult (MMTOE)	
KG	340.4	48	52.92	ARA
Cauvery	52.1	2	8.36	
Total	392.	60	61.28	





Discovered Resources: HP-HT & Tight Portfolio





Challenges:

- HP-HT wells test the limit of equipments, fluid & stimulation systems.
- Invariably require HF a challenge in HP-HT conditions
- G&G skills, full value chain (A-P-I- D-P) technology / technique/ skill induction.
 Bantumilli South Field
 - Early Cretaceous Syn-Rift Play
 - Depth Of Occurrence: 4000-4400 m
 - Presence of 45ppm H₂S & 12% CO₂
 - Reservoir Pressure: >11000 Psi
 - ReservoirTemperature : 390 Deg F
 - Low Permeability





Miocana Cratacaous

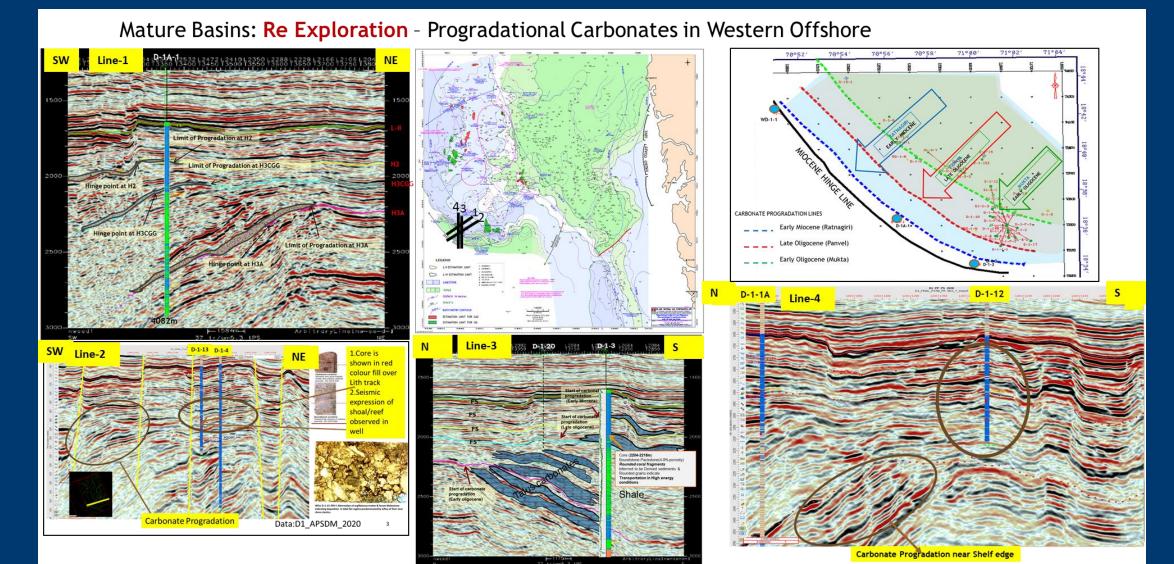
Assam Shelf: Western Onland: YTF: 252 MMtoe YTF: 379 MMt oe **Emerging Plays: Tura, Emerging Plays: Paleocene &** Sylhet & Basement E. Eocene NSP Coverage: NB & Kopili Mesozoic Possibly Valley Assam Arakan Fold Belt: Mumbai Offshore: YTF: 330 MMtoe YTF: 2366.5 MMt oe **Emerging Plays: Bhuban & Emerging Plays: Panna,** Bokabil Daman, Basal Clastics, NSP Coverage: Schuppen Mahua, Bombay Belt, Manipur, Mizoram & SE Tripura Cauvery Basin: YTF: 349 MMtoe KG Basin: **Emerging Plays:** YTF: 1569 MMtoe **Basement**, Early **Emerging Plays: Pliocene** Cretaceous (Biogenic & Thermogenic),

- Total Open Acreage :3,50,000 Sq. Km. (Approx)
- Total YTF : 20,476 MMt distributed in 53 plays
- Total YTF in emerging plays : 5245 MMtoe (26 % of total YTF) distributed in 17 plays





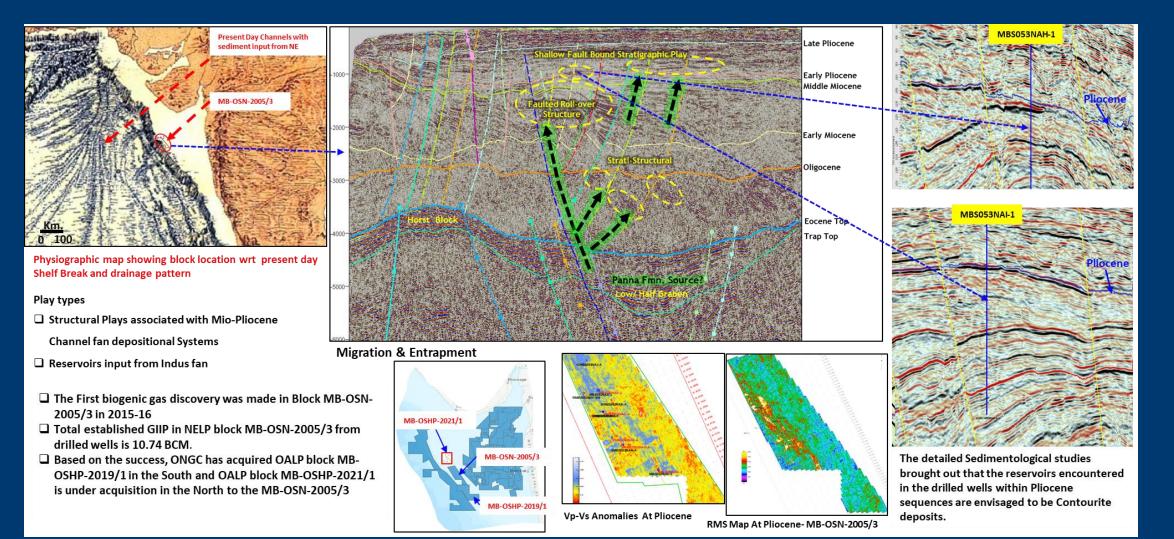
Western Offshore Basin: Cumulative Production : 1335MMtOE, YTF Potential : 4852 MMt







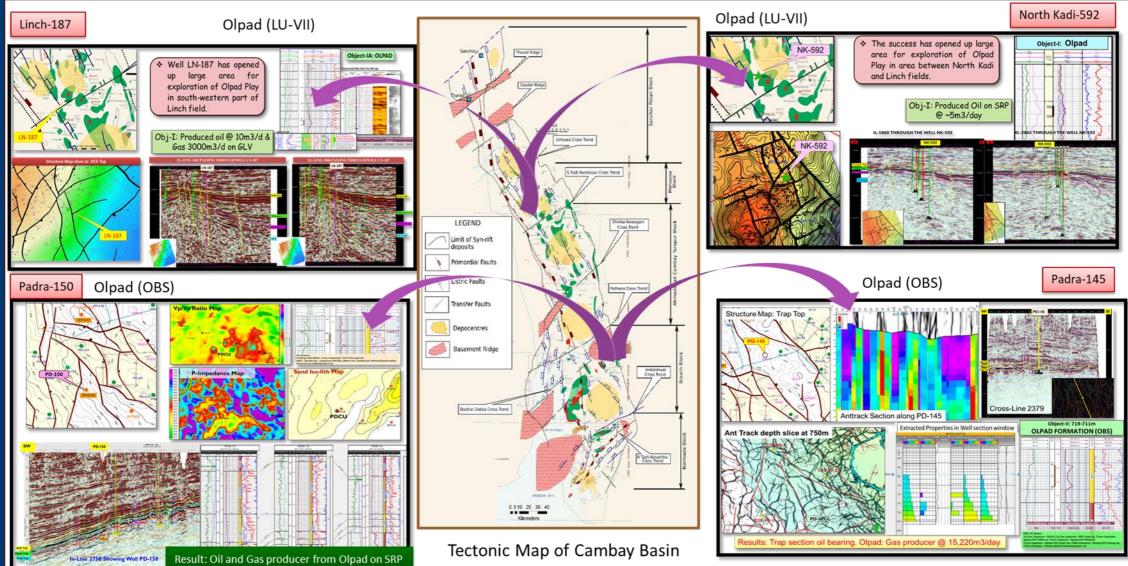
Western Offshore Basin: Cumulative Production : 1335MMtOE, YTF Potential : 4852 MMt







Cambay Basin: Cumulative Production : 354 MMtOE, YTF Potential : 786 MMt

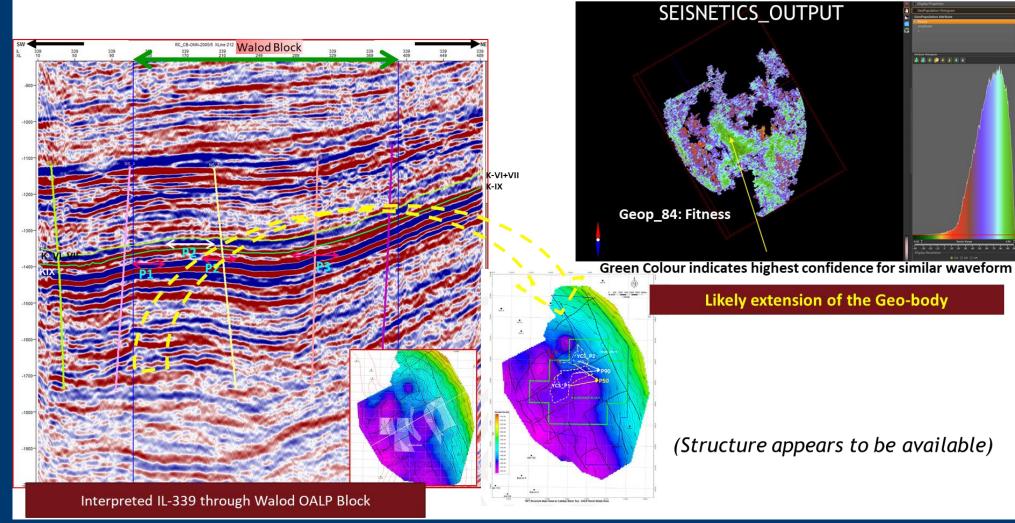






Cambay Basin: Cumulative Production : 354 MMtOE, YTF Potential : 786 MMt

Mature Basins: **Re Exploration-** Unexplored Deeper Play : Cambay Basin



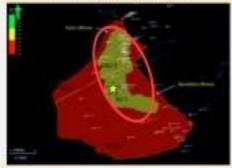




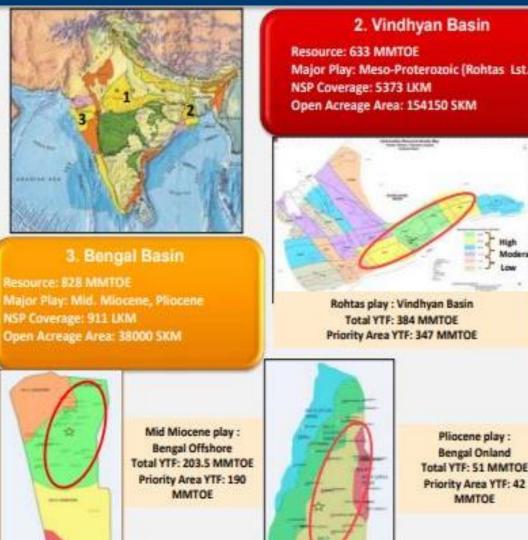
1. Kutch- Saurashtra Basin Resource: 2073 MMTOE Major Play: E.Cret & M. Jurassis NSP Coverage: 4115 LKM Open Acreage Area: 133300 SKM



Early Cretaceous play : Kutch Offshore Total YTF: 102 MMTOE Priority Area YTF: 82 MMTOE



Mid Jurassic Lr. play : Saurashtra Offshore Total YTF: 67.5 MMTOE Priority Area YTF: 57 MMTOE



2. Vindhyan Basin

Major Play: Meso-Proterozoic (Rohtas Lst.) NSP Coverage: 5373 LKM Open Acreage Area: 154150 SKM



MMTOE

Discoveries Made

•

- **Consolidation Efforts Through Appraisal underway**
- **Kutch Offshore on verge of** \bullet **Development**
- **Exploration in these basins Is** expanded aggressively





Exploration Opportunities in Cat-II Basin : Vindhyan Basin

Comparing to Hatta 2 Discovery: Larger Giant Field

Khazzan-Makarem-Ghazeer Field, Oman Basin, Tight Gas Giant field (>10 Tcf Gas recoverable

✓ Reservoir lithology: Carbonate Rock & Siliclastics
 ✓ HC type: Gas or Tight Gas
 ✓ Faulted Anticline
 ✓ Reservoir Age
 ✓ Depositional Environments

A giant Ordovician to Proterozoic tight gas discovery; it is one of the region's largest unconventional tight gas accumulations and according to BP, it has the potential to be a major gas supply for Oman for decades to come (at least 40% increase to natural gas supply).

Comprises a dip-closed drape anticline developed over the Makarem High, a regional basement arch. The reservoir horizons thin over the structure's crest, with the Birba absent over the crest, indicating the structure was already a positive feature in the upper Neoproterozoic to Cambrian.

Oman Basin

Intracratonic Syn-rift in Late Precambrian, developed into post-rift interior sag by early Paleozoic. Southern passive margin of Tethys Ocean in Mesozoic; thick carbonate deposition. Shallow marine carbonates, siliciclastics and evaporites were deposited in several Infra Cambrian to Early Cambrian rift basins.

The Amin & Buah formation sub-units are a connected reservoir, and these are sandstone siliclastic type reservoirs deposited in a similar alluvial/lacustrine environment as the Kaimur Group – reservoir discovery in the Nohta 3 well in the Vindhyan Basin.

Green Development concepts:

BP reported in its Socioeconomic review Oman 2020, released in May 2021, that as part of BP's pledge to advancing the low carbon agenda, Khazzan was the first field in Oman to introduce "green completions"; a zero-flaring concept where produced hydrocarbons during well test operations were "cleaned" and then routed to processing facilities for export rather than being flared. BP had successfully delivered 23 well and re-tested three wells in Oman using the "green completions" concept.

Less focus on Basin constraints and a look at detailed information on a matching aged reservoir with similar tight gas reservoir but on a far larger scale development.





Exploration Opportunities in Cat-II Basin : Vindhyan Basin

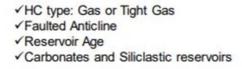
Comparing to Hatta 2 Discovery: Giant Field

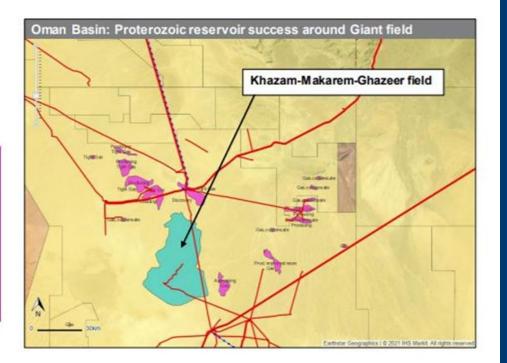
Khazzan-Makarem-Ghazeer Field - tracing smaller marginal matching discoveries

Success followed with marginal fields matching the same reservoir and HC Type and these were cost effectively tied into existing infrastructure. Play chasing and using the detailed Giant Field as a bases to explore new structures.

60% of the marginal fields are on production with 20% under appraisal with plans to tie into existing infrastructure for cost-effective short-term gas production.

- Consider the possibility of chasing the Vindhyan Group to find matching structure types.
- Not defining analogues on a direct reserve match, looking at larger scale fields to pick out using the development remarks to note possibly reservoir complexity issues which would be a higher cost risk in a smaller sized discovery.

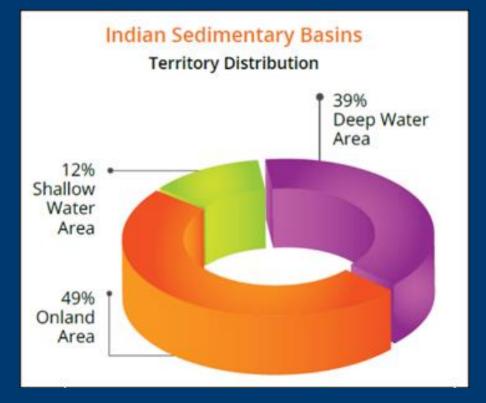








- Our biggest development project near completion. FDP underway for two more clusters.
- Significant YTF with existing infrastructure (Cluster-II) –
- Strategic relook : ONGC intends to consolidate
- KG basin significant discoveries.
- Cauvery, Mahanadi & Andaman oil & gas discoveries.
- Large size discoveries have eluded us so far.
- Very poorly explored.
- Less than 150 prospects drilled in an area of 1.3 MMKm2.
- Cost and technology intensive.



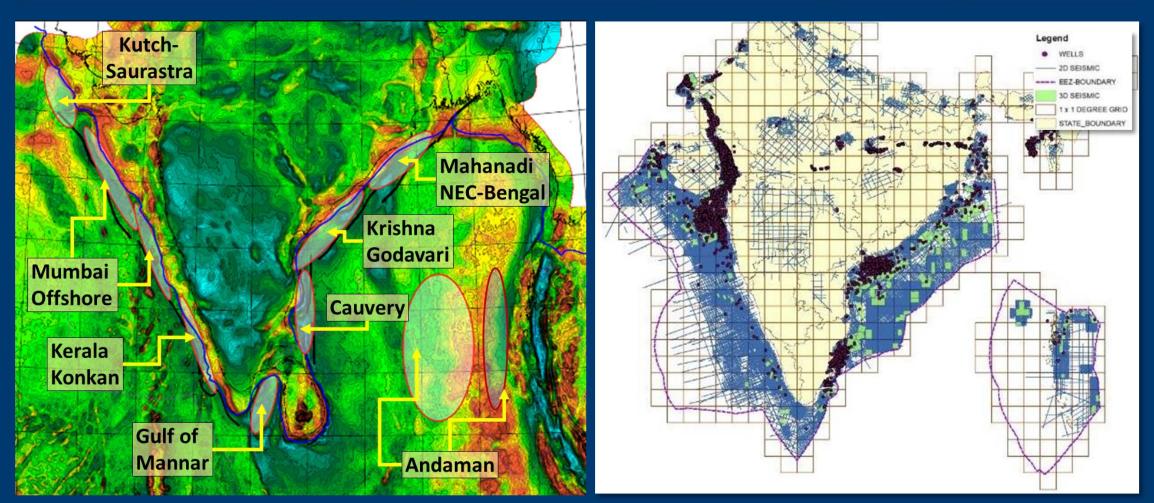




DATA AVAILABILITY IN DEEP OFFSHORE BASINS

2D Seismic density : ~ 250 LKM/1000 SKM

Expln. well density: ~ 0.1 Well/ 1000 SKM

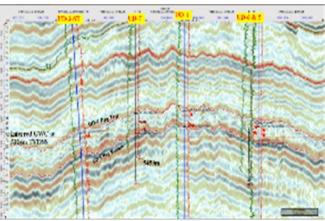






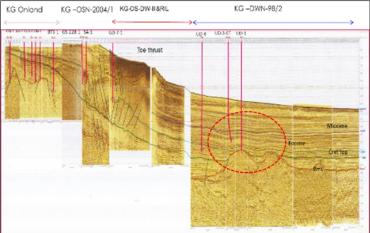
Expln. Opportunities: Cluster-III: Ultra DW Discovery

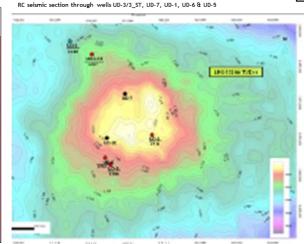


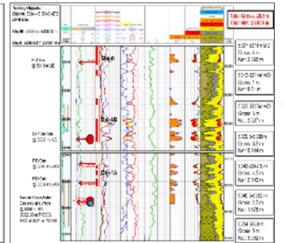


- Estimated In-Place of 87 BCM.
- Water Depth: 2700-2900m
- Located about ~144 km from the nearest land-fall point.
- Target Depths up to 5400 Mts.
- Field is Under Appraisal
- FDP submission planned by 1st August 2022.

> Approx CAPEX: 3.2 Billion \$



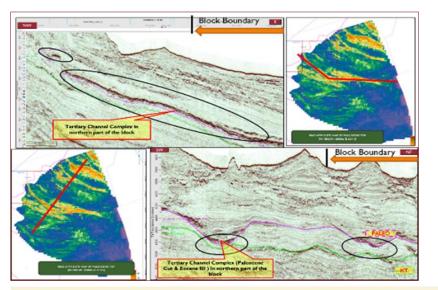


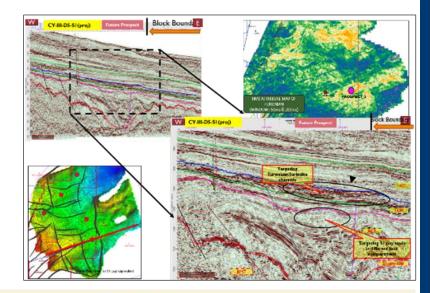






Exploration Opportunities: Cauvery deep offshore





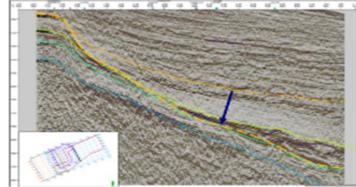
- Hydrocarbon potential is envisaged from Basement to Tertiaries.
- Proven HCs in fractured Basement & Late Cretaceous slope fan systems in shallow offshore.
- Several strati structural features present in deep & ultra deep water area.
- Major grabens akin to onshore with thick Synrift sediments.
- Exploration history suggest active petroleum systems economic challenge needs to be overcome.





Eocene Unconformity Cretaceous Fan Oligocene Wedge Mio-Pliocene slope channel fan system • ٠ ٠

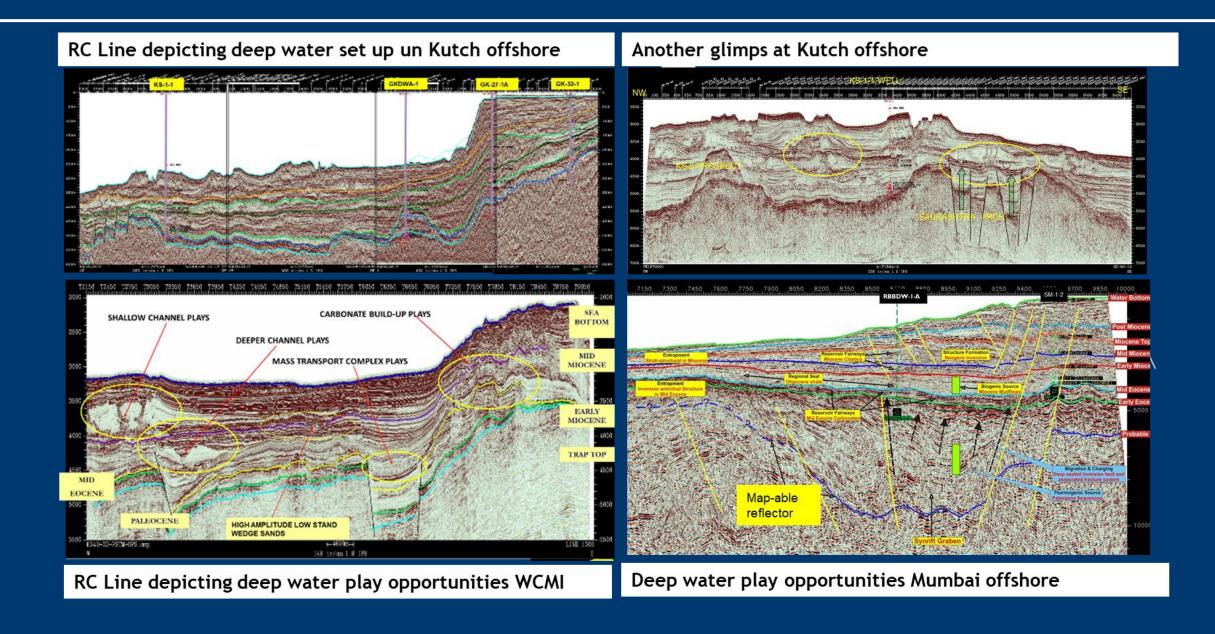
Eocene reworked Carbonate



- 8926 LK 2D, 29,500 SK
 3D
- 26 Wells 7 gas discoveries.
- Biogenic gas in Mio-Pliocene & Paleogene in Many discoveries by ONGC and RIL.
- 81 MMt in[place assessed by ONGC.

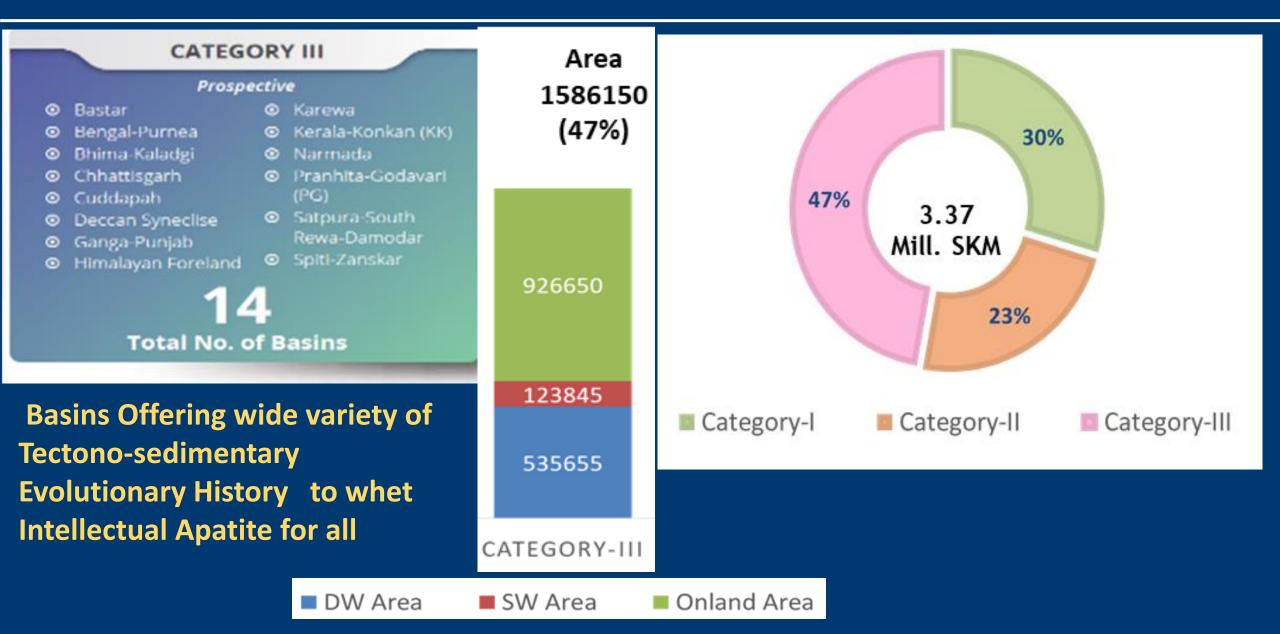














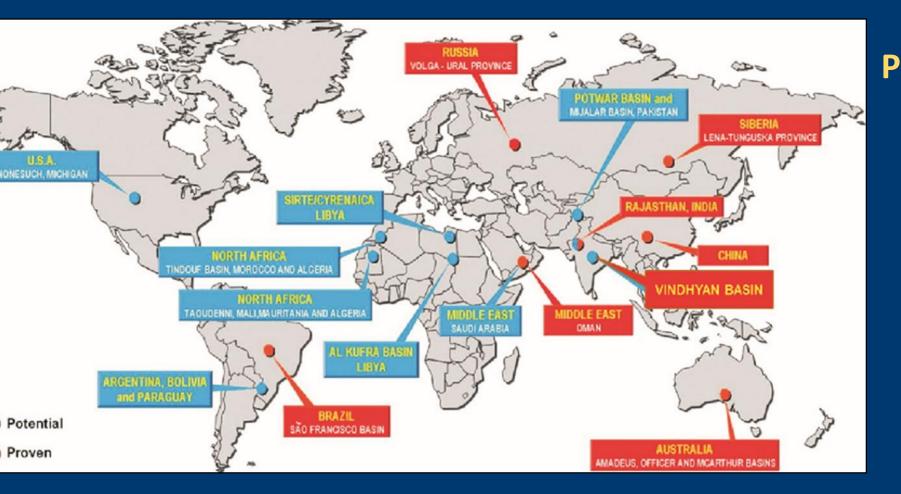


S.No.	Cat:III Basins	Plays in the Basin	Type of Basin	Analogous Basin(s)	
1	Bastar	_		Amadeus Basin (Australia), Lena-	
2	Bhima Kaldgi	Proterozoic	Intracratonic Sags	Tunguska Province (Russia) and	
3	Chhattisgarh			Vindhyan Basin (India)	
4	Cuddapah			Vinanyan Basin (inala)	
5	Deccan Syneclise	Proterozoic- Gondwana	Intracratonic Sags/Rift	Cooper Basin, Australia, Parana Basin, South America and Karoo Basin, South Africa.	
6	Ganga-Punjab	Proterozoic-Tertiary	Peripheral Foreland	Huqf Basin-Oman, Tarim Basin-China	
7	Himalayan Fold belt	Neo Proterozoic- InfraCambrian, Paleozoic and Tertiary	fraCambrian, Paleozoic and Fold Thrust		
8	Karewa	Paleozoic, Mesozoic and Plio- Pleistocene	Intermontane		
9	Narmada			Cooper Basin, Australia	
10	Satpura_S Rewa_Damodar	Gondwana	Intracratonic Transtensional Basin	, Parana Basin, South America and Karoo Basin, South Africa	
11	Pranhita Godawari		Cooper Basin, Australia and KG Basin,India		
12	Spiti Zanskar	Paleozoic and Mesozoic	Intermontane	Potwar Basin of Pakistan	
13	Kerala-Konkan Basin	Mesozoic-Tertiary	Pericratonic Rift		
14	Bengal-Purnea Basin	Gondwana-Tertiary	Pericratonic Rift, Intracratonic Rift	Purnea Basin: Cooper Basin, Australia	
			Remnant Ocean		





Global Proterozoic Basins



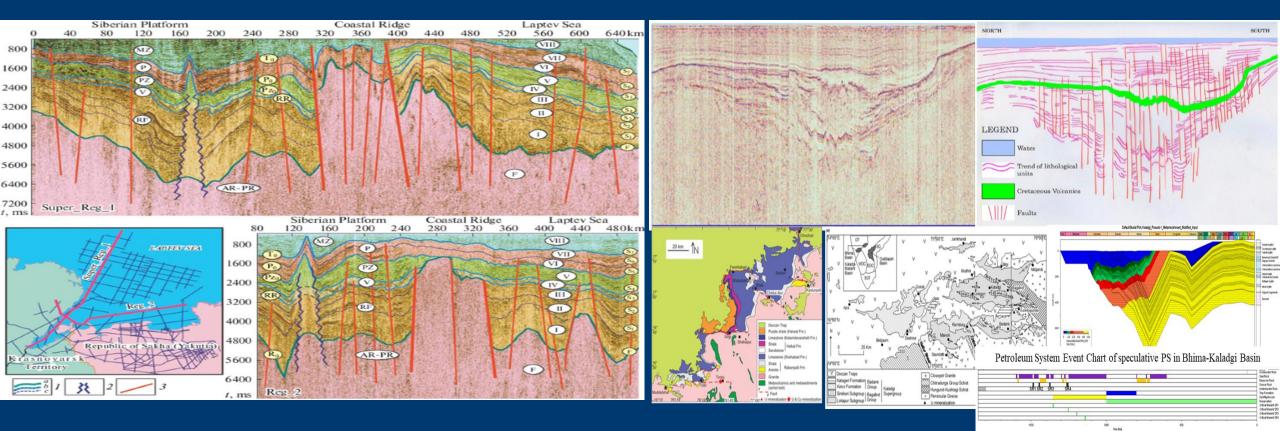
Proterozoic Basins: India Bhima-KalaDigi Vindhyan Cuddapah Chattisgarh **Bastar**





Lena-Anabar Basin: Russia

Bhima-Kaladigi: India

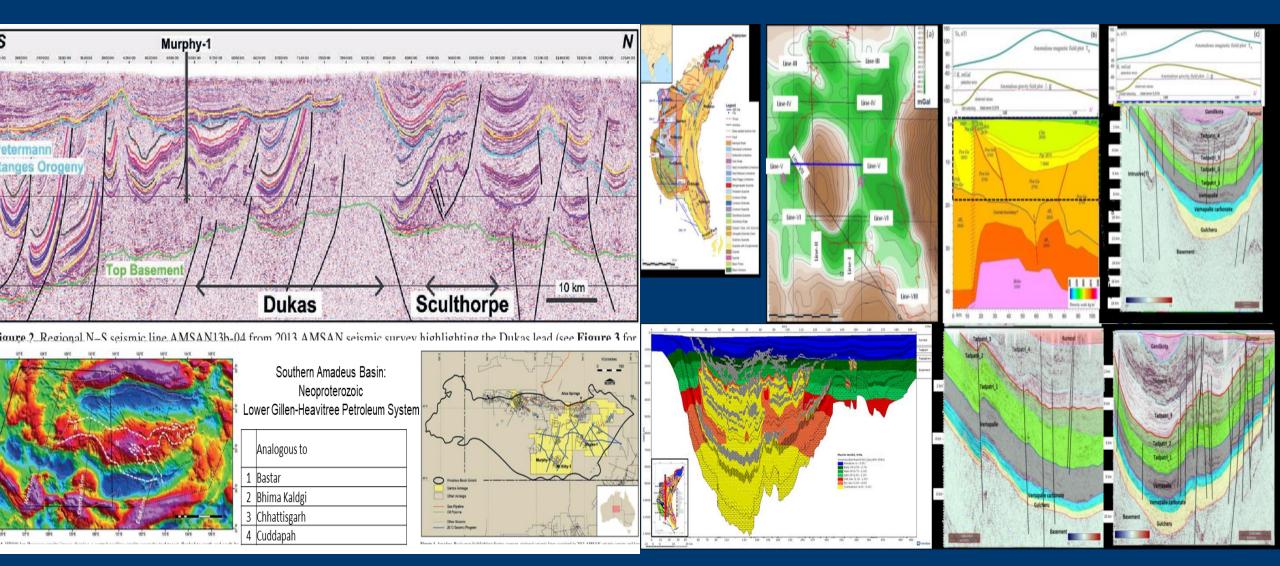






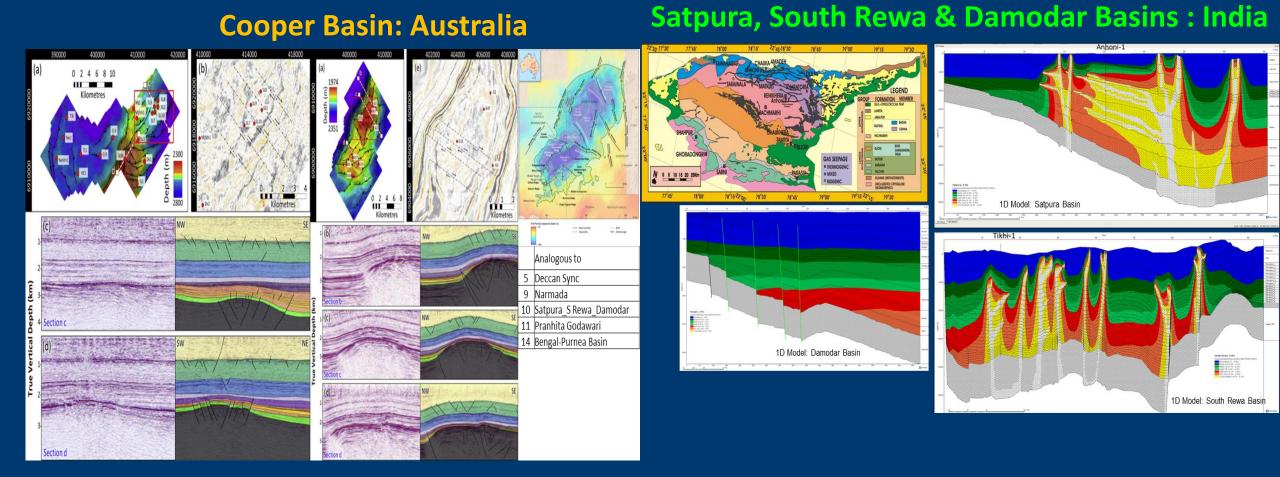
Amadeus Basin: Australia

Cuddapah Basin: India





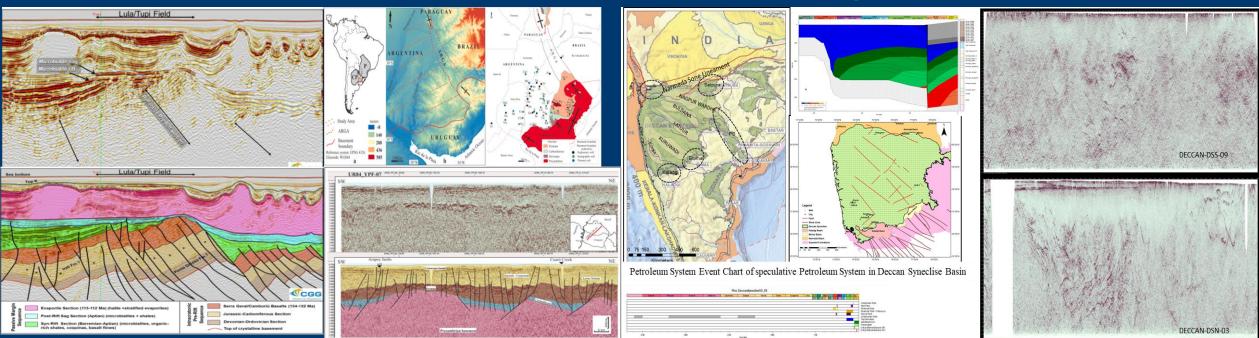








Parana Basin: Uruguay, Brazil, Argentina



At Nascent Stage of Exploration Data Synthesis for Basin Evolution Studies to develop Understanding of Plausible Play Systems, Geometries etc underway

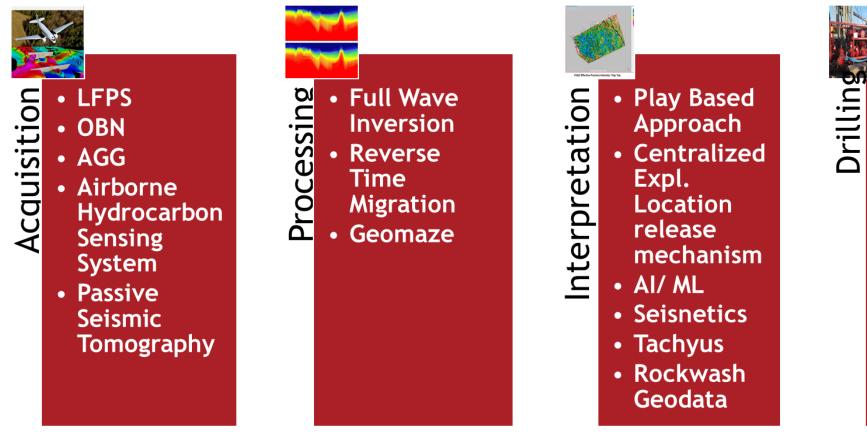
Deccan Syneclise Basins : India





Exploration Strategy Elements: Technology

Technological Intervention: Exploration Cycle





Tripura)





Exclusive EOIs Were floated For Basin Specific Areas, Technical Challenges For Collaboration/ Consultancies

KG-Cauvery Basin

ओएनजीसी ्र्र्यू ONGC	Oil and Natural Gas Corporation Ltd.
	KG-PG Basin & Cauvery Basin, Chennai

NOTICE INVITING EXPRESSION OF INTEREST

EOI Ref. No. ONGC/EOI/KG-PG & Cauvery/Technical consultation

ONGC, KG-PG & Cauvery Basins, Chennai invites **Expression of Interest (EOI)** for identification of suitable partners/service providers to partner/ technically assist in specific E&P portfolios in Krishna Godavari and Cauvery Basins, India as per schedule given below:-

Downloading of Brief details: 07.05.2021 to 28.05.2021. Registration of Firms for participating in EOI, last date for submission of EOI document along with copy of presentation and confirmation to attend the EOI Meeting: 31.05.2021. Date for EOI Meeting: 09.06.2021. Mode of EOI Meet: Online. For details of Expression of Interest (EOI) and downloading of Brief Scope of work, please log on to our website at https://tenders.ongc.co.in

Scope Of Work

Technically assist / offer consultation in collaboration with ONGC G&G Teams with emphasis on knowledge transfer

- 1. Deep Water
- 2. HP-HT,
- 3. Unexplored Acreages

Assam Arakan Basin



Oil and Natural Gas Corporation Ltd. Assam & Assam-Arakan Basin

NOTICE INVITING EXPRESSION OF INTEREST

EOI Ref. No. ONGC/EOI/A&AA Basin/Technical Consultation ONGC, Assam & Assam-Arakan Basin, Jorhat invites Expression of Interest (EOI) for identification of suitable partners/service providers to partner/technically assist in specific E&P portfolios in Assam & Assam-Arakan Basin, India as per schedule given below:

Downloading of brief details: 12.06.2021 to 02.07.2021. Registration of Firms for participating in EOI, last date for submission of EOI document along with copy of presentation and confirmation to attend the EOI Meeting: 05.07.2021. Date for EOI Meeting: 15.07.2021. Mode of EOI Meet: Online. For details of Expression of Interest (EOI) and downloading of Brief Scope of work, please log on to our website at https://tenders.ongc.co.in

Technically assist / offer consultation in collaboration with ONGC G&G Teams with emphasis on knowledge transfer

- 1. Thrust Fold-Belt
- 2. Schuppen Belt & North Bank
- 3. Deeper Plays : Basement & Gondwana





EOI Exclusively forWestern India Volcanic Margin Petroleum Prospectivity (WI-VMAPP) study;

Western Offshore Basin

Bids received from 5 bidders (17.06.2021):

- 1. BEICIP-FRANLAB (V600297)
- 2. HALLIBURTON INDIA OPERATIONS PRIVATE LIMITED (V895179)
- 3. PANSEIS GEO SERVICES PRIVATE LIMITED (V917304)
- 4. VOLCANIC BASIN PETROLEUM RESEARCH (V604640)
- 5. SCHLUMBERGER SOLUTIONS PRIVATE LIMITED (V862105)
- Tender was awarded to PANSEIS GEO SERVICES PRIVATE LIMITED
- LOA was placed on 30.09.2021 with 1 month as mobilization time and total project life of 9 months from LOA; extensible by 3 months.
- The Contract and the Confidentiality agreement for data is to be signed on 29.10.2021 along with handing over of data. The initial interaction with bidder through VC was held on 12.10.2021.



Thus we can march ahead





Thank you

