

Petroleum Exploration and Development Opportunities in Sri Lanka

Petroleum Resources Development Secretariat (PRDS)
www.prds-srilanka.com



Growing Island nation

Sri Lanka, formerly called "Ceylon", is an island nation in the Indian Ocean

The documented history spans 3,000 years, with evidence of pre-historic human settlements dating back to at least 125,000 years

The island's strategic location in the Indian Ocean, intersecting with the major air and sea routes between Europe and the Far East, gives it an strategic advantage as a global logistics hub

- The three major ports - Colombo, Hambantota and Trincomalee, and the two international airports - Colombo and Mattala offers investors with attractive and efficient logistics support in the shipping and aviation related investments creating an ideal environment for global upstream business ventures and partnerships

- Colombo is one fastest growing cities in Asia

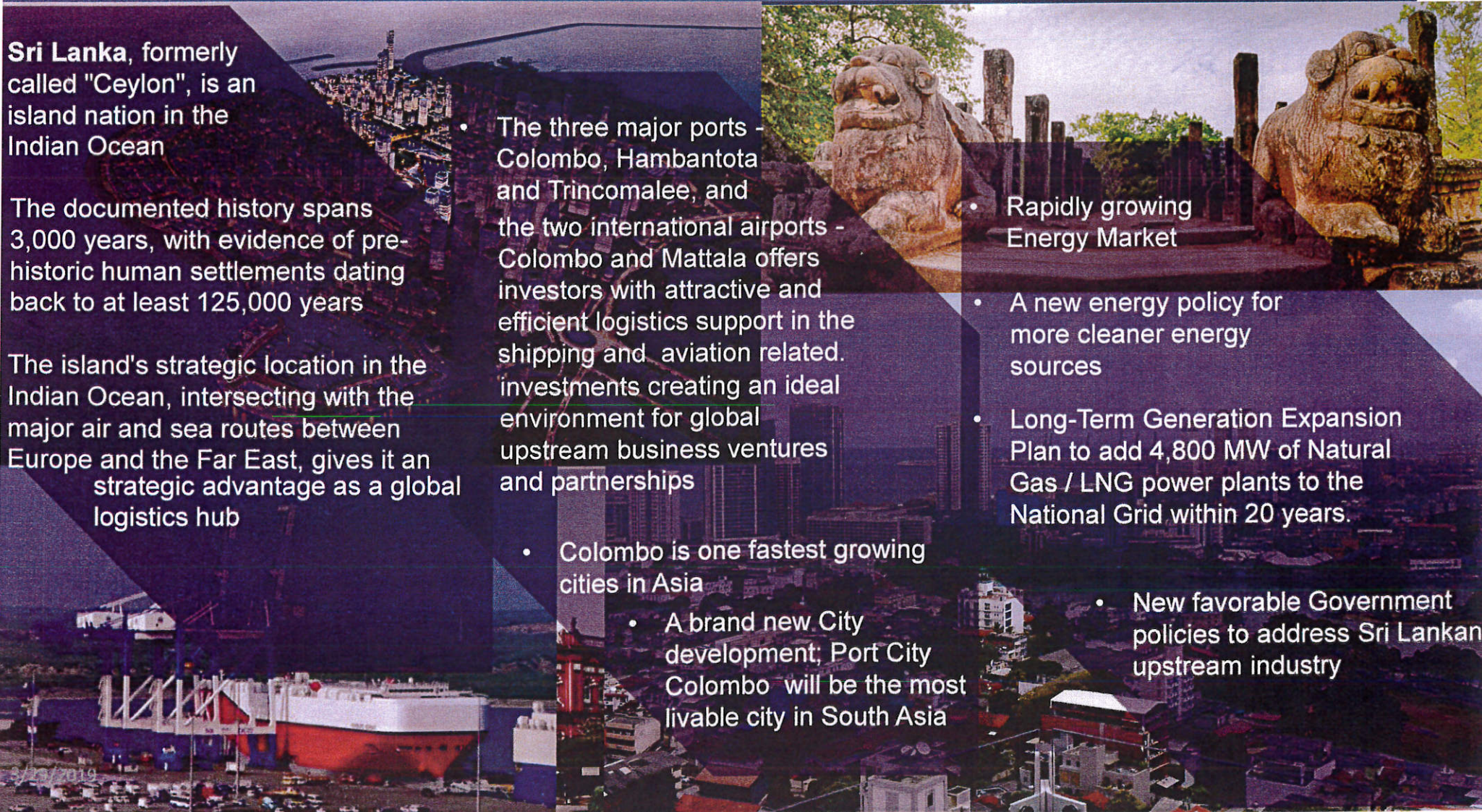
- A brand new City development; Port City Colombo will be the most livable city in South Asia

- Rapidly growing Energy Market

- A new energy policy for more cleaner energy sources

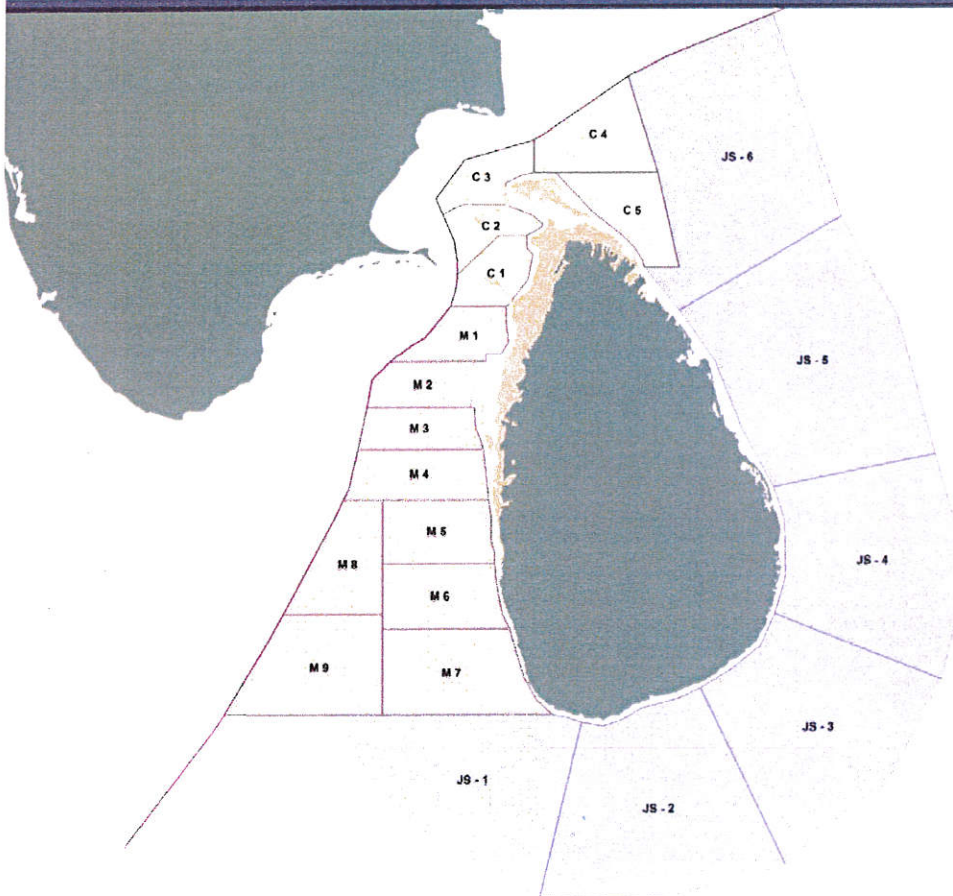
- Long-Term Generation Expansion Plan to add 4,800 MW of Natural Gas / LNG power plants to the National Grid within 20 years.

- New favorable Government policies to address Sri Lankan upstream industry



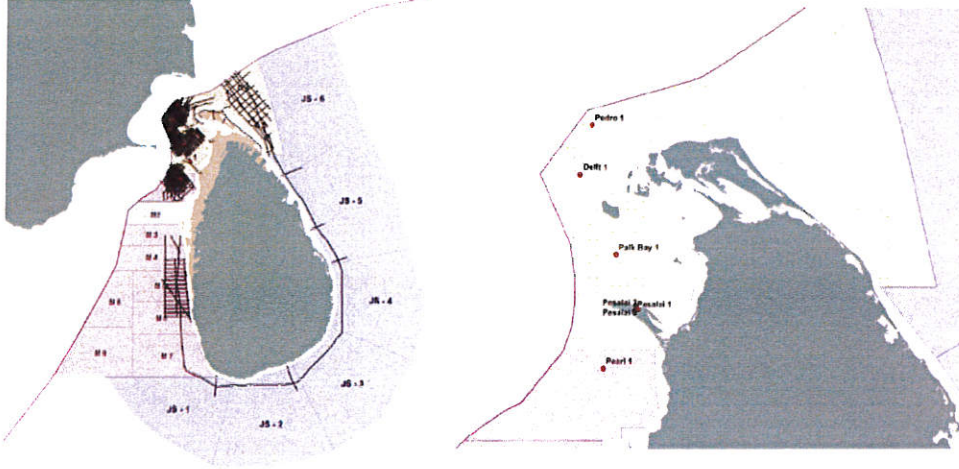
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E&P Opportunities



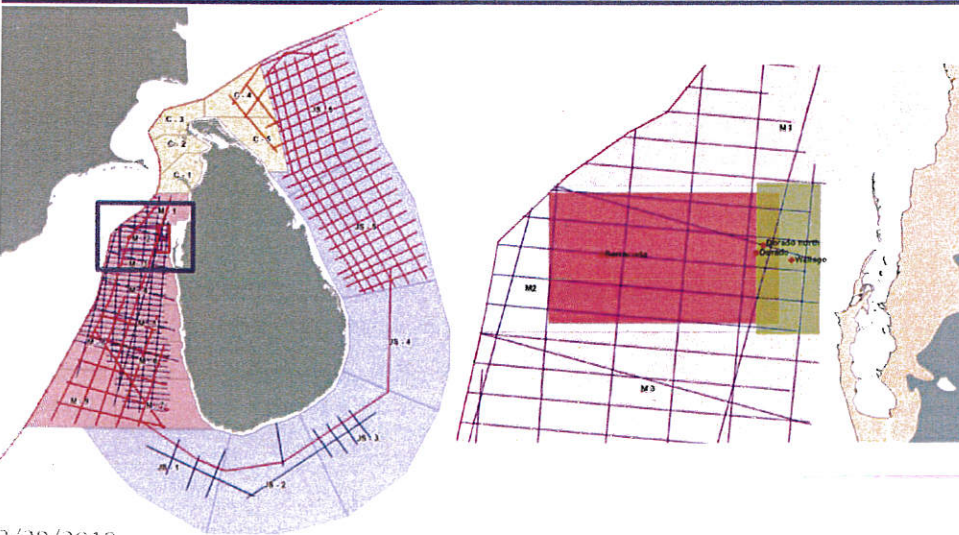
- Shallow to deep water E& P opportunities
- Three offshore sedimentary basins
 - Mannar Basin – 9 exploration blocks (M1 – M9)
 - Cauvery Basin – 5 exploration blocks (C1 – C9)
 - Lanka Basin - 6 ultra deep water blocks (JS1 – JS6)
- Two natural gas discoveries
- New oil and gas plays
- Total data coverage of
 - 2D Seismic data – 22375 line kms
 - 3D Seismic data – 2350 sqkm
 - Well Data – 11 wells
- Rapidly growing domestic energy market
- Attractive PSC terms
- Multi- Client data acquisition opportunities
- Open data room policy at PRDS
- Joint Study opportunities

Petroleum Data coverage



Vintage Data

- Data acquired from the exploration activities carried out from late 1960s to 1984 have categorized under vintage data. Most of the seismic and well logs are vectorized data.
- In-addition, well reports, interpretation reports and other reports are available.
- Total of approximately 9030 line kms of seismic data were acquired and total of 8199 line kms of seismic data were vectorized.
- Total of seven wells were drilled and there was a gas show in the Pasalai – 1 well. Other wells were dry.
- For data prices & purchase contact Data Manager at PRDS

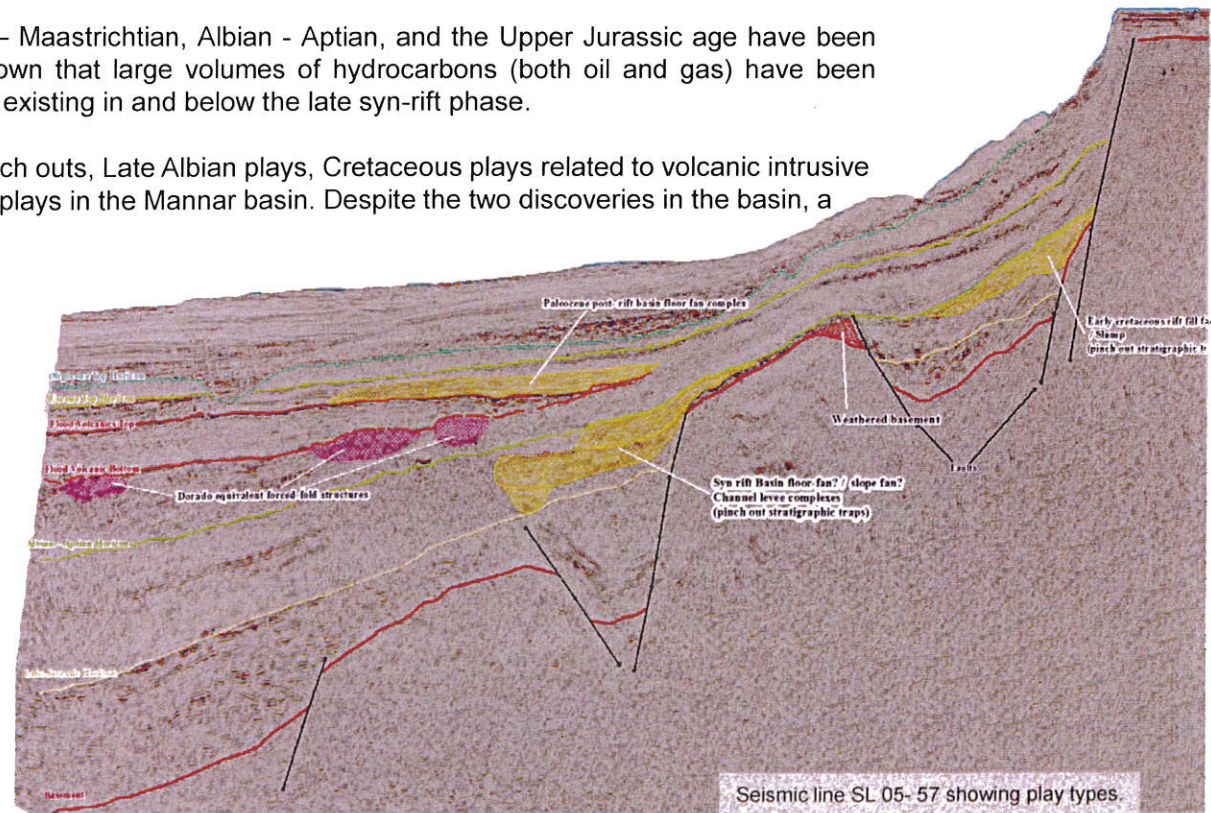


New Data

- Data acquired from the exploration activities carried out since 2001 to date have been categorized under new data.
- Total of approximately 14,174 line kms of 2D seismic data were acquired, consecutively 1100 line kms in 2001, 4500 line kms in 2005, 742 line kms in 2009 and 7832 line kms in 2018.
- Total of approximately 2353 sq kms of 3D seismic data were acquired in the block M2 consecutively, 1753 sq kms in 2009 and 600 sq kms in 2012.
- Four wells have been drilled and well data pertaining to these wells are available.
- In-addition several re-processed seismic data packs and reports are available
- For data prices & purchase contact Data Manager at PRDS

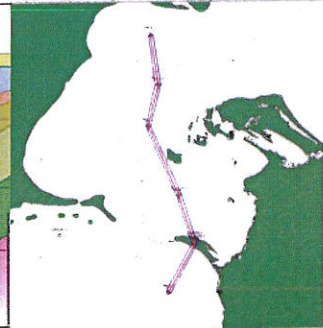
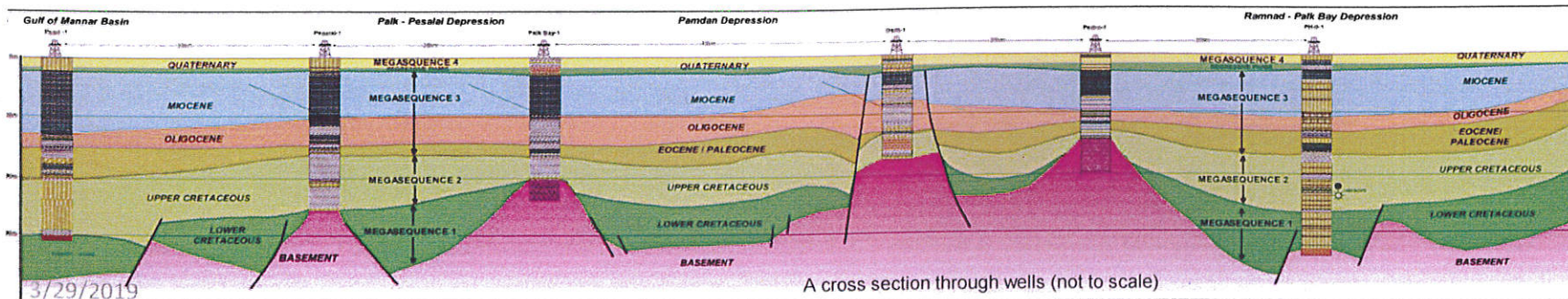
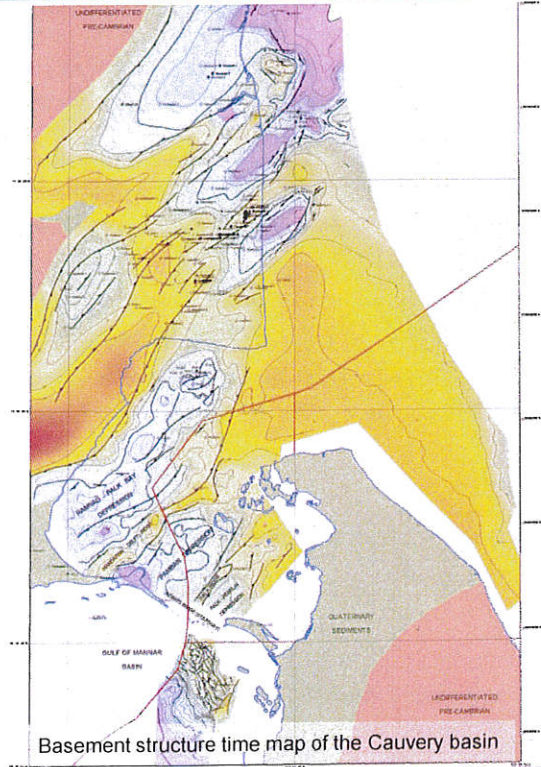
Mannar Basin

- Deep water Mannar basin is located between the coasts of South-eastern India and western Sri Lanka, and lies to the south of the Cauvery basin. In terms of the areal extent, Mannar basin approaches an area of approximately 50,000 square kilometres within the maritime jurisdiction of Sri Lanka.
- The basin is a failed-rift basin and its formation was initiated with the East-West Gondawana separation in Upper Jurassic age. The basin has experienced two syn-rift events followed by a thermal sag phase and an inversion in Eocene. Deep-marine sedimentary environment has been persisted since Barremian.
- Three potential source rock levels belonging to the Campanian – Maastrichtian, Albian - Aptian, and the Upper Jurassic age have been identified. Scenario based source rock modeling work have shown that large volumes of hydrocarbons (both oil and gas) have been generated from these source rocks. Particularly, the source rocks existing in and below the late syn-rift phase.
- Rifted weathered basement highs, early syn-rift abrupt margin pinch outs, Late Albian plays, Cretaceous plays related to volcanic intrusive and extrusives, and Tertiary fan and channel plays are prominent plays in the Mannar basin. Despite the two discoveries in the basin, a major portion of the Mannar basin still remains under explored.
- Divided into 9 exploration block (M1 to M9).
- **Data availability**
 - Approximately 5572 line km of new 2D seismic data
 - 3001 line km of Vintage 2D seismic data
 - Well data from 4 exploration wells – Dorado, Dorado North, Barracuda & Wallago.
 - Approximately 1924 line kms Multi Client 2D seismic data acquired in 2018.

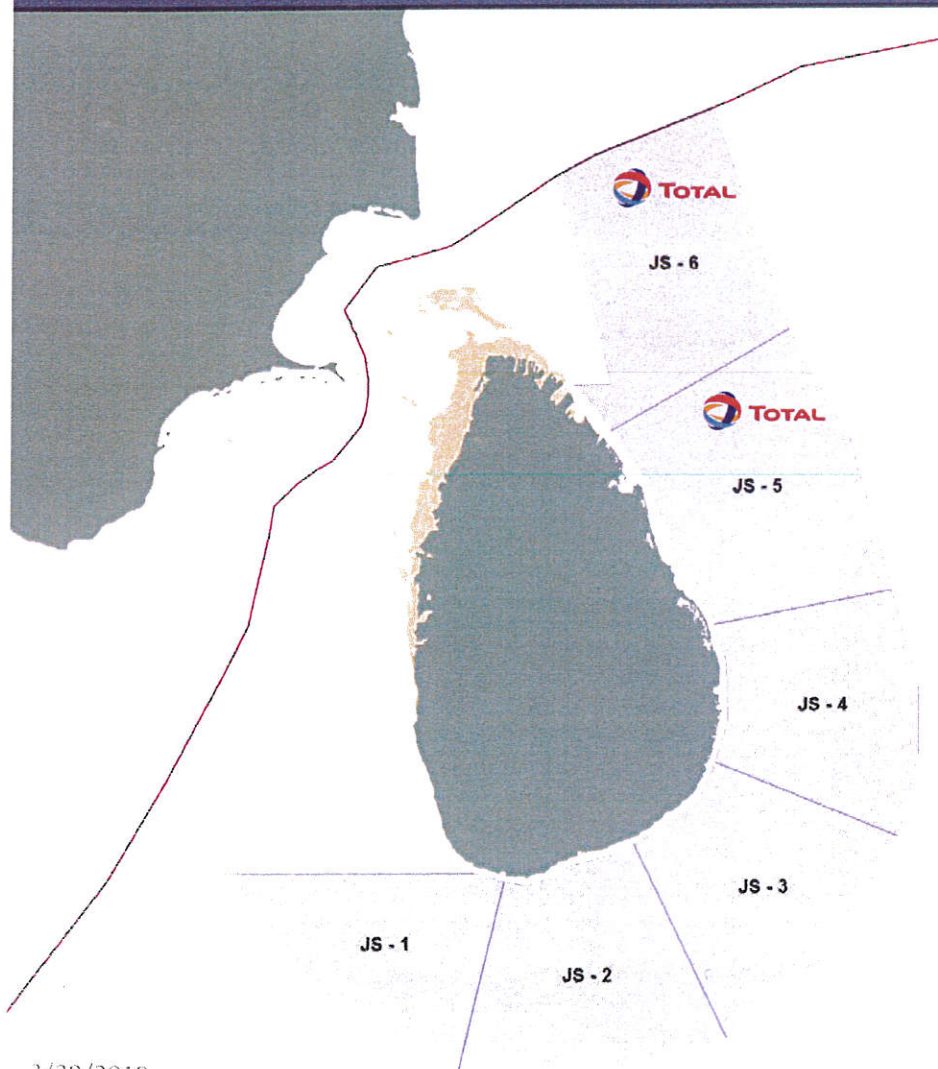


Cauvery Basin

- Cauvery basin is consisted with sub-basins; Ramnad – Palk bay depression, Pamban Depression and Palk – Pesalai depression. These sub – basins are separated by ridges; Mandapan – Delft and Palk.
- Cauvery basin is proven for it's hydrocarbon generation.
 - The PH9-1 well, drilled in the Ramnad – Palk bay sub basin, tested 1488BOPD of 56 API crude with 570 Mcf/d gas from 6m pay. This flow came from a sand layer in the Cretaceous.
 - On the Indian side oil shows- in Cretaceous and weathered basement rocks have been recorded.
 - Pesalai – 1 well has confirmed a Gas show in the in basal Cretaceous sands.
- Source Potential - Mature Cretaceous marine shale.
- Reservoir Potential -The Cretaceous sands/ Weathered basement/ tertiary sands & limestones.
- Cap Rock - Claystones and shales below the lower Miocene sections
- Plays -Basement fault blocks / Simple anticlinal traps formed by drape and differential compaction/ Onlapping sediments to the basement highs
- The Basin (approximately 20,000 sqkm) has been divided into 5 exploration blocks (C1 – C5).
- **Data availability**
 - Approximately 4400 line kms of 2D vintage seismic data
 - Well data from Drilled 6 exploration wells – Pedro-1, Palk Bay-1,Delft-1, Pesalai-1, Pesalai-2, Pesalai-3
 - approximately 295 line kms Multi Client 2D seismic data acquired in 2018 covering C4 ad C5 blocks

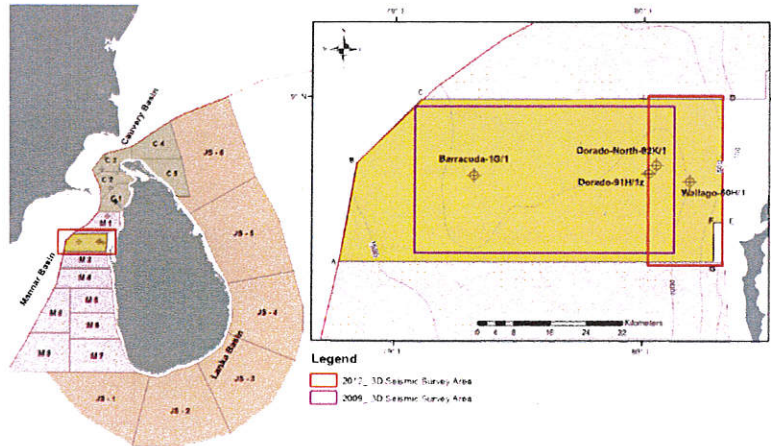


Lanka Basin

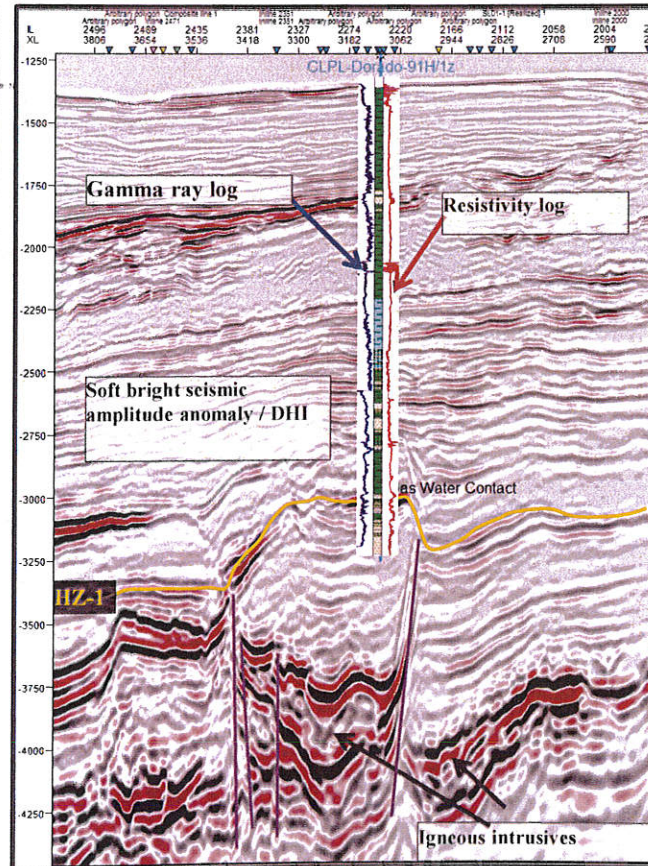


- The Lanka basin is a passive margin and began to evolve in lower Cretaceous age. It is bounded by an abrupt margin to the Sri Lankan land mass
- It is too early to discuss the hydrocarbon potential in this basin since its data coverage is extremely limited. However, Possible play types are basin floor fans, turbidites, abrupt margin onlap, anticlines, etc...
- Marine shales have been anticipated as potential source rocks
- The basin (approximately 130,000 sqkm) is divided into six larger blocks for joint studies (JS 1 –JS 6). Currently two blocks (JS-5 & JS-6) have been awarded to Total of France. Blocks from JS-1 to JS 4 are available for joint studies. Approximately 5000 line kms of 2D seismic data were in 2018 covering JS5 and JS-6 blocks and the data are being processed.
- The objective of Joint Study is to explore the Joint Study blocks for hydrocarbon prospectivity by conducting geological, geophysical and technical surveys, analyzing and interpreting the acquired data.
- If this study indicates commercially viable oil or gas reserves, the Exploration company reserves the right to negotiate a production sharing agreement with the Government of Sri Lanka, failing which the Government may open the blocks to other bidders. In this case, Exploration company retains one time pre-emptive right to match the best bid for a specified period.
- **Data availability**
 - Approximately 740 line kms of 2D seismic off the south coast
 - Few vintage seismic lines on the narrow continental margin

Block M2 - Status and Dorado Gas discovery

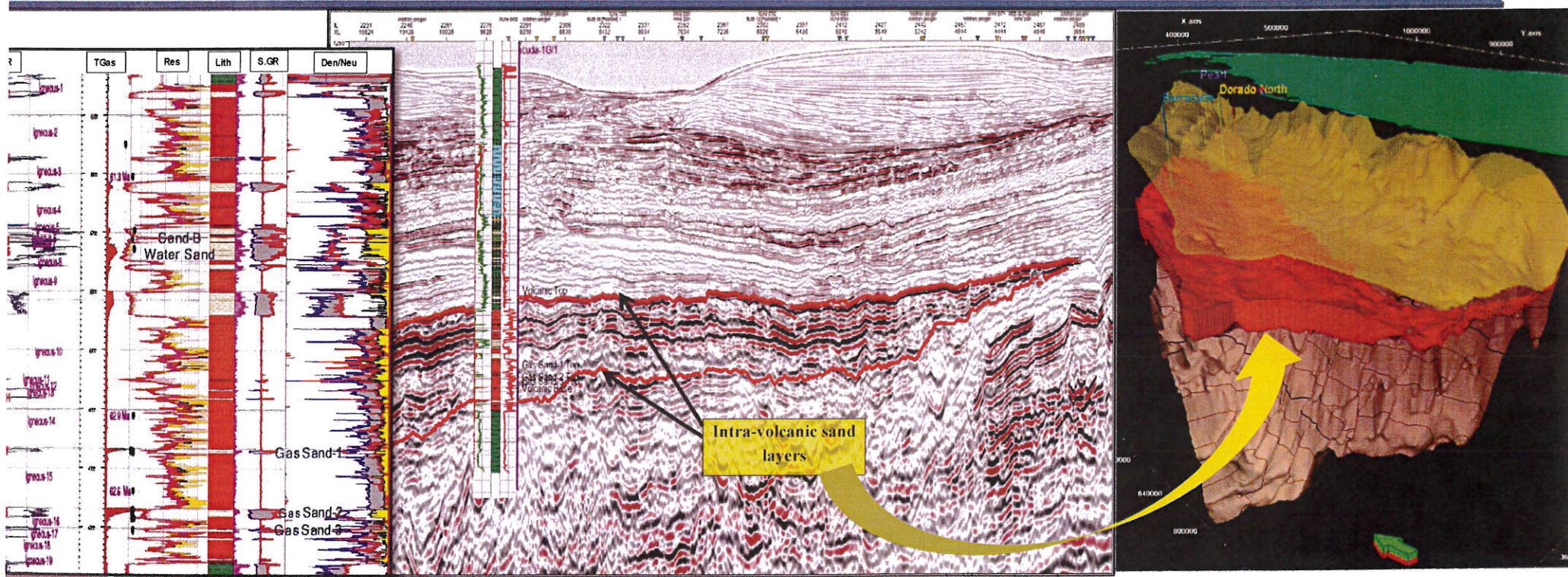


- Block Area : 3000 sq. km, Water depths varying from approximately 300m to 2000 m
- Seismic Coverage :
 - 3D : 2353 Sq.Km. (within block)
 - 2D : 5700 LKM (Regional data)
- Number of Wells drilled within the block – 4
(2 Gas Discoveries, 2 Dry Holes)
 - Dorado , Barracuda – Gas discoveries
 - Dorado North. – Dry
 - Wallago – Prematurely Abandoned
- More leads & prospects
- Proximity to Emerging Energy Markets:
 - Sri Lanka, Southern India



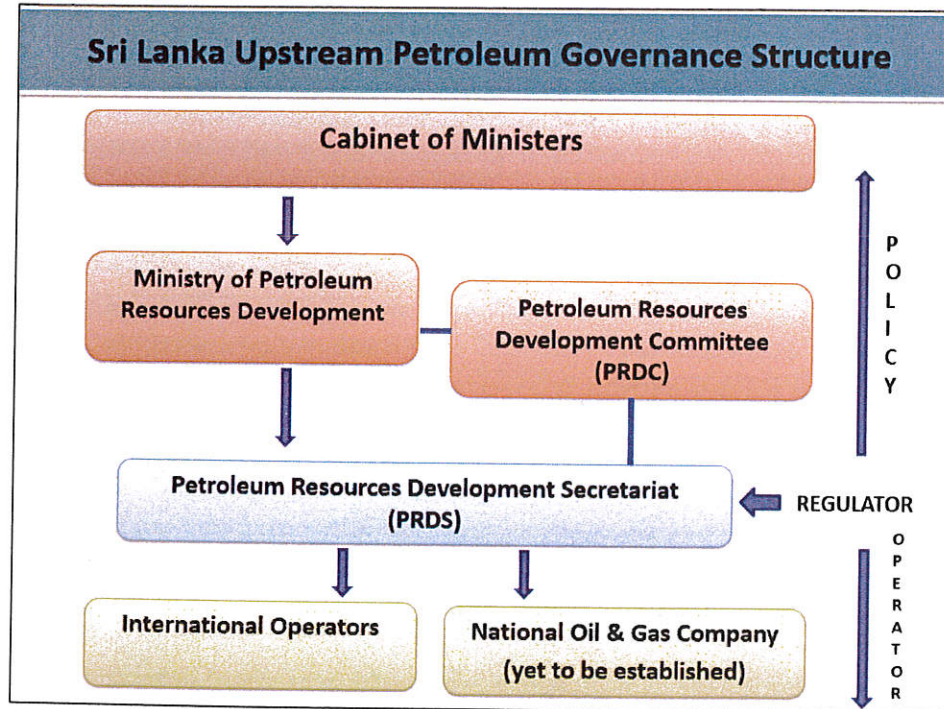
- Dorado well is located approximately 30 km away from the western shore line.
- The pool is dominant with dry gas (>95% methane) and they may have been charged from Albian or syn-rift sources in the basin since the Paleocene.
- The Dorado discovery was made in a forced fold structure formed above an igneous intrusion during the Maastrichtian period.
- The reservoir is feldspathic-arenite with average porosity and moderate permeability.
- The presence of gas in the trap is apparent on seismic data as a bright amplitude anomaly and also, the prospect is having Class III type Amplitude Versus Offset (AVO) response.
- Modular Formation Dynamic Tester (MTD) - pressure data confirms the Gas-Water Contact (GWC) and thus, the pool limits have been determined with high confidence.
- Estimated mid case recoverable volume is 350bcf.

Block M2 – Barracuda Gas discovery



- The Barracuda discovery was made in the well; Barracuda and gas was encountered in three intra flood-volcanic sand layers.
- These sand layers are feldspathic to subfeldspathic-arenites rich with mafic minerals and porosities of layers are consistent with variable permeabilities.
- Mapping of sand layers is a major technical challenge and thus, estimation of the pool limits is a major challenge. The mid case GIIP volume estimation is 1.5 Tcf and High case is 5 Tcf .
- However, it is apparent on seismic data that the flood volcanic layer together with intra-volcanic sand layers is pinching out towards the basin margin.
- Therefore, higher lateral extension of these sand layers could be anticipated.

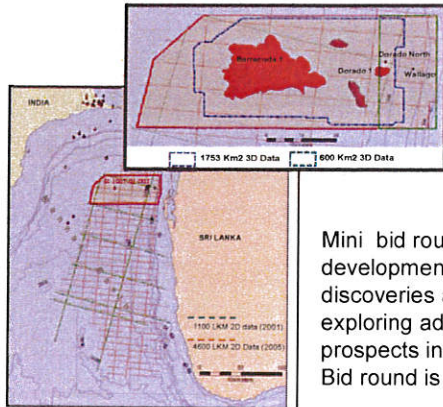
Key Legislative and Fiscal Features



- Petroleum Resources Act No. 26 of 2003
- Sri Lanka Upstream Petroleum Local Content Guidelines;
- Geophysical, Geological, Environmental, Geotechnical, Drilling and Local Content Guidelines;
- Relevant Tax and Environmental regulations
- Signature and Production Bonus
- Contractor can have up to 100% of initial participating interest. Each of the companies participating in a consortium shall have a minimum participating interest of 10%.
- The Government, through its wholly owned subsidiary, at its choice may (or may not) take up a fully paid option of:
 - (a) Max Fifteen percent (15%) for deep water blocks;
 - (b) Max Twenty percent (20%) for shallow water blocks.
- Cost recovery up to 100% with an annual maximum ceiling.
- Royalty linked to the biddable average daily production rates.
- Share of profit petroleum linked to the biddable average daily production rates.
- Local content development commitment
- Applicable Taxes with attractive tax benefits

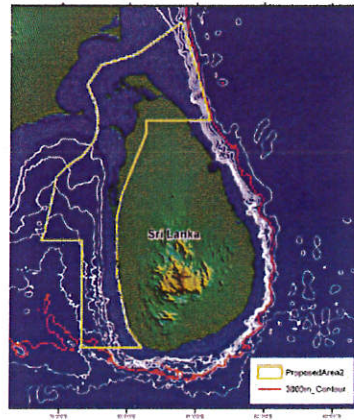
Upcoming E&P events

1. Block - M2 mini bid round



Mini bid round for the development of gas discoveries and exploring additional prospects in Block M2 – Bid round is open.

2. Multi-client Gravity & Magnetic data acquisition

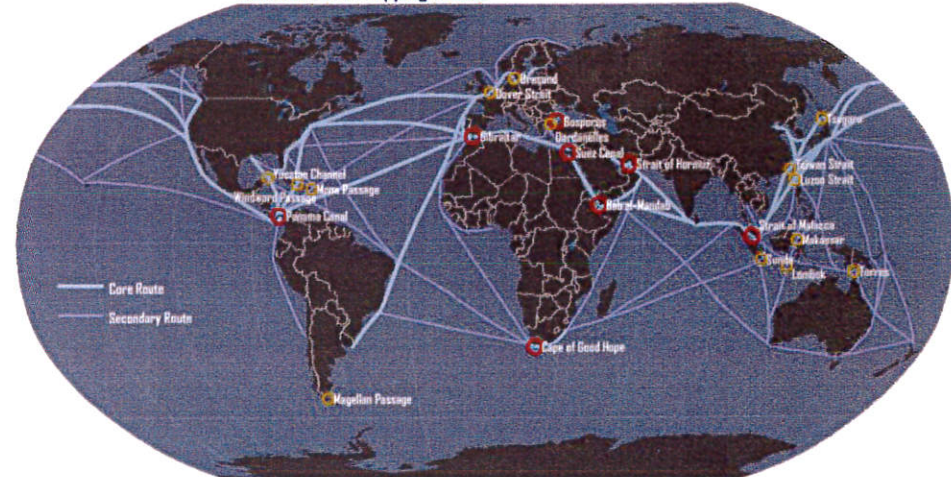


PRDS has planned to acquire Air-borne Gravity, Gravity gradiometry and Magnetic data in Cauvery and Mannar basins on Multi-client basis and licensing by Q1 of 2019.

Other Proposed Events

4. Invitation of bids for the exploration blocks M1 and C1
5. Joint Exploration Studies for C2 and C3 blocks in Cauvery basin
6. Request proposals for the R&D partnerships (academic/commercial)
7. EOIs for Joint Study for the remaining ultra deep blocks in the Lanka basin
8. Preparatory activities for the 3rd international licensing round for the remaining blocks in the Mannar and Cauvery basins
9. Encourage investment partnerships to use Sri Lanka's strategic location as a upstream petroleum service hub

Main Maritime Shipping Routes



Dr. Jean-Paul Rodriguez, Dept. of Global Studies & Geography, Victoria University

Useful Links

Useful Information	Link
Petroleum Resources Act No. 26 of 2003	http://www.prds-srilanka.com/aboutus/legislation.faces
Upstream Geophysical, Geological, Environmental and Geotechnical Program Guidelines	http://www.prds-srilanka.com/aboutus/legislation.faces
Initial Natural Gas Utilization Road Map of Sri Lanka	http://www.prds-srilanka.com/aboutus/publications.faces
Sri Lanka Upstream Petroleum Local Content Guidelines	http://www.prds-srilanka.com/pdfs/Guidelines2014.pdf
Marine Environmental Protection Authority	http://www.mepa.gov.lk
Sri Lanka Energy Policy	http://powermin.gov.lk/english/?page_id=1394
Petroleum products – Marketing and Sales	http://ceypetco.gov.lk/marketing-sales/
Sri Lanka Electricity Tariffs and Charges	http://www.pucsl.gov.lk/english/industries/electricity/electricity-tariffscharges/
Sri Lanka Energy Balance	http://energybalance.axioo.com/

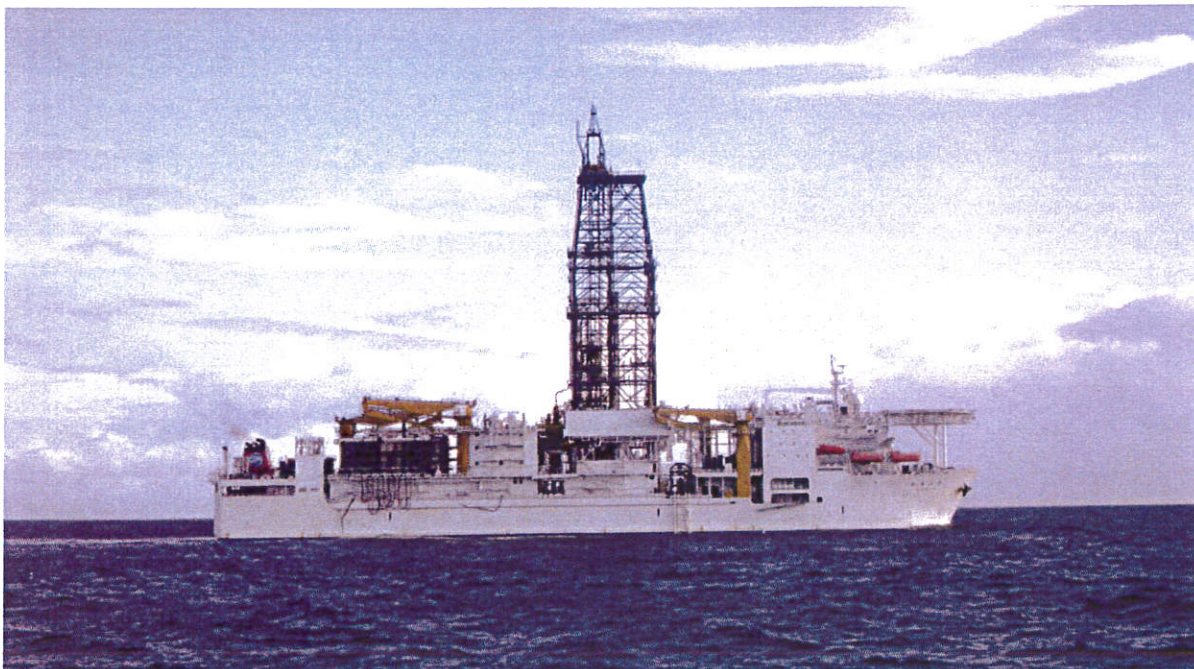
Vision & Mission

Vision

To ensure that all Sri Lankans benefit from the petroleum resources of the country by managing the industry in an equitable, safe and environmentally sustainable manner.

Mission

Design and monitor fiscal regimes that meet the country's evolving economic needs, matching them with a stable, efficient regulatory framework that attracts investment and encourages knowledge transfer, until the last economic reserves are produced.



Contact Details

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Whether you're seeking, developing or extracting energy resources, GAC Sri Lanka can take the strain and put our technical muscle and skill at your service. With many years of experience in serving the oil & gas sector, trust us to take care of the details while you focus on your business.

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3/29/2019

The GAC Sri Lanka Advantage:

- Specialist expertise in supply chain management, offshore support and agency services
- Wide geographical coverage supported by strategic regional warehousing and base management
- End-to-end supply chain solutions
- Full offshore support including own fleet of vessels from tugs to supply and crew boats
- Strict HSSE and FCPA compliance



Delivering your strategy.