

## ***The Middle East to India Deepwater Pipeline***

# The SAGE Project Vision



## The MEIDP Project

The MEIDP Project is envisaged as transmission pipeline **Infrastructure project** allowing transportation of Middle East Gas to the West Coast of India

The pipeline will be laid as a “**Common Carrier**” pipeline whereby SAGE will be the Gas Transporter and will be paid a Tariff for pipeline use

The Gas Buyers and the Gas seller will negotiate the **Long Term Gas Supply Contract** themselves [under the aegis of SAGE in a Tri-partite Framework Agreement]

MEIDP 1 will be the **first in a series** of pipelines supplying gas to the Gujarat coast of India, from the vast available resources in the Middle east, by the **safest, most economic and reliable** means

## Iran - India's Gas Partner

### *India needs gas*

- Over **2,000 TCF** of natural gas reserves are held by countries with which **India** has a traditional **trading relationship** i.e Iran, Qatar and Turkmenistan.
- Iran** has over 1000 TCF reserves and is **eager to export gas**.
- The **deepwater route** across the Arabian Sea is the **shortest secure distance** between huge middle east reserves and the rapidly developing industrial heartland of India, and is **too short for LNG to be an economic** transportation option

### *Iran has gas*

- Iran has always been a friendly neighbour to India
- Iran has expressed its willingness to supply Natural Gas and a Framework Agreement has been discussed with NIGEC [Now NIOC Gas Export Division] for Pipeline Construction and Gas Supply through the SAGE Pipeline
- In 2015 NIGEC confirmed to SAGE that they are currently in a position to provide gas for **2 pipelines** from Iran to India



# SAGE Key Team Members/ Technology Partners

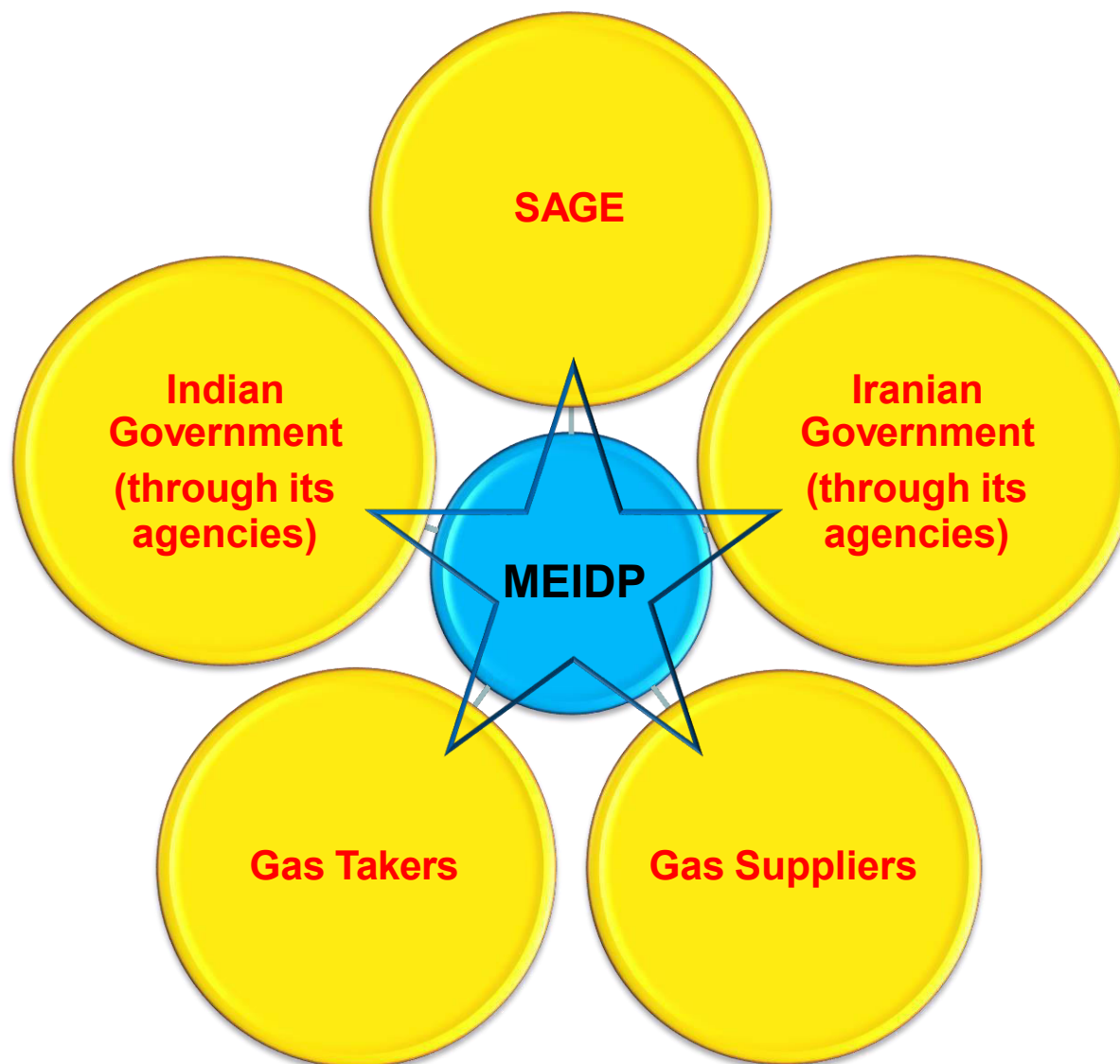


Mr T.N.R Rao	Former Petroleum Secretary, Govt of India Architect of Oman-India Pipeline Chairman of SAGE Advisory Board
Mr Subodh Jain	Director South Asia Gas Enterprise PVT Ltd. Director Siddho Mal & Sons and Director INOX Air Products Ltd. Former Senior Advisor to Oman-India Pipeline
Mr Peter Roberts	Former Director South Asia Gas Enterprise PVT Ltd. Director Verderg Ltd. Former Project Director of Oman-India Pipeline
Dr Herman Franssen	Member of the SAGE Advisory Board and Senior Consultant to SAGE President, International Energy Associates, USA Former Advisor to Oman-India Pipeline & Former Economic Advisor to the Sultanate of Oman, MoP
Mr Ian Nash	Manging Director, Peritus International (UK) Ltd. and Senior Technical Consultant to SAGE PM for Detailed Design of Europipe 2 Gas Trunkline and BP Block 31 ultra deep flowlines PM for MedGaz FEED Ultra Deep Trunklines and EM for Canyon Express Ultra Deep development

Dr Alastair Walker	Member of the SAGE Advisory Board and Senior Consultant to SAGE Leading International Expert on Marine Pipeline Engineering Professor Emeritus, University of Surrey UK & Visiting Professor, University College London
Dr Roberto Bruschi	Senior Vice President Saipem SpA, Milan, Italy
Dr Ping Liu	Operations Director, Intecsea BV, Netherlands
Mr Marco Monopoli	Offshore Commercial Manager Saipem SpA, Milan, Italy
Mr Johan Drost	Allseas International, Delft, Netherlands
SBI Capital Markets Ltd	Financial Advisory Services
Engineers India Ltd	Leading Onshore Pipeline and Facilities Engineering SAGE Indian Design Consultants
Ernst & Young	Advisory Services

Governments **must** be **stakeholders** (through their agencies) for Transnational Pipelines

All interest parties **must** be **stakeholders** for Large Infrastructure Projects



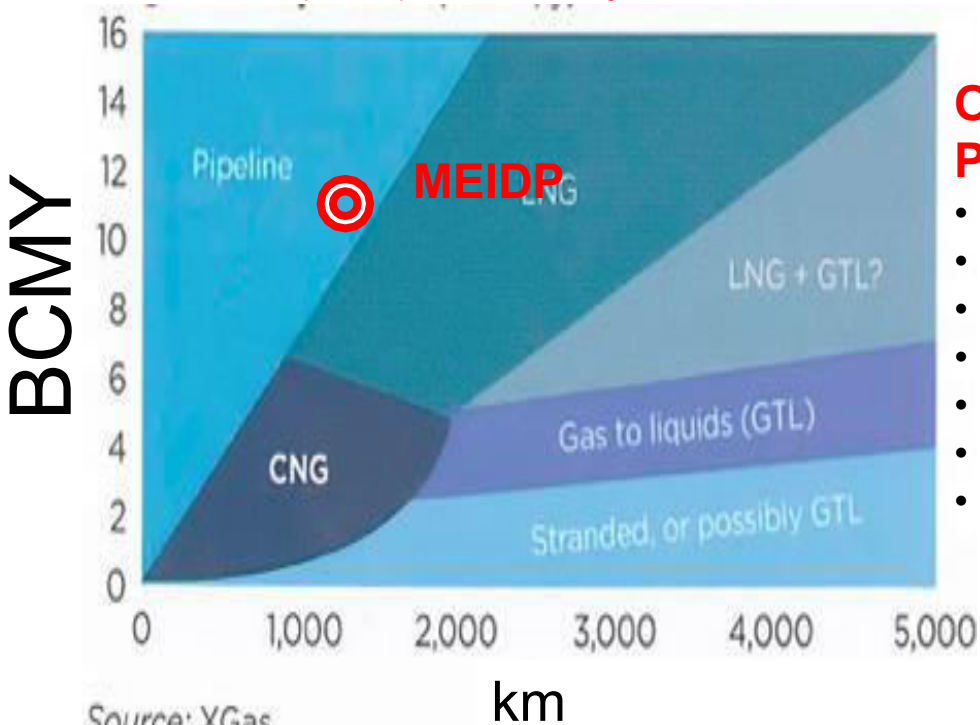
## SAGE

MOUs and Agreements to Co-operate in developing MEIDP have been signed with:

Pipe Mills	Installation Contractors	Suppliers & Takers	Engineering & Consultancy
<ul style="list-style-type: none"><li>• British Steel (TATA Corus)</li><li>• Welspun</li><li>• JindalSAW</li><li>• PCK (China)</li><li>• <i>JFE</i></li><li>• <i>Europipe</i></li><li>• <i>NSSMC (Nippon Sumitomo)</i></li><li>• <i>Bao Steel</i></li></ul>	<ul style="list-style-type: none"><li>• Allseas</li><li>• Saipem SpA</li><li>• Heerema Marine Contractors</li></ul> <div>Certification Bodies</div> <ul style="list-style-type: none"><li>• DNVGL</li></ul>	<ul style="list-style-type: none"><li>• Indian Oil Corp.</li><li>• GAIL</li><li>• GSPC</li><li>• Oman Ministry of Oil and Gas</li><li>• NIGEC</li></ul>	<ul style="list-style-type: none"><li>• Peritus International Ltd.</li><li>• Engineers India Ltd.</li><li>• Intecsea</li><li>• FUGRO GeoConsulting Ltd.</li><li>• SBI Caps</li><li>• Ernst &amp; Young (EY)</li></ul>

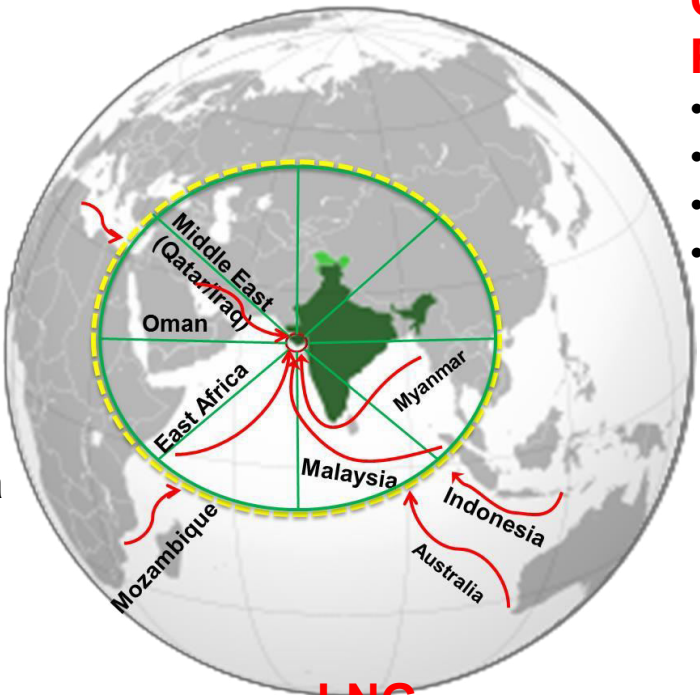
Key Highlights of Pipeline and LNG		
Particulars	Pipeline	LNG
Constant Supply	Yes	No
Gas Source	Fixed source and destination for gas	Flexibility to source gas from various sources
Long Term Commitment	Yes	Possible to source Long Term and Spot Cargoes
Cost of Construction	Dependent on distance, capacity and depth	Dependent only on capacity – relatively independent of distance
Operating Cost	Only transportation tariff applies	Transportation tariff, Liquefaction charges, Regas charges
Maintenance Cost	Minimal	Periodic maintenance required

Ultradeepwater capabilities and Challenges Statoil R&D



### Offshore Pipeline

- Qatar
- Iraq
- Oman
- Iran
- Myanmar
- Malaysia
- East Africa (North)



### Onshore Pipeline

- Turkmenistan
- Iran
- China
- Russia

### LNG

- East Africa (South)
- Australia
- Indonesia
- North Africa
- Western Med

**Economic Limit of Pipeline Gas to India West Coast is ~2000km**

	Dry Gas Price	Liquefaction Cost	Shipping Tariff	Regasification	Total Cost
LNG	3-4	~4.0	0.3	0.5	7.8-8.8
Pipeline	3-4	-	2.5	-	5.5-6.5
Difference in landed gas price					2.3

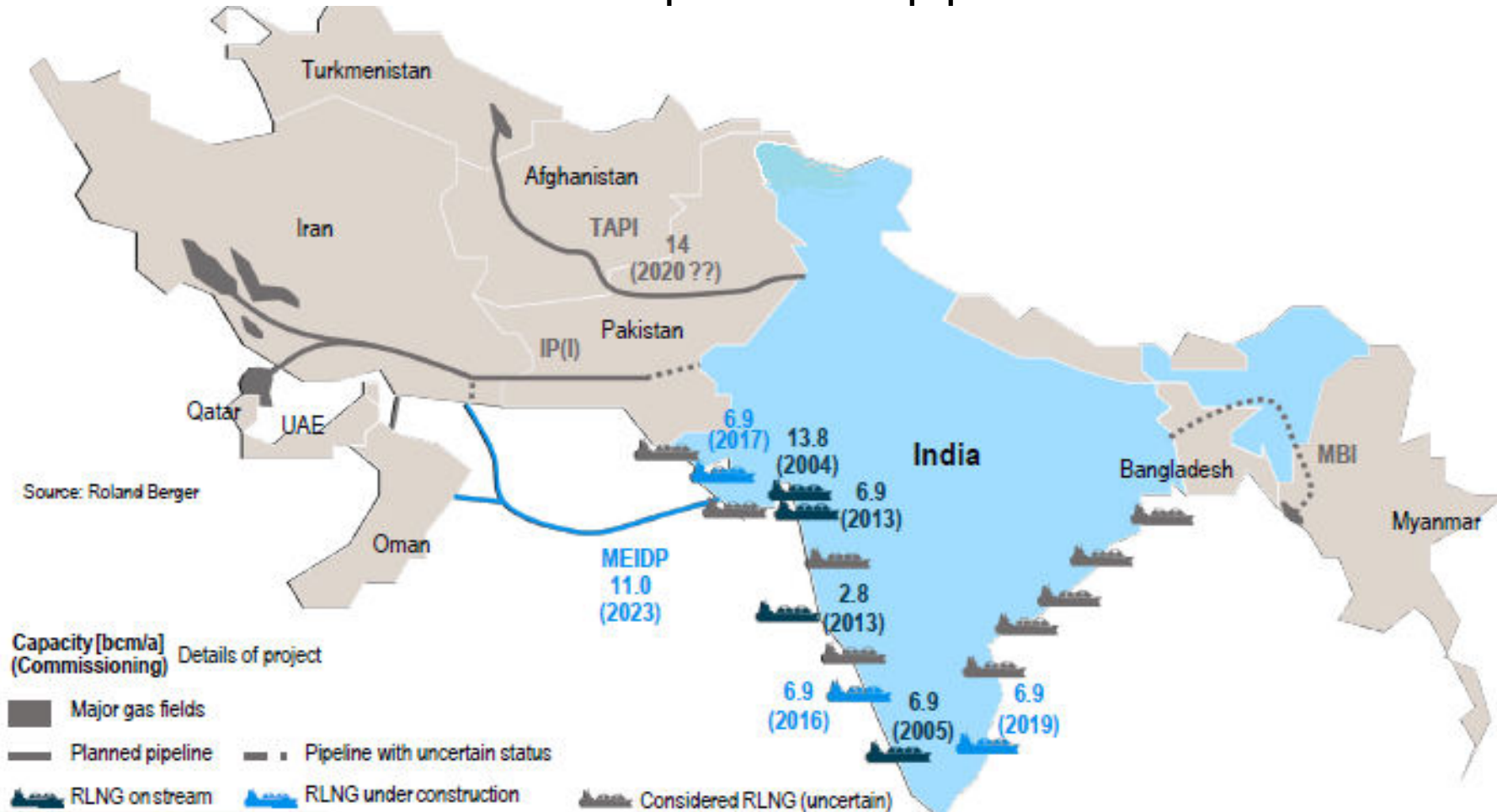


# Competing Indian gas import projects

To cover the increasing gas demand, India plans to expand its import infrastructure with new RLNG plants and pipelines

- + 4 existing LNG regasification plants
- + 12 planned/considered LNG regasification plants
- + up to 4 pipelines

Pipelines help to moderate Gas prices



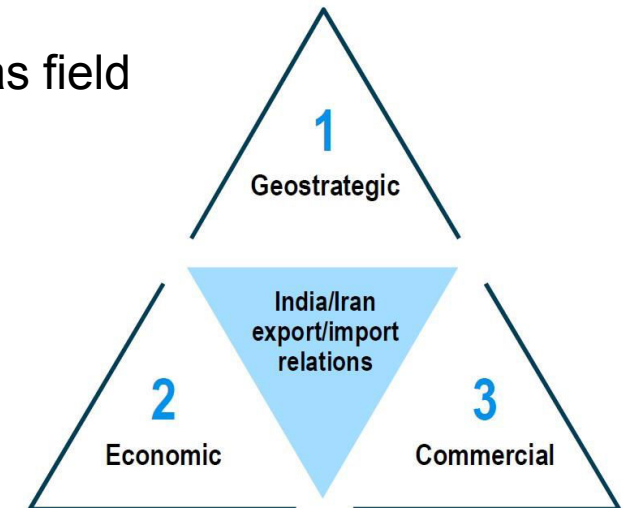


## MEIDP's offshore route avoids regional conflicts



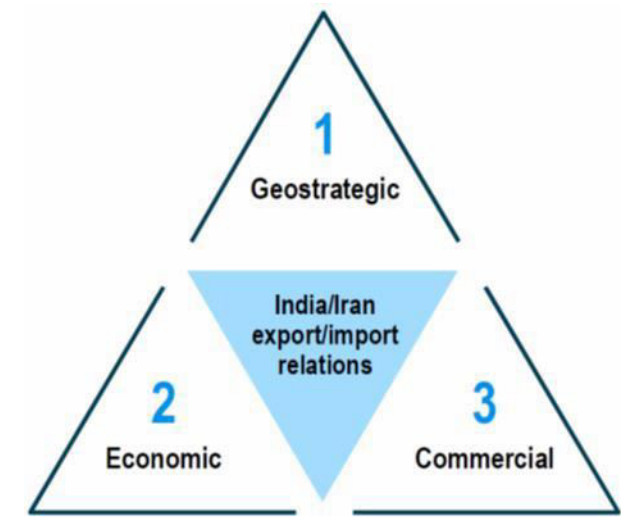
- > The larger MENA region and South Asia generally presents a **challenging geopolitical environment** and security environment for large-CAPEX cross-border infrastructure
- > The offshore route of **MEIDP avoids conflicts** and limits the impact of potentially deteriorating geopolitical relations as well as **limiting on-the-ground security threats** posed by non-state actors

- Provides Iran with a Safe and Secure long term means of Gas monetization. (Unlike other considered pipeline options such as IPI).
- Gives Iran access to a large and growing gas market on its doorstep. With potential for up to 4 Pipelines along the corridor based on India's projected gas shortage.
- Provides Iran with the opportunity for higher net back gas price than LNG given that LNG in Iran will be greenfield development.
- Facilitates upstream Investment in Iran by Indian companies in Discovered Gas field near SAGE pipeline to allow easy evacuation of Gas to India (OVL Farzad B).
- Builds on existing intergovernmental agreements on trade and development.



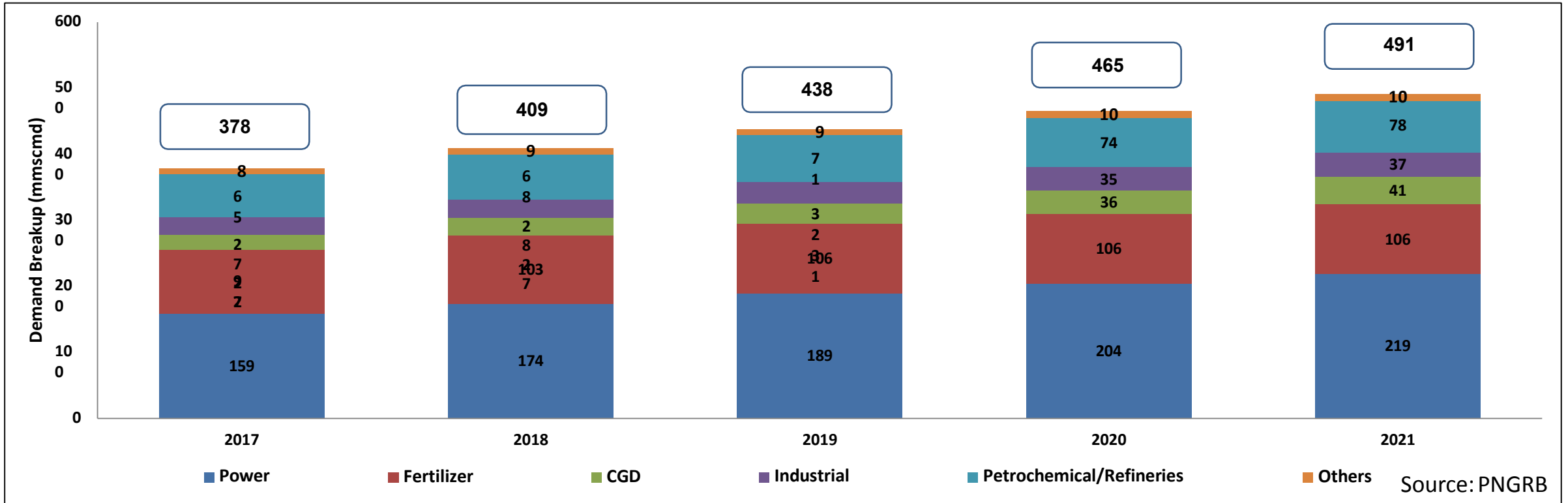
Even as a developing Country it can be argued that India is becoming too heavily dependent on costly LNG. SAGE pipeline Gas from Iran can generate Power at prices similar to Clean Coal. Potentially each SAGE Gas pipeline of 31.1 mmscmd saves India almost a billion dollars annually when compared to Spot / Term LNG imports / price.

- Pipeline/LNG competition moderates Gas prices to the consumer
- 50% of India Gas demand is from the Power & Fertilizer industry, who can only use Gas at affordable prices (\$5 to \$6 per mmbtu) and hence cannot afford LNG, unless subsidized.
- Currently 15,000 MW of Gas based Power generation capacity is stranded due to High long term LNG Gas prices
- Five new Fertilizer Plants are planned in India (India is also considering overseas Fertilizer plants).
- Much investment is taking place in India internal Gas pipelines (and LNG Terminals) but currently there is no Gas in India's main "Arteries"



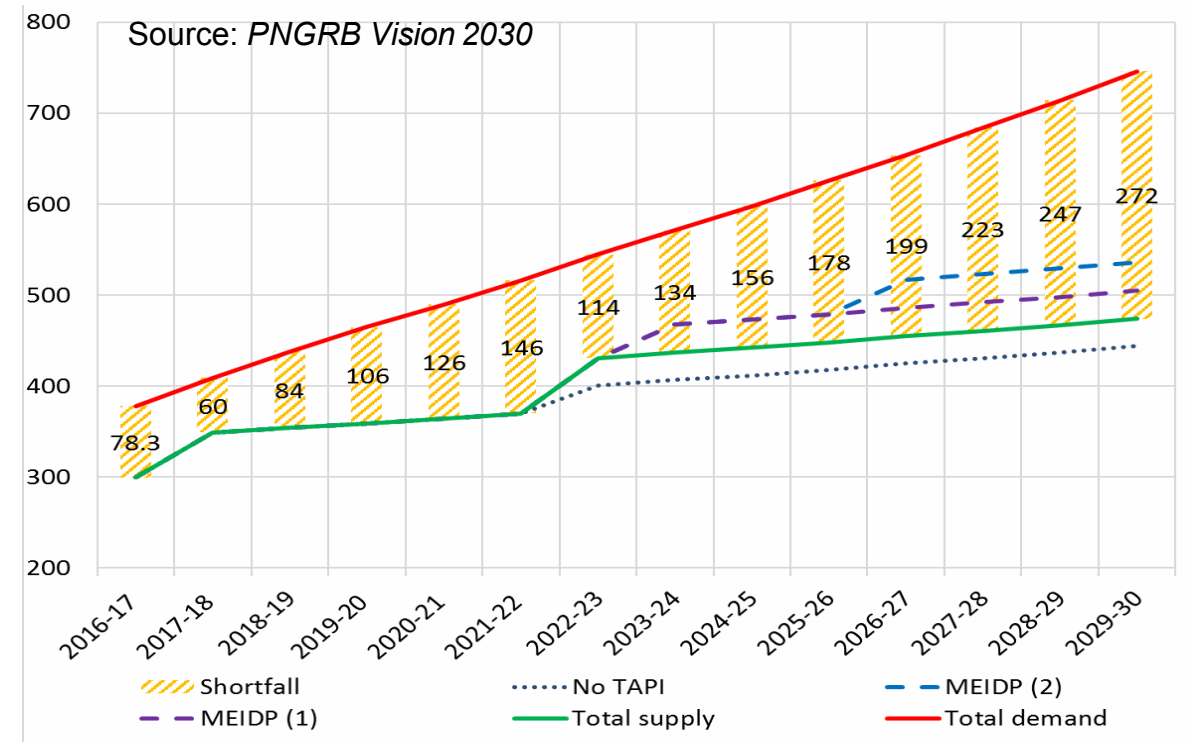
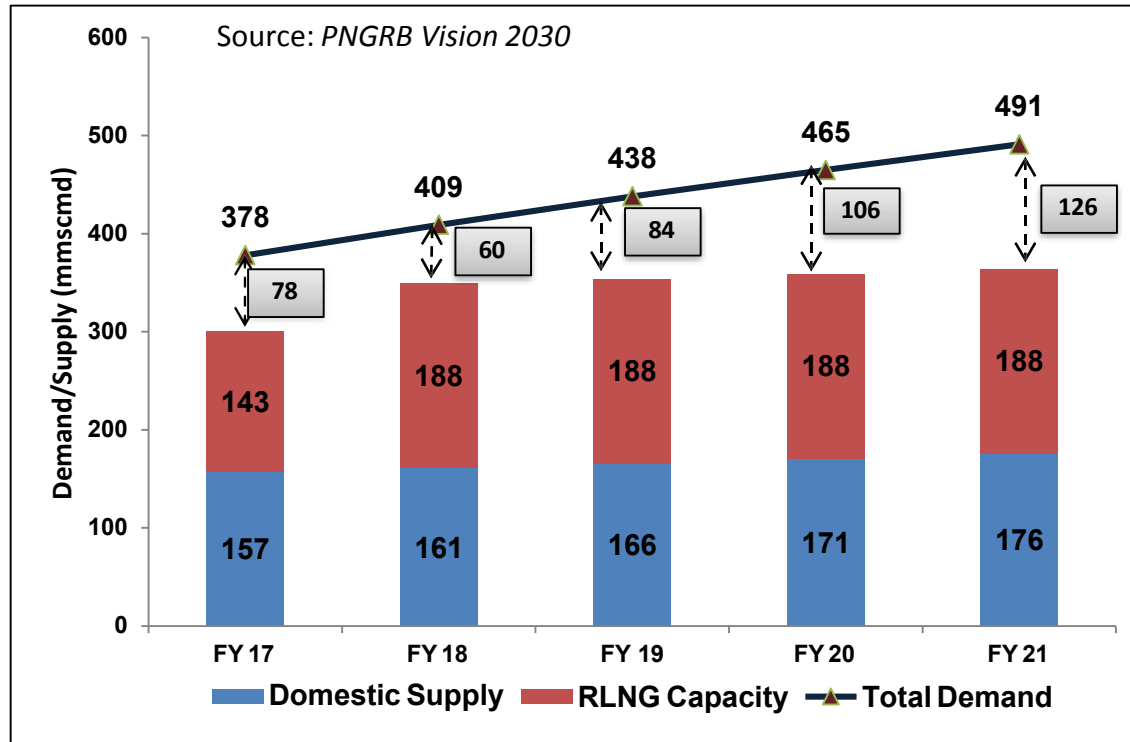


# Projected Demand-Sector Specific



- Majority of this incremental demand shall be from Power, Fertilizer and CGD sector.
- Gas based power generation is expected to contribute the highest to the overall demand, in the range of 42% to 45%.
- Demand from Fertilizer & CGD sector is expected to follow with a contribution of around 25% to 30% in the total demand.

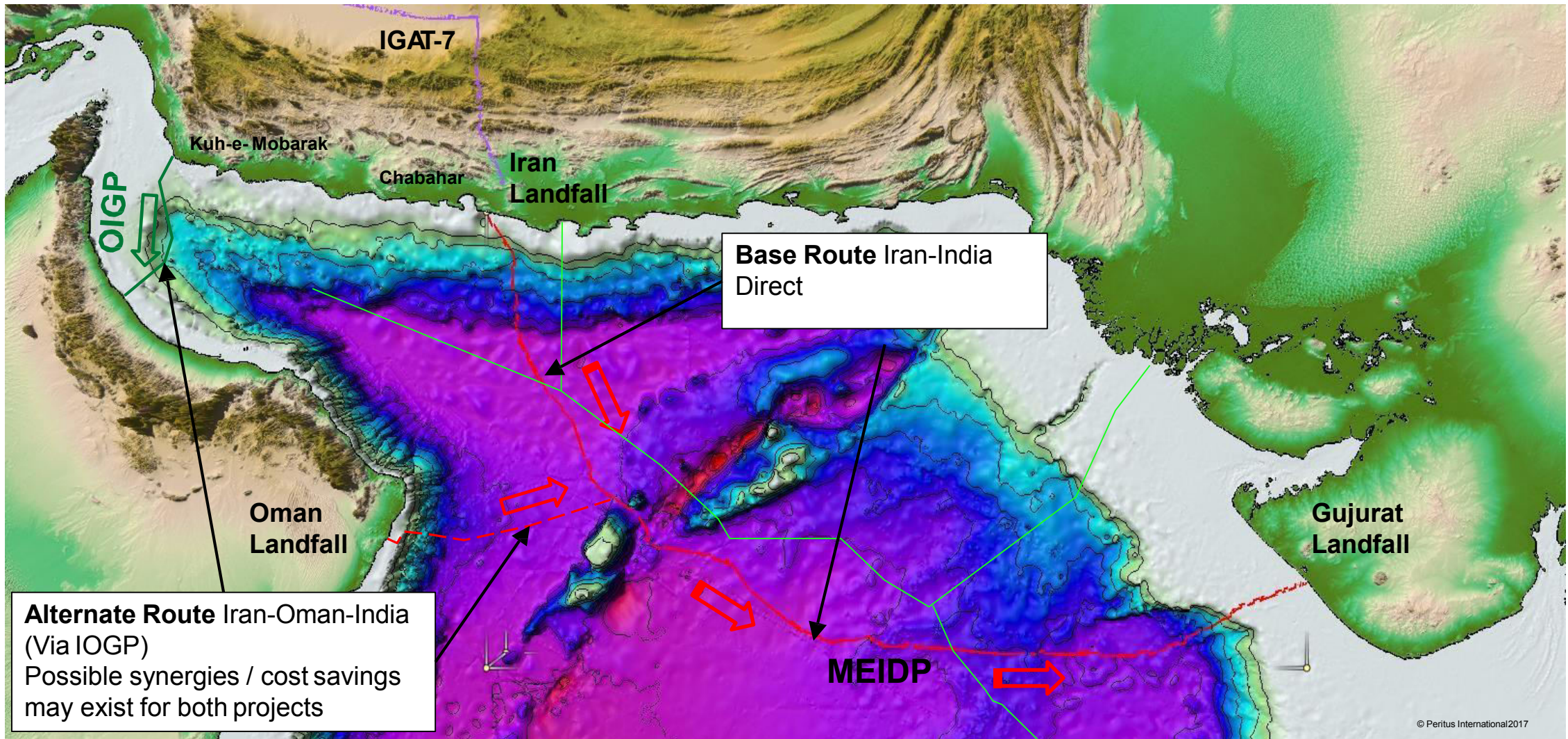
# Demand-Supply Gap - Realistic Demand



- According to MoPNG, the total realistic demand for natural gas is expected to increase at a CAGR of 6.5% to around 491 MMSCMD by 2020-21.
- The gap between demand & supply of domestic natural gas is expected to widen going forward
- The shortfall in Gas Supply can be met by a mix of sources viz. LNG/RLNG, Transnational Gas Pipelines subject to affordability.

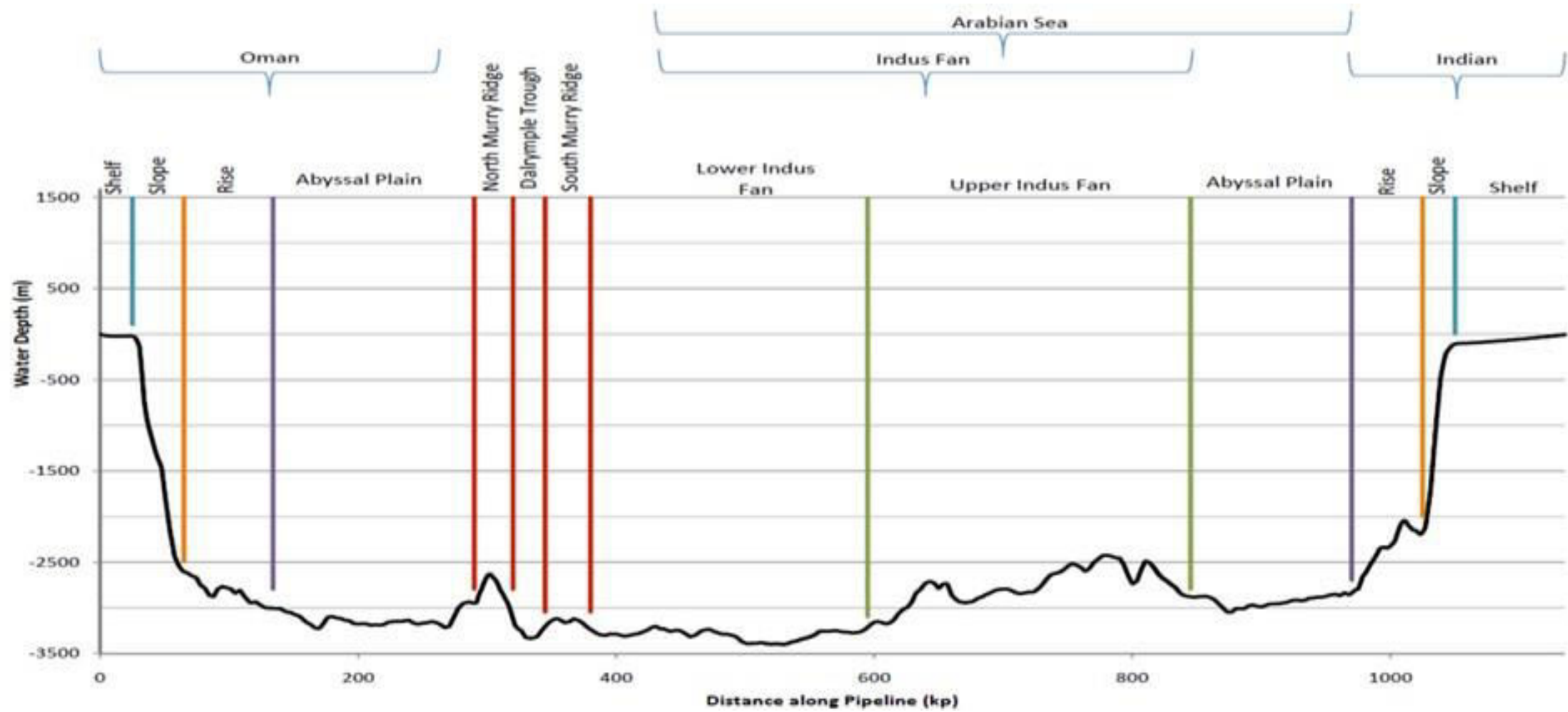


# MEIDP Route to India





# MEIDP Route to India



## □ CCS

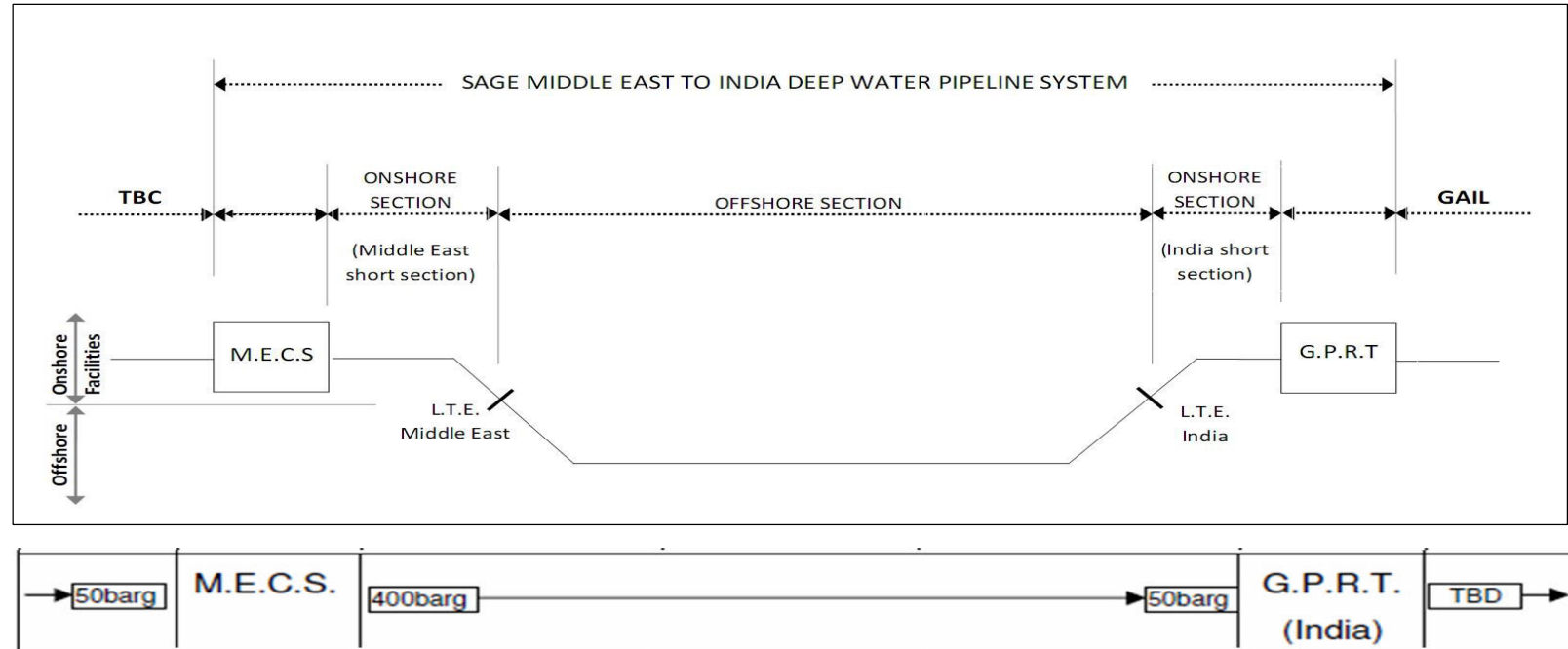
- 1.0BSCFD (annual Average)
- 1.1BSCFD Nominal flowrate
- Sales Quality Natural Gas
- Dehydrated at MECS (<47mg/Sm<sup>3</sup>)
- Inlet pressure 50 – 100 Barg
- Outlet pressure 400 Barg
- Cooling

## □ GPRT

- 1.0BSCFD (annual Average)
- Inlet at 50 Barg
- Compression to 90 Barg
- Heating/Cooling

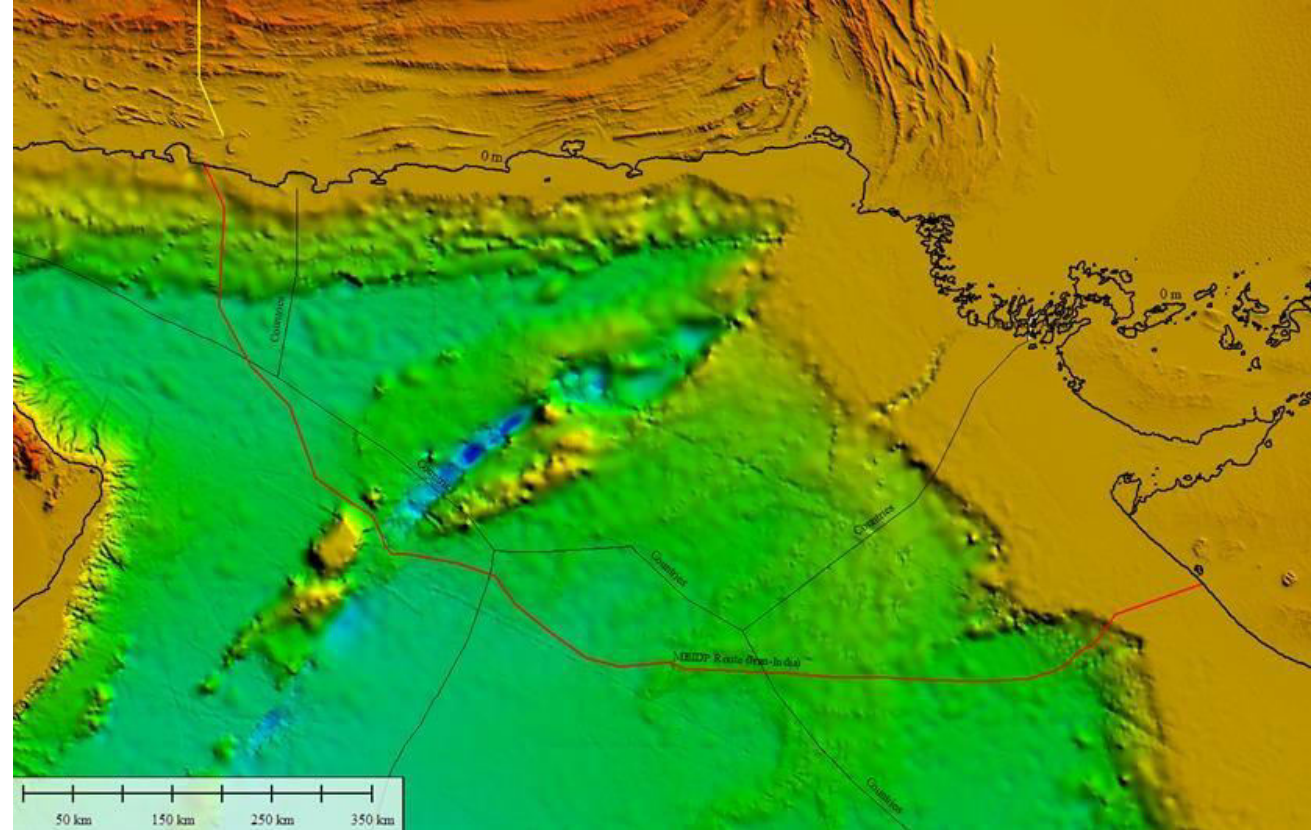
## Primary Design Code

Offshore - DNV, Offshore Standard  
DNV-OS-F101, Submarine Pipeline  
System :2013



# MEIDP Project Features

- **Start Points:** - Chabahar, Iran
- **End Point:** - Near Porbandar (South Gujarat), India
- **Throughput:** - 10.3BSCM/yr
- **Inlet Pressure:** - 400barg
- **Diameter:** - 24" I.D. (27.2" O.D.)
- **Wall Thickness:** - 32.9-40.5mm WT (DNV OS-F101)
- **Steel Grade:** - DNV SAWL485 FDU
- **Maximum Depth:** - 3,450 meters
- **Length:** - 1,300 kilometers
- **Steel Tonnage:** - 800,000tonnes
- **Project Duration:** - 6 years  
(5yrs Fast Track)
- **Pipeline Construction:** - 2 years





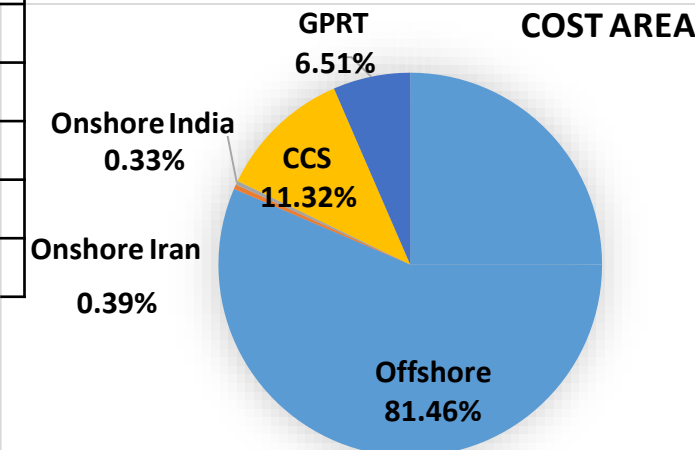
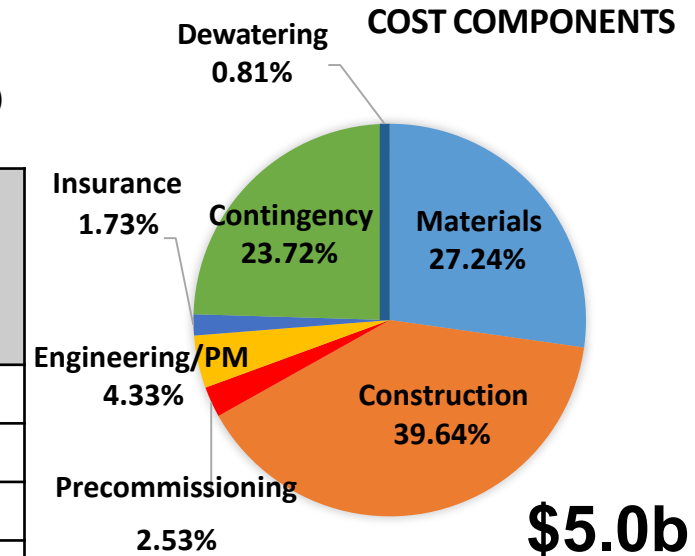
# Indicative Project Cost – CAPEX Breakdown

- “As Built” Project Cost (*Indicative*): ~USD 5 Bn
- Project Cost Break up

(USD Mn)

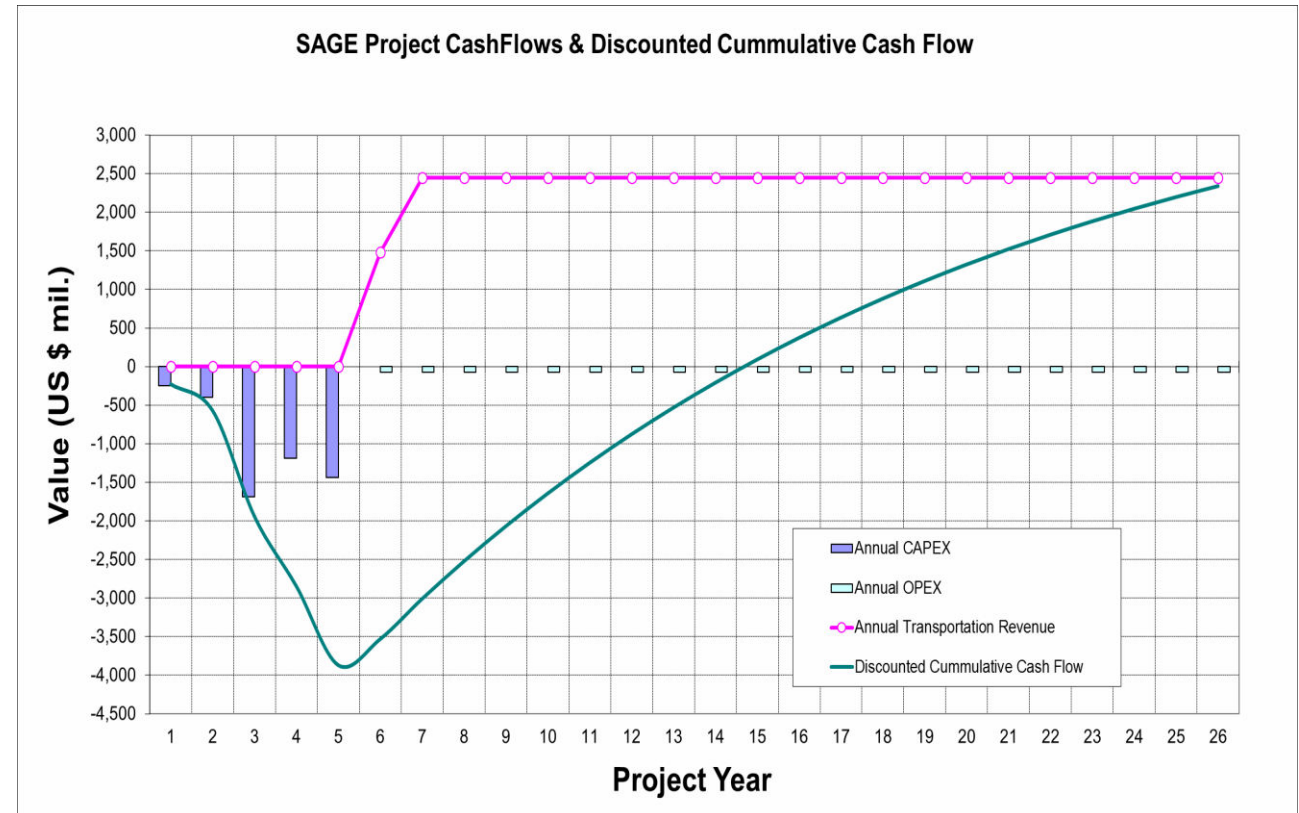
Particulars	Offshore Segment	Iran Onshore Segment	India Onshore Segment	CCS*	GPRT#	Total
Material Procurement	960.6	2.2	1.3	202.6	100.0	1,266.6
Construction	1,708.2	7.1	5.6	196.7	118.2	2,035.9
Pre- Commissioning& Commissioning	89.8			8.1	5.3	103.1
Engineering & Project Management	120.2	7.8	7.8	50.6	40.0	226.4
Insurance and Certification	69.0	0.1	0.1	10.2	5.6	85.0
Contingency	863.6	5.1	4.4	196.9	113.3	1,183.4
<b>Total Hard Cost</b>	<b>3,811.3</b>	<b>22.4</b>	<b>19.1</b>	<b>665.0</b>	<b>382.3</b>	<b>4,900.3</b>
Contingency Dewatering	57.2					57.2
<b>Total Project Cost</b>	<b>3868.5</b>	<b>22.4</b>	<b>19.1</b>	<b>665.0</b>	<b>382.3</b>	<b>4957.4</b>

\*Chabahar Compression Station #Gujarat Port Receiving Terminal



# Financial Highlights

- Project Cost: USD ~\$5.0 Billion from Iranian coast to Indian Gujarat West Coast
- SBI Capital Markets recommended various feasible financing options
  - Debt at 5%
  - Debt to Equity Ratio 2.33:1
  - Project Internal Rate of Return (IRR) of 12-14%
- SAGE cost estimate gives a gas transport tariff between \$2.25/MMBTU - \$2.5/MMBTU

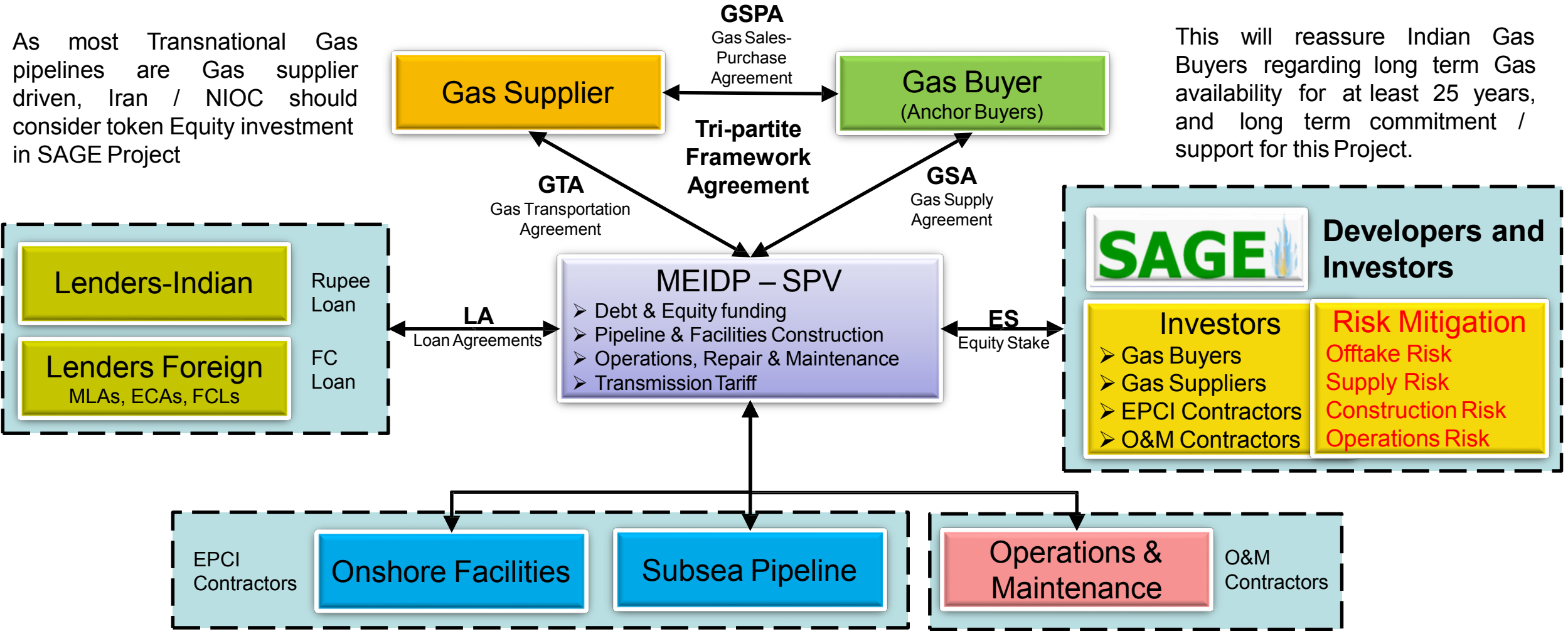


# Proposed Project Structure



As most Transnational Gas pipelines are Gas supplier driven, Iran / NIOC should consider token Equity investment in SAGE Project

This will reassure Indian Gas Buyers regarding long term Gas availability for at least 25 years, and long term commitment / support for this Project.



Offshore SPV to be incorporated based on tax implications of different geographies in the world  
Project de-risked through the involvement of multiple global stakeholders who have the capability to implement this project



# Project Progress and De-Risking

Working with  
leading global  
technical  
consultants &  
contractors

Identifying  
technology  
challenges &  
Risks

Route Survey  
and evaluation

Developing  
Engineering  
solutions

## Technical Consultancy:

- Peritus International, EIL, Petrofac, Intecsea, Fugro Geoconsulting, D'Appolonia SpA

## Pipe Mills:

- Welspun, Jindal SAW, PCK, Europipe, JFE, NSSMC, British Steel (TATA)

## Certification Bodies:

- DNVGL

## Installation Contractors:

- Allseas BV
- Heerema Marine Contractors
- Saipem SpA

## Installation and Intervention Gap Analysis

- Peritus International (2011)

## Quantified Risk Assessment:

- Peritus International (2011)

## Geohazard Fault Crossing Assessment:

- Peritus International (2011)

## Metocean Parameter Definition:

- Fugro (2011/2012)

## GIS Data Collection:

- Fugro (2012)
- D'Appolonia (2012)

## Emergency Pipeline Repair:

- Peritus International (2011)

## Reconnaissance Survey Definition & SOW:

- Peritus International (2012 & 2015)

## Reconnaissance Survey:

- Fugro OSAE (2013)

## Landfall Point Identification:

- EIL 2014

## Route Optimisation:

- Peritus International (2015)

## Design Basis definition:

- Peritus International (2010)

## Flow Assurance Studies:

- Peritus International (2010 & 2016)

## Mechanical Design:

- Peritus International (2010 & 2016)

## Onshore Compression:

- Intecsea WorleyParsons (2011)
- Petrofac (2012)

## Receiving Terminal:

- Petrofac (2012)

## Installation Assessments:

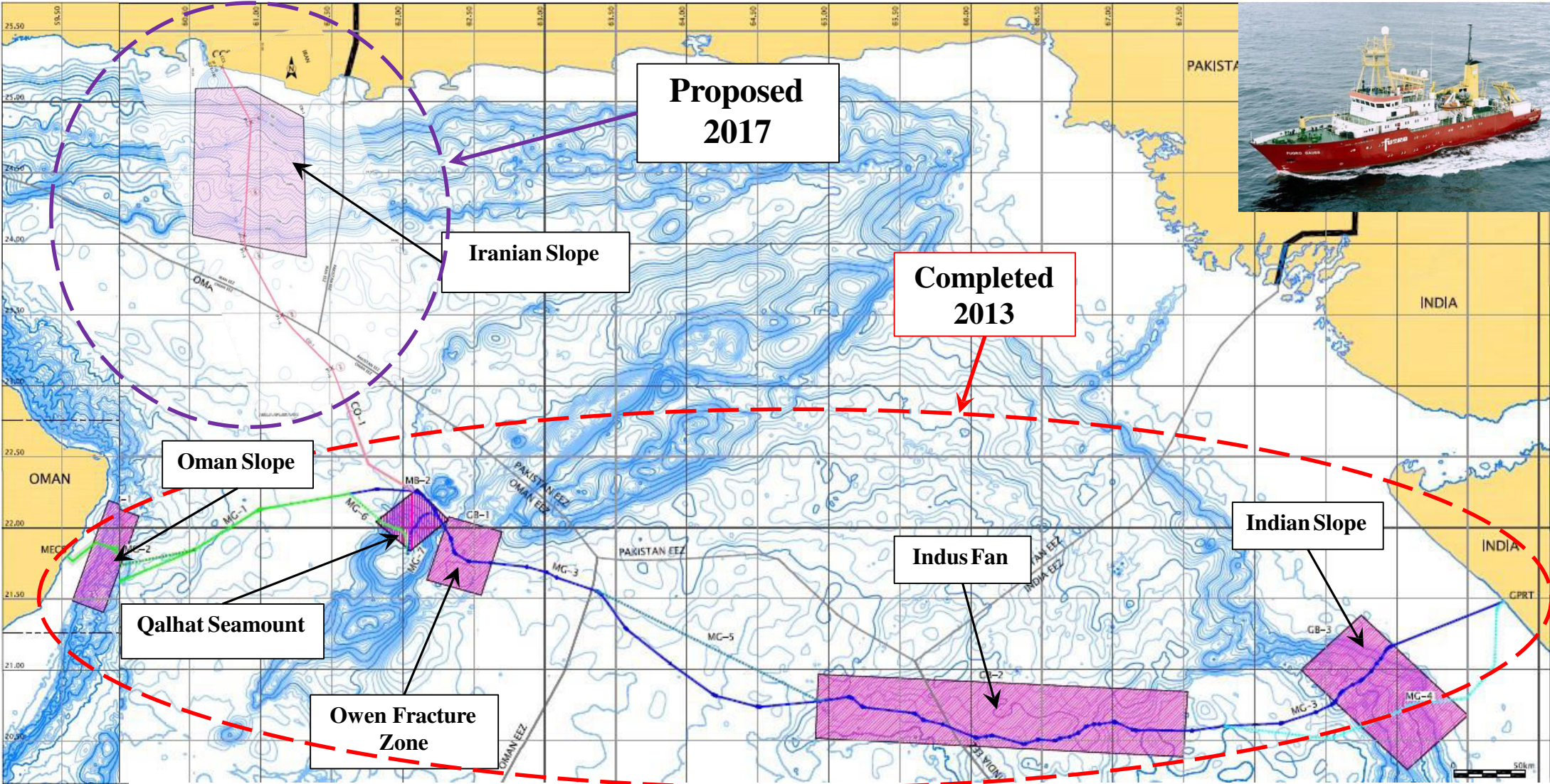
- Allseas (2015)
- Saipem (2015)

SAGE has collaborated with global leaders to develop solutions for MEIDP's technical challenges

- Project Definition and preliminary technical studies were carried out in 2010-2013
- Confirmed Technical Viability 2013
- Reconnaissance survey performed in 2013 on Oman to India route. Base case route reviewed and optimised
- Review of project economics and legal project framework 2014
- Route options defined to avoid Pakistan ECS and updated flow assurance mechanical design performed 2015/2016
- Updated Cost Estimate and schedule 2016
- Technical Review Workshop Held Aug 2016 (SAGE/Peritus/EIL/DNVGL/Saipem/Allseas)
- Feasibility Confirmation by DNVGL is ongoing



# MEIDP Recon Survey Route

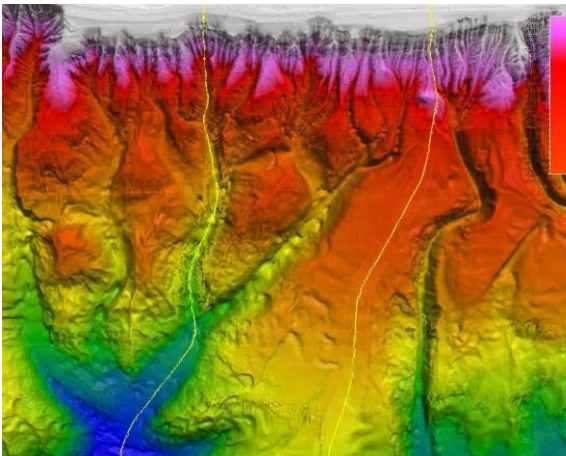




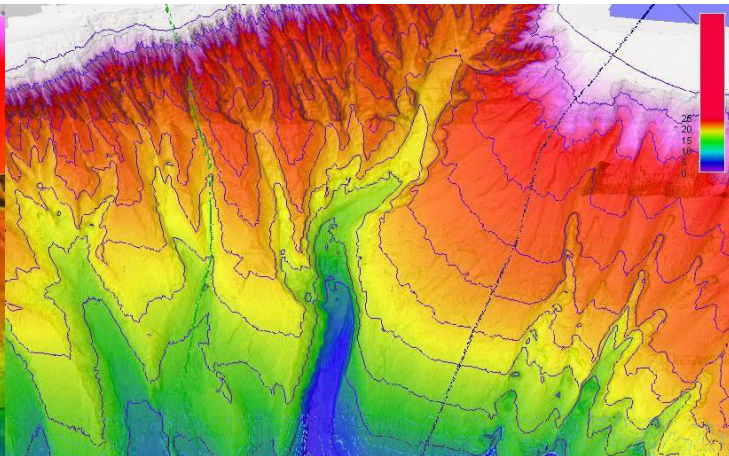
# 2013 MS Highlights



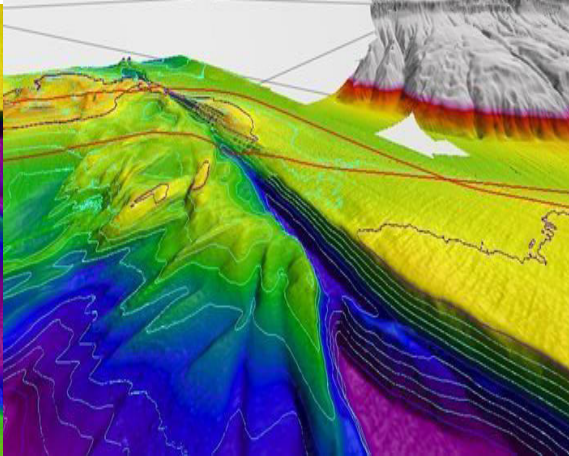
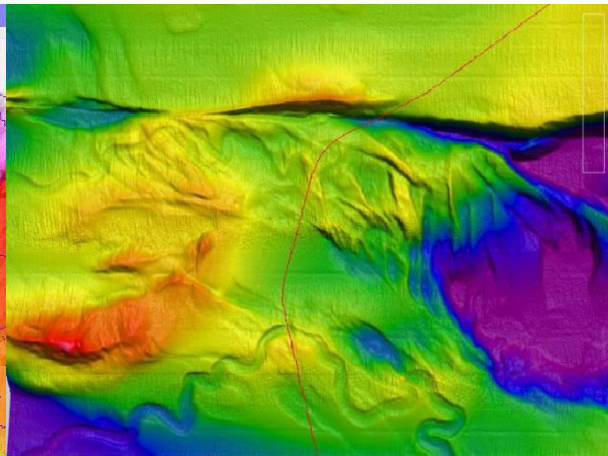
*Oman Continental Slope*



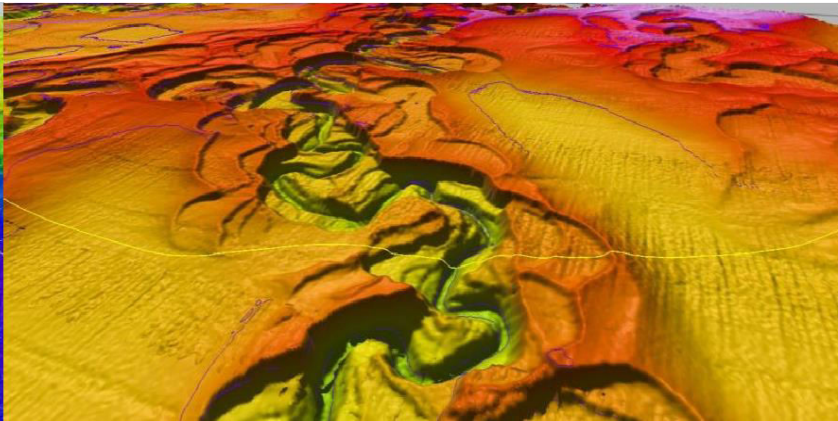
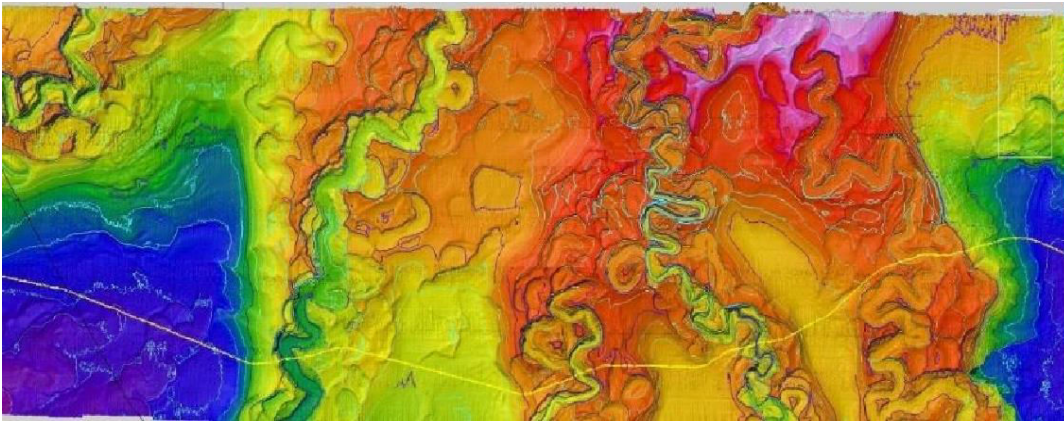
*Indian Continental Slope*



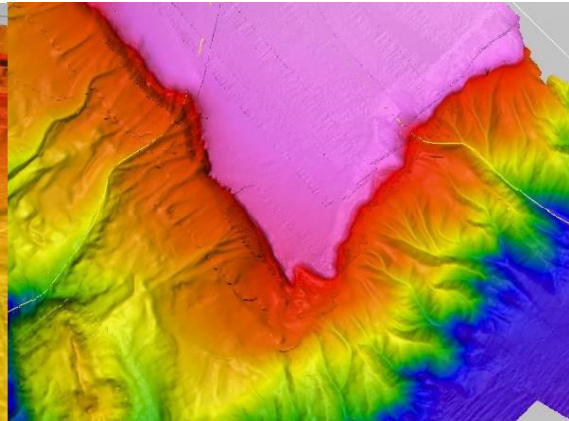
*Owen Fracture Zone*



*Indus Fan*



*Qalhat Seamount*





# Highlighted Technical Challenges

## Building on Previous Experience

ISSUES	Oman-India	MEIDP	Comments
Availability Of Pipe Mills	Upgrade in Capability required	Capability exists for the required size and thickness.	Welspun; Jindal SAW; Tata(CORUS) steel, JFE, PCK and Europipe are capable vendors
Lay Vessel	No Ultra Deep water vessel capability	Ultra Deep water vessels with adequate capability are available.	Pioneering Spirit, Casterone, Aegir and S7000 are already available in the field. JSD 6000 is still being considered.
Deep water repair system	No qualified deepwater pipeline repair system was available	Deepwater pipeline repair systems are now available and accessed by Repair "Clubs"	Diverless Subsea pipeline repair System have been developed for Deep water application by Saipem. Saipem currently has work class ROV rated to 4000m depth.

## Today's Challenges

- Ultra Deep Water 3400m - 3600m depending on Route
- Wall Thickness on limit of Mill Capacity
- Mill Qualification
- Active Fault crossing (Seismic Design)
- Indus Fan channel crossings up to 200m deep and 30 degree slopes
- High pressure 400barg system
- Anti Flooding system required for Installation
- Hydrotest dispensation required
- Steep Slopes and geohazards on shelf breaks in Iran and India (Seismic Design)

SAGE has performed detailed assessments to ensure that these challenges can all be met by design methods and equipment now available in the Offshore Pipeline industry.

# MEIDP Capable Pipelay Vessels & Mills



项目名称: MIDDLE EAST TO INDIA 3500M DEEPWATER PIPELINE  
钢管规格: O.D. 691mm × W.T. 40.5 mm  
执行标准: DNV-OS-F101  
设计压力: 40 MPa  
钢板供应: WISCO (HuBei)  
管 号: 81503303

钢板级别: DNV SAWL 485 FDU  
设计温度: -30° C ~ +60° C  
制管机组: PCK ZhuHai JCOE  
炉 号: 15100344

番禺珠江钢管 (珠海) 有限公司  
2014 年 6 月



Allseas, HMC and Saipem have all confirmed their vessels can install the Middle East to India Deepwater Pipeline (MEIDP)

Two pipe Mills (JindalSAW, PCK) have manufactured linepipe specifically for SAGE to MEIDP Dimensions and Specification.

- Design Basis definition
- Flow Assurance Studies
- Mechanical Design
- Onshore Compression Station
- Offshore Compression Station Definition & Review
- Receiving Terminal Definition
- Quantified Risk Assessment - OIP Update
- Geohazard and Fault Crossing Assessment
- Metocean data collection
- Emergency Repair Equipment
- GIS Data collection
- Riser and Subsea By-Pass definition
- Pipeline Intervention Review
- Vessel & Equipment Capabilities review
- Alternative Integrity Verification Phase 1 (Establish no hydrotest principle)
- Cost Estimate Update
- Reconnaissance Survey definition and scope of work
- Mill qualification and ring testing program (Indian Mills)
- Reconnaissance Survey (Oman-India) Completed
- Landfall point identification in India

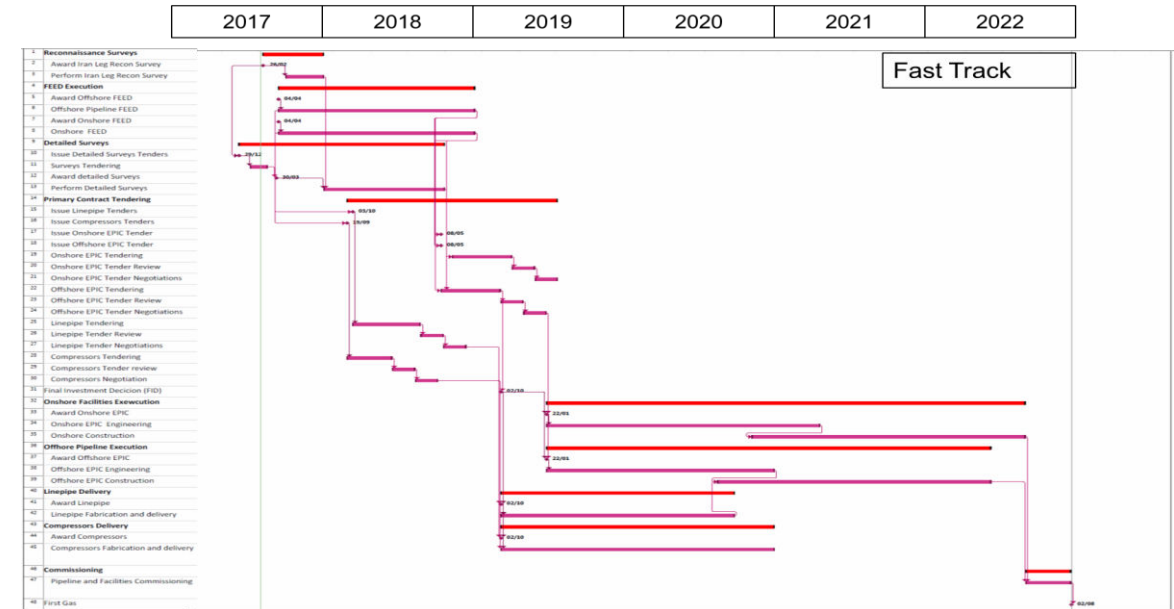


# Programme – Current Timeline (Provisional)

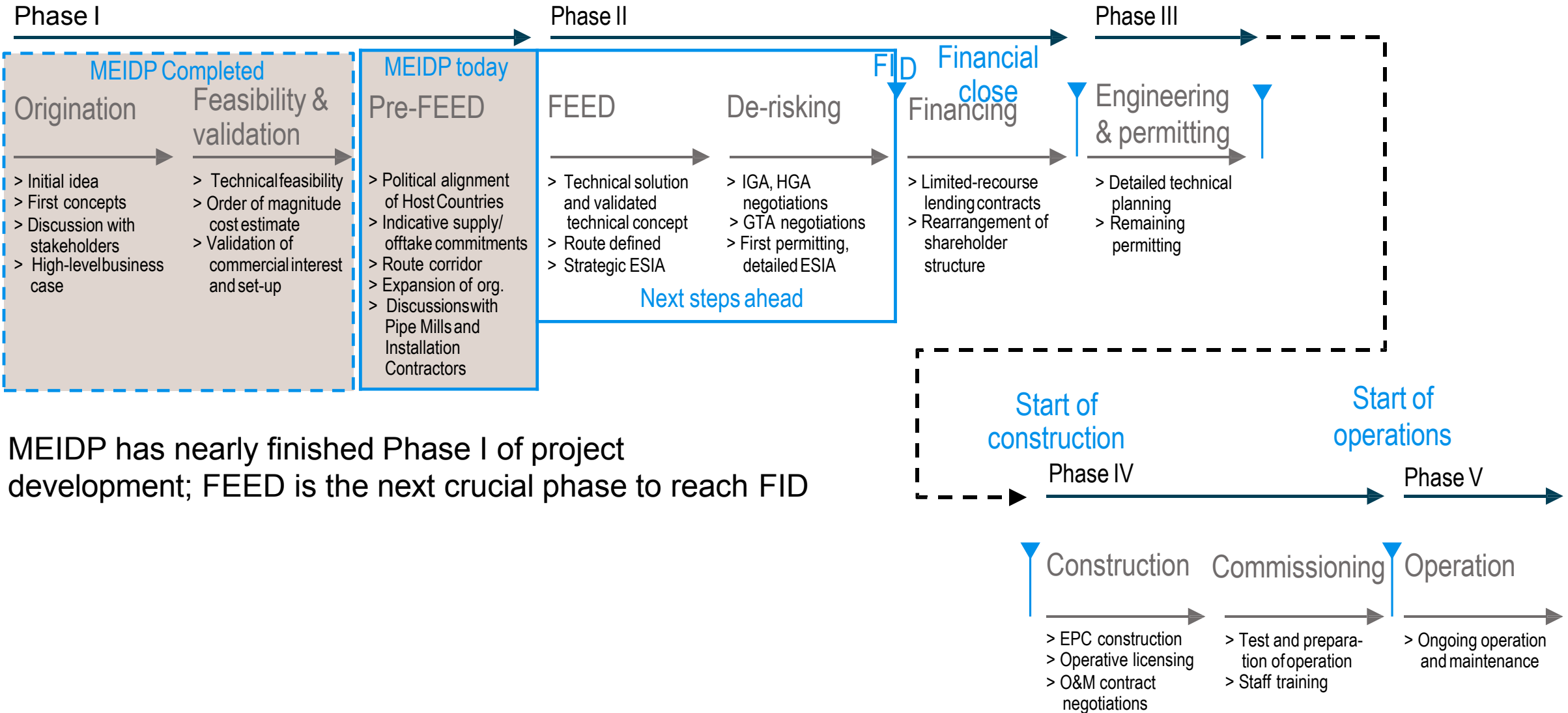
Event	Date
Award Reconnaissance And Metocean Surveys	Apr 2017
Commence Reconnaissance Survey	Oct 2017
Commence Metocean Survey	Oct 2017
Award Onshore & Offshore FEED	Aug 2017
Award Detailed Surveys	Oct 2017
Final Investment Decision	Dec 2018
Award Linepipe Contract	Dec 2018
Award Onshore & Offshore EPIC	Jun 2019
Start Offshore Construction	Oct 2020
Start Compressor Station Construction	Apr 2021
Complete Offshore Construction	Apr 2023
Complete Compressor Station Construction	Jun 2023
First Gas	Dec 2023

Project can be set up in a 5 year time span if bought on **fast track** with **active government support** as substantial preparatory work has already been done and continues

Pipeline construction will occur over a 2 year period



# MEIDP The Way Ahead



MEIDP has nearly finished Phase I of project development; FEED is the next crucial phase to reach FID

- Indian gas demand and supply balance **shortfall** continues to increase from 100mmscmd in 2014 to **270 mmscmd in 2030** as per PNGRB vision 2030 study.
- Iran has 31 mmscmd gas for MEIDP. Iran is also willing to consider to supplying a **2nd SAGE Pipeline**.
- Project will add to energy **security by diversification**.
- Provides an **economically competitive** method of gas supply and **promotes completion** in Indian energy markets.
- The **technology** to design and lay deep sea pipeline is available **now**.
- The project is **financially** and **technically viable**.
- Long Term contracts and surety of supply, will facilitate **existing** projects in India which utilise the Gas (eg., Power / Fertilizer Plants).
- Project needs **strong diplomatic & political** support from Iranian and Indian Governments
- Long Term contracts and surety of supply, will facilitate new greenfield projects in India especially **Power & Fertilizer** Sectors.
- Turkmenistan Gas & OVL Farzad B Gas can also come to India through SAGE Pipeline route.

# Thank You



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[www.sage-india.com](http://www.sage-india.com)*



# Published Papers for Reference

- Middle East India Deepwater Pipeline (MEIDP) – Geohazard Features Assessment and Intervention, Ian Nash and Christopher Burnett ISOPE 2014 – Proceedings
- Middle East India Deepwater Pipeline (MEIDP) crossing of the Indus Fan, Ian Nash, Christopher Burnett and Russell Smith, Peritus International Ltd. Offshore Technology Conference (OTC), May 2014, (OTC 25175)
- Middle East to India Deepwater Pipeline (MEIDP) Crossing of the Owen Fracture Zone, Ian Nash, Christopher Burnett and Simon Parry, Peritus International Ltd, Offshore Technology Conference Asia (OTC-ASIA), March 2014 (OTC 24958)
- Middle East India Deepwater Pipeline (MEIDP) – findings and implications of the 2013 reconnaissance survey, I. Nash, Petrotech 2014 Conference, New Delhi, India, Feb 2014.
- Bringing the Middle East India Deepwater Pipeline (MEIDP) closer to reality – findings of the 2013 reconnaissance survey. Ian Nash, Peritus International & Robert Hawkins, Fugro. Offshore Pipeline Technology (OPT) Conference, Amsterdam, Feb 2014.
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