Under the patronage of H.H. Sheikh Khalifa Bin Zayed Al Nahyan, the President of the United Arab Emirates تحت رعاية صاحب السمو الشيخ خليفة بن زايد آل نهيان رئيس دولة الإمارات العربية المتحدة

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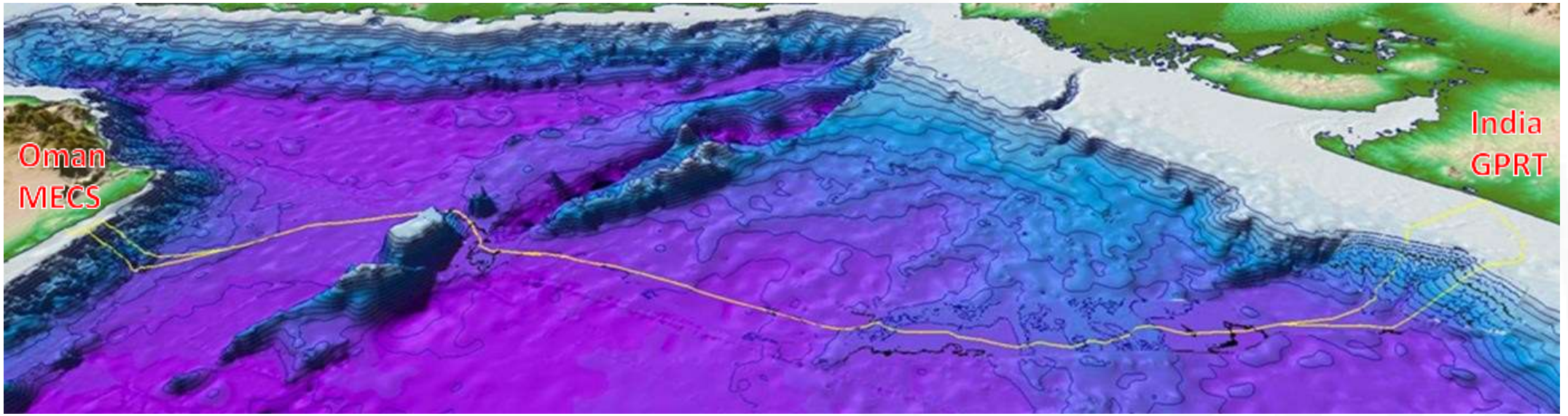
MEIDP – India's Transnational Pipeline from the Middle East



Ian Nash, Peritus International Ltd. Consultants to South Asia Gas Enterprise Pvt Ltd.

Peritus

SAGE
Middle East to India
Deepwater Gas Pipeline

MEIDP - India's transnational Gas Pipeline

- INDIA- ENERGY SCENARIO & GAS DEMAND
- MEIDP – THE PROJECT AND ITS RATIONALE
- MEIDP - PIPELINE TARIFF ESTIMATION & GAS PRICING
- MEIDP - PROJECT STRUCTURE AND STAKEHOLDERS
- MEIDP - PROJECT BACKGROUND & CURRENT STATUS
- THE WAY AHEAD AND TIMELINE
- CONCLUSION

India's Current Energy Mix

- **India is the 3rd Largest Energy Consumer & 3rd Largest Oil Consumer in the World** (BP Statistical Review 2018)
- Energy Demand to grow with GDP growth of India
- India has a stated aim for Natural Gas to constitute **15% total energy by 2030.**

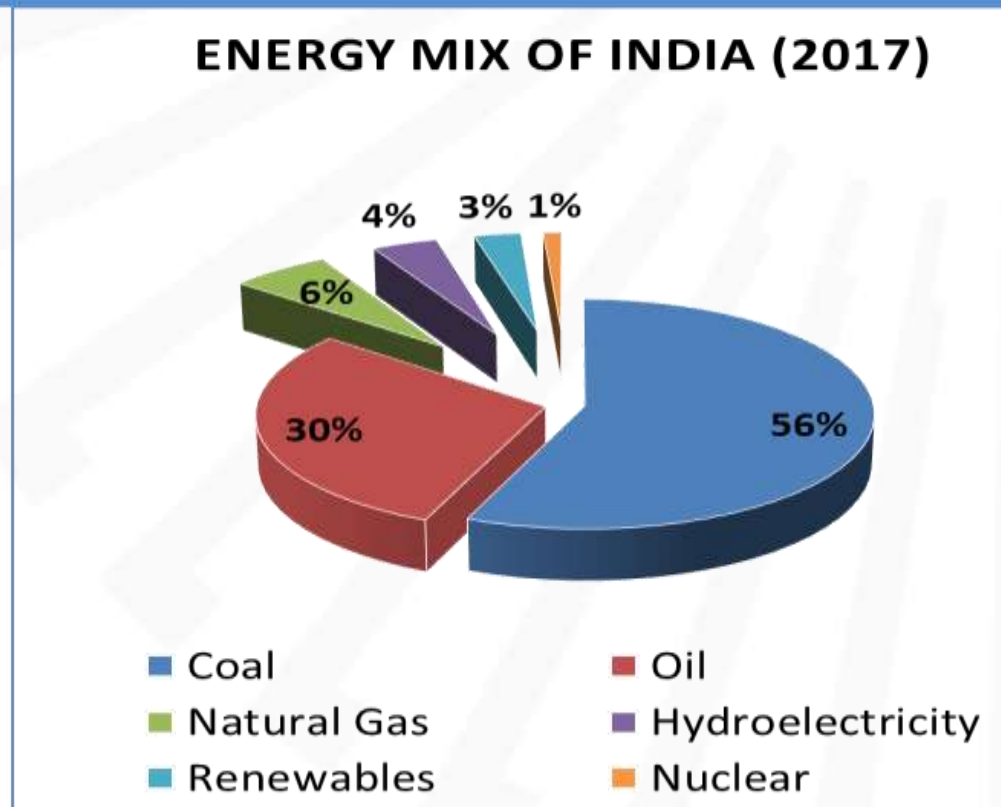
Energy Sources in India

COAL: Coal is the dominant energy source contributing **56%** of the total energy consumption

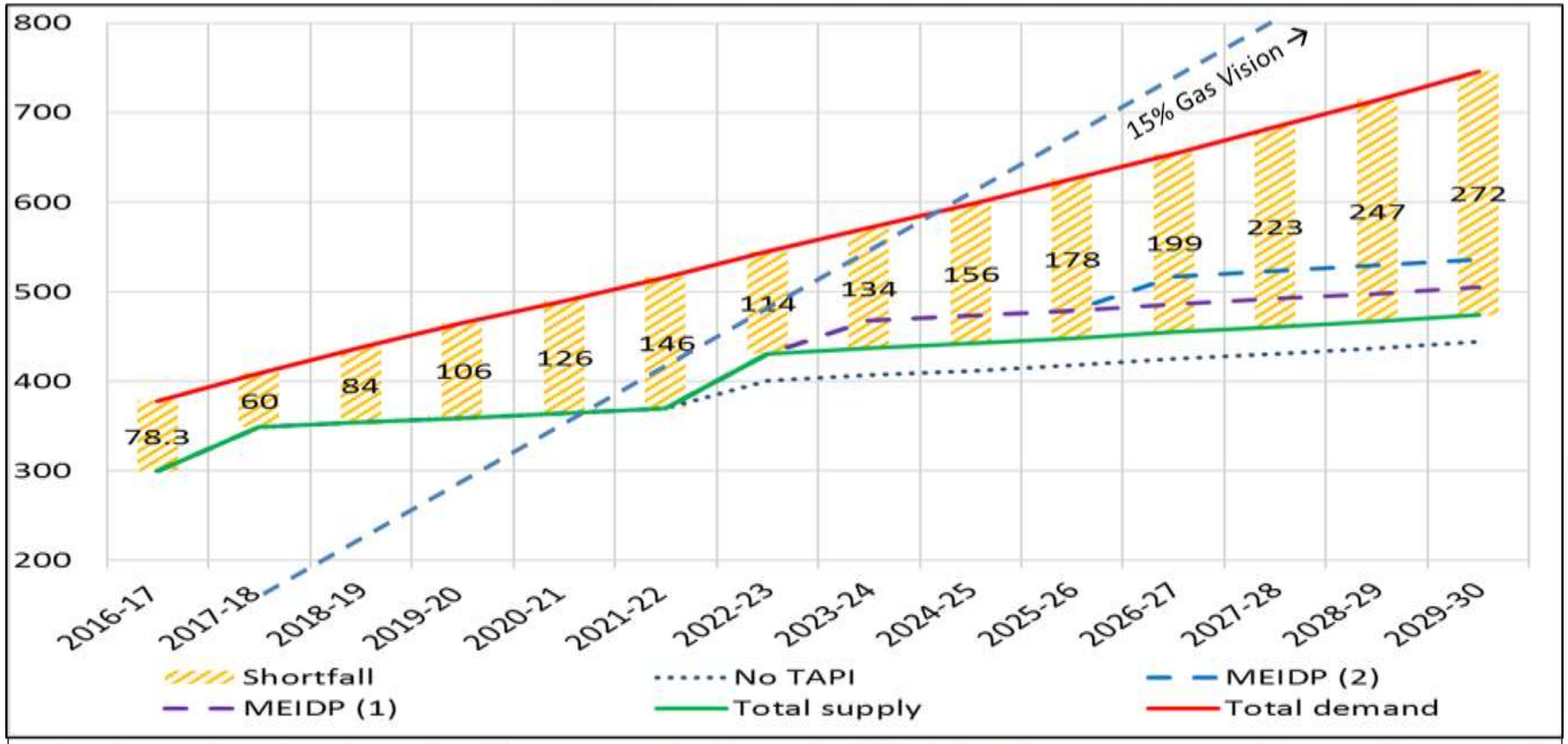
CRUDE OIL: Second major fuel consumed in India; Import Dependency: 30% of Consumption

NATURAL GAS: Third major fuel consumed in India;

- ✓ **Domestic Production of Natural Gas** in India has declined in the recent years from **143 MMSCMD** in **FY2011** to **88 MMSCMD** in **FY 2017**
- ✓ India has **Low reserves of Natural Gas** (Proven Reserves of 1.2 TCM, 0.7% of World Reserves)
- ✓ All Gas import options LNG & Pipelines must be used



India’s Demand-Supply Gap



- Based on India’s vision to reach **15%** energy supplied by gas **by 2030**. India will have gas demand of over **950 mmscmd** over the next 20 years. (3 – 4 times current gas demand), if power plants and City Gas Distribution (CGD) use gas fully too and all gas needs have to be met
- The **gap** between **demand & supply** of domestic natural gas is expected to **widen** going forward
- The shortfall in Gas Supply can only be met by a mix of sources **LNG/RLNG and Transnational Gas Pipelines will be required.**

Indian Sector Specific Demand of Natural Gas

[SBI Cap Review of Affordability of Gas for SAGE]

FY	2013	2014	2015	2016	2017	Average
DEMAND						
Fertilizer	25%	30%	31%	32%	30%	30%
Power	28%	22%	20%	21%	23%	23%
CGD	13%	14%	14%	13%	14%	14%
Refinery	9%	10%	9%	9%	9%	9%
Petrochemical	4%	3%	5%	5%	4%	4%
Others	20%	22%	21%	21%	20%	21%
SUPPLY						
Domestic Gas	70%	67%	66%	66%	56%	65%
LNG Import	30%	33%	34%	34%	44%	35%

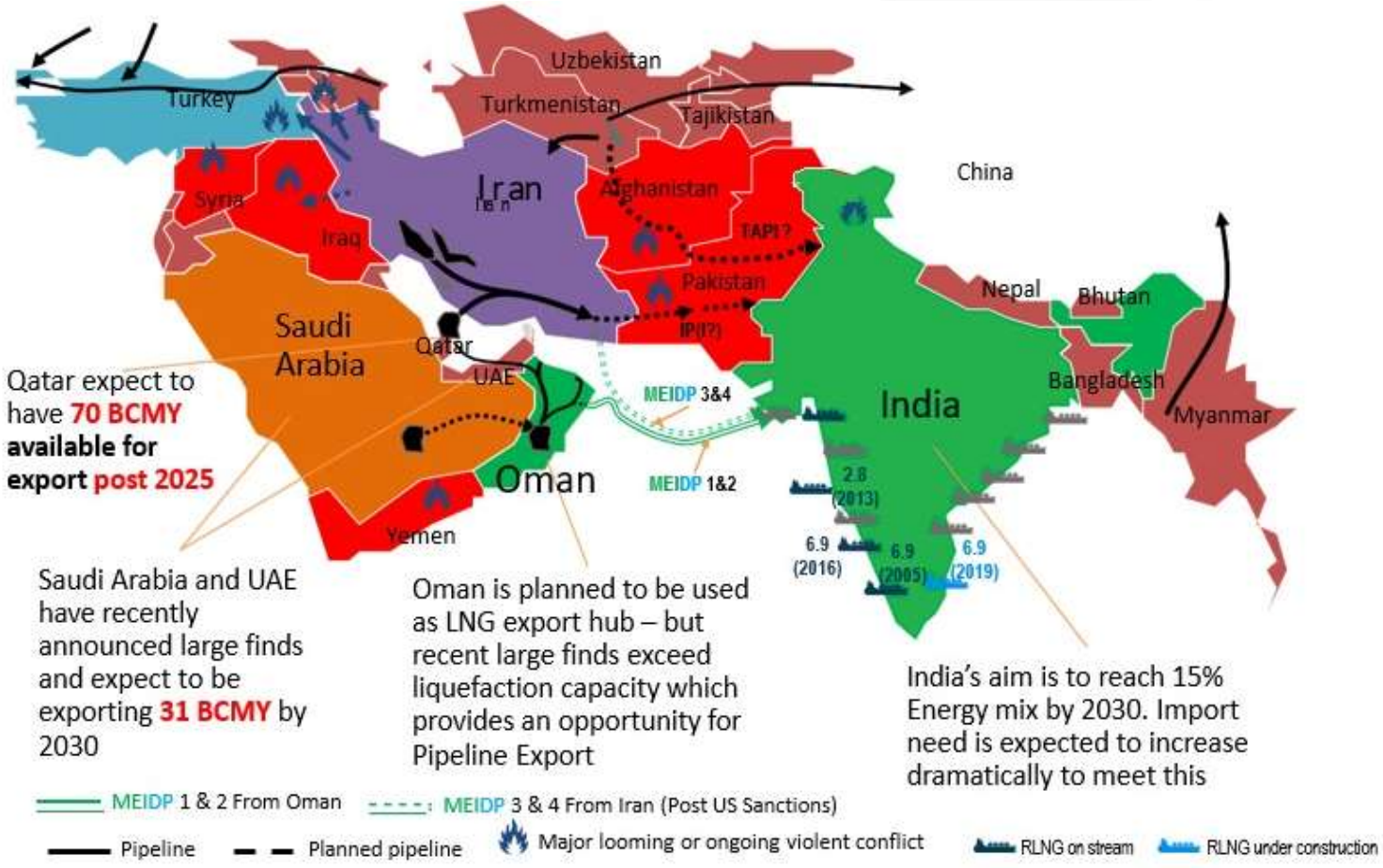
Source: PNGRB

- 67% of the demand from anchor sectors such as Power, Fertilizer, CGD
- Going forward, **Power & Fertilizer** sectors are expected to be major demand centre for imported gas
- However, Power sector being the most price sensitive sector, (**15GW are Stranded**)
  - Affordability of Gas price will determine the overall demand

MEIDP - Competing Indian Gas Import Projects and Security

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

MEIDP from Oman is the only pipeline project catering to India markets and not crossing conflict.



Major looming or ongoing violent conflict

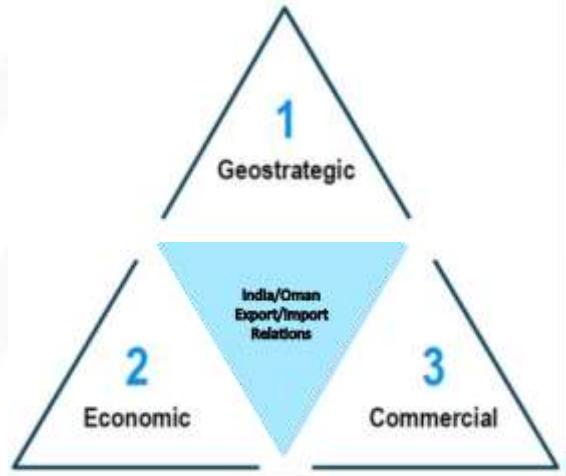
Pipelines help to moderate Gas prices, but the larger MENA region and South Asia generally presents a **challenging geopolitical environment** and security environment for large-CAPEX cross-border infrastructure.

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.

MEIDP - Win for Oman (Saudi and UAE)

Recent large Oman Gas finds in Mubrouk and phase 2 development of Khazzad will mean Oman has spare gas. **MEIDP** provides Oman with a **Safe and Secure** long term means of Gas monetization

- Gives Oman **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.
- Facilitates upstream **investment** in Oman by **Indian companies**
- Builds on **existing intergovernmental agreements** on trade and development.
- Consistent with Oman's aim to become a **regional gas hub** as a route for anticipated excess Saudi Gas from Recent red sea gas finds.
- Saudi Arabia and UAE will have **surplus gas** in the coming years based on recently announced **large gas finds**. India is an Ideal destination for this gas (Via Oman)



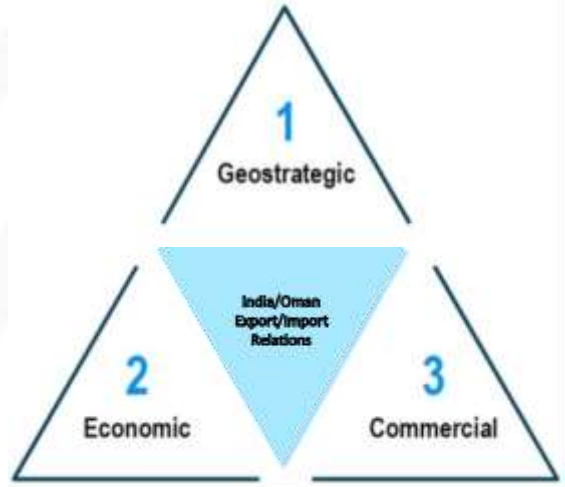
MEIDP - Win for India

Even as a developing Country it can be argued that India is becoming too heavily dependent on costly LNG.

MEIDP Gas from Oman can facilitate Power Generation at prices similar to Clean Coal.

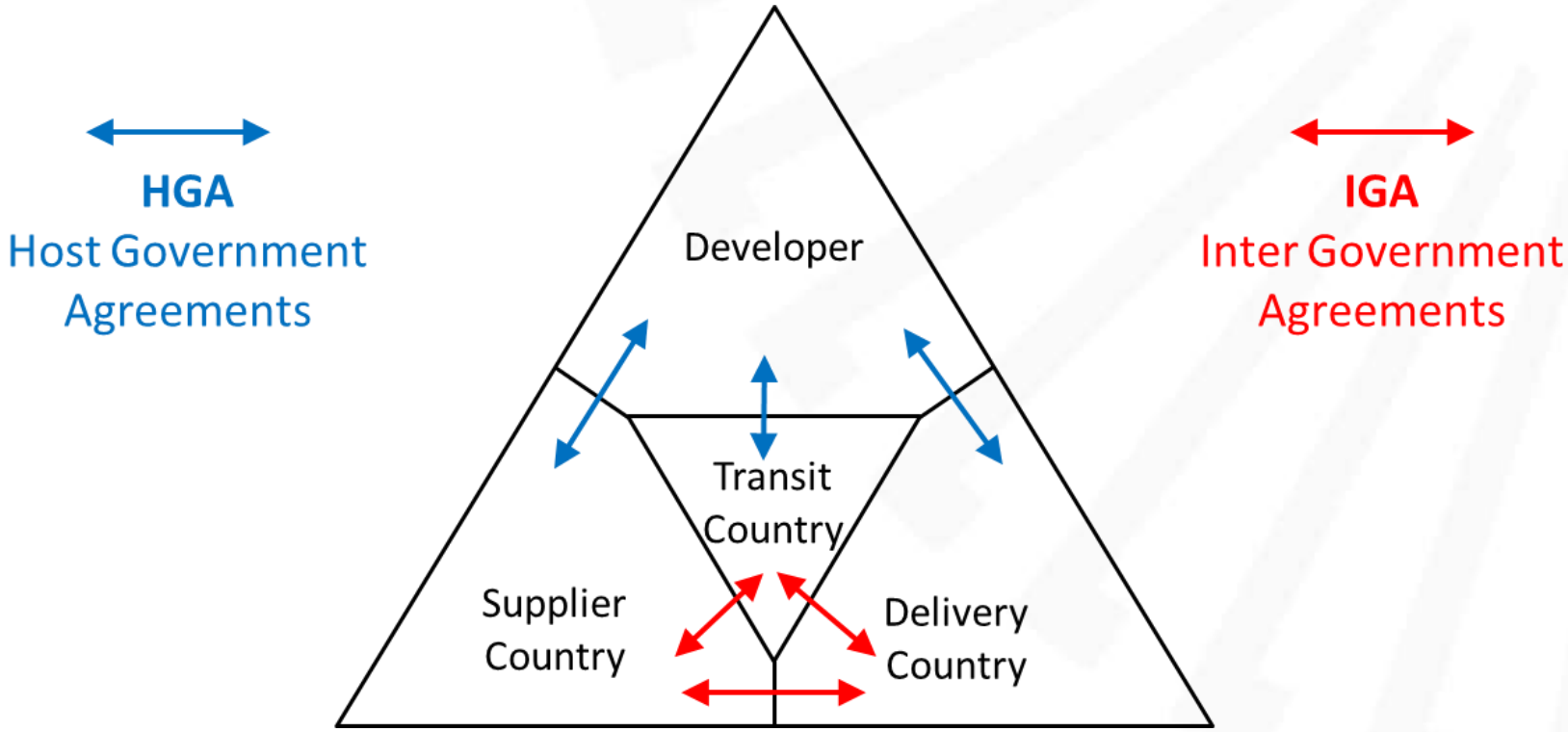
Potentially each **MEIDP** gas pipeline delivers 31.1 mmscmd (1.1 bscfd) saving India almost a billion dollars annually when compared to Spot / Term LNG imports / price.

- Pipeline/LNG competition moderates Gas prices to the consumer
- 53% of India Gas demand is from the Power & Fertilizer industry, who can only use Gas at affordable prices (~$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"



Transnational Pipelines-Elements for Success

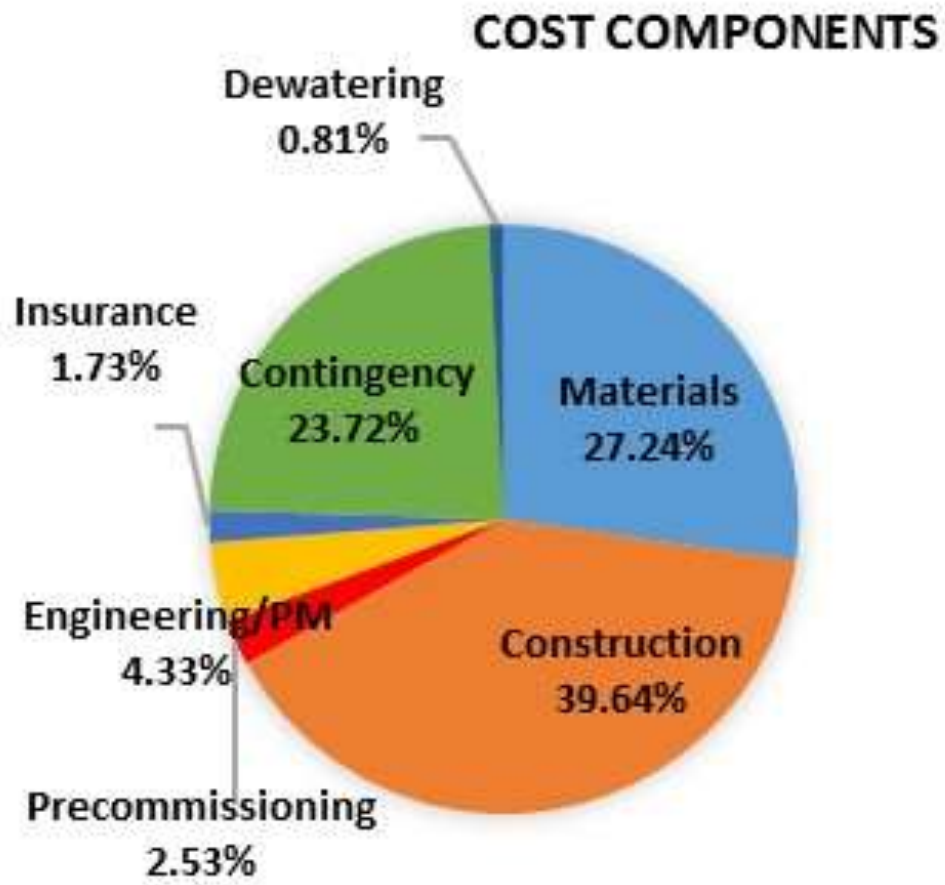
- Major dedicated volumes of gas, which are essential for a project.
- A competent and committed commercial champion.
- Economic viability of the pipeline and superiority over other alternatives.
- Political support, which is instrumental (Absolutely Necessary) but not decisive.

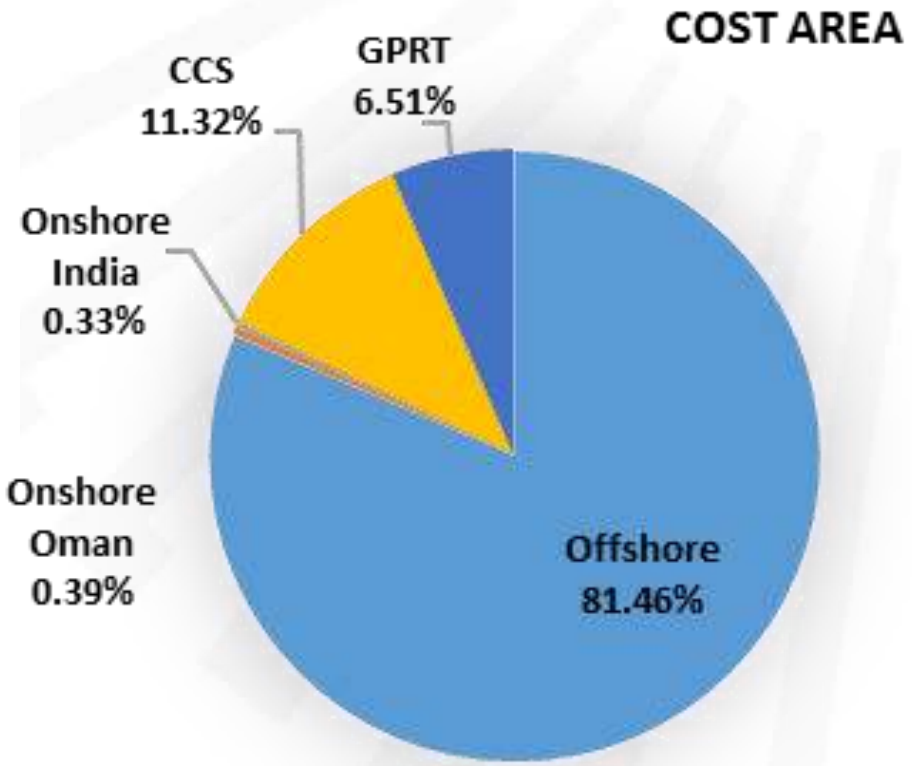


MEIDP – Capex Cost Estimate

MEIDP Cost Components and Cost Areas (2017 Cost Update)

Estimated project CAPEX cost of $4.5 billon USD





MEIDP – Competitive Gas Price Summary

[SBI Cap Review of MEIDP Tariff for SAGE]

- **Weighted Average Gas Price** at the inlet of MEIDP pipeline has been evaluated based on the
  - Affordable gas price for each sector
  - Contribution of each sectoral demand in the total demand of gas

Sector	Affordable price at MEIDP pipeline inlet (USD/mmbtu)	Price at MEIDP pipeline delivery point (USD/mmbtu)	Sector wise MEIDP Gas demand (%)
Power	3.00	7.09	30%
Fertilizer	3.75	7.84	30%
Other sectors (CGD, Petrochemical, etc.)	4.50	8.59	40%
Weighted Average Gas price at inlet of MEIDP Pipeline (USD/mmbtu)	**3.825**	**7.92**	**100%**

- The **Weighted Average Gas Price** at the inlet of the MEIDP Pipeline is estimated to be around USD 3.83/mmbtu

MEIDP – Pipeline Tariff Estimation

❖ **Levelized Pipeline Tariff* based on**

➢ Financial / Commercial Viability & Bankability of the Project

Case 1: Levelized Tariff (USD $/MMBTU)	
Particulars/Year	**Oman-India**
For all years	1.86

Case 2 : Fixed Tariff with escalation	
Particulars/Year	**Oman-India**
1	1.48
2	1.52
3	1.57
4	1.61
5	1.66

❖ **Route 1 (Oman-India)**

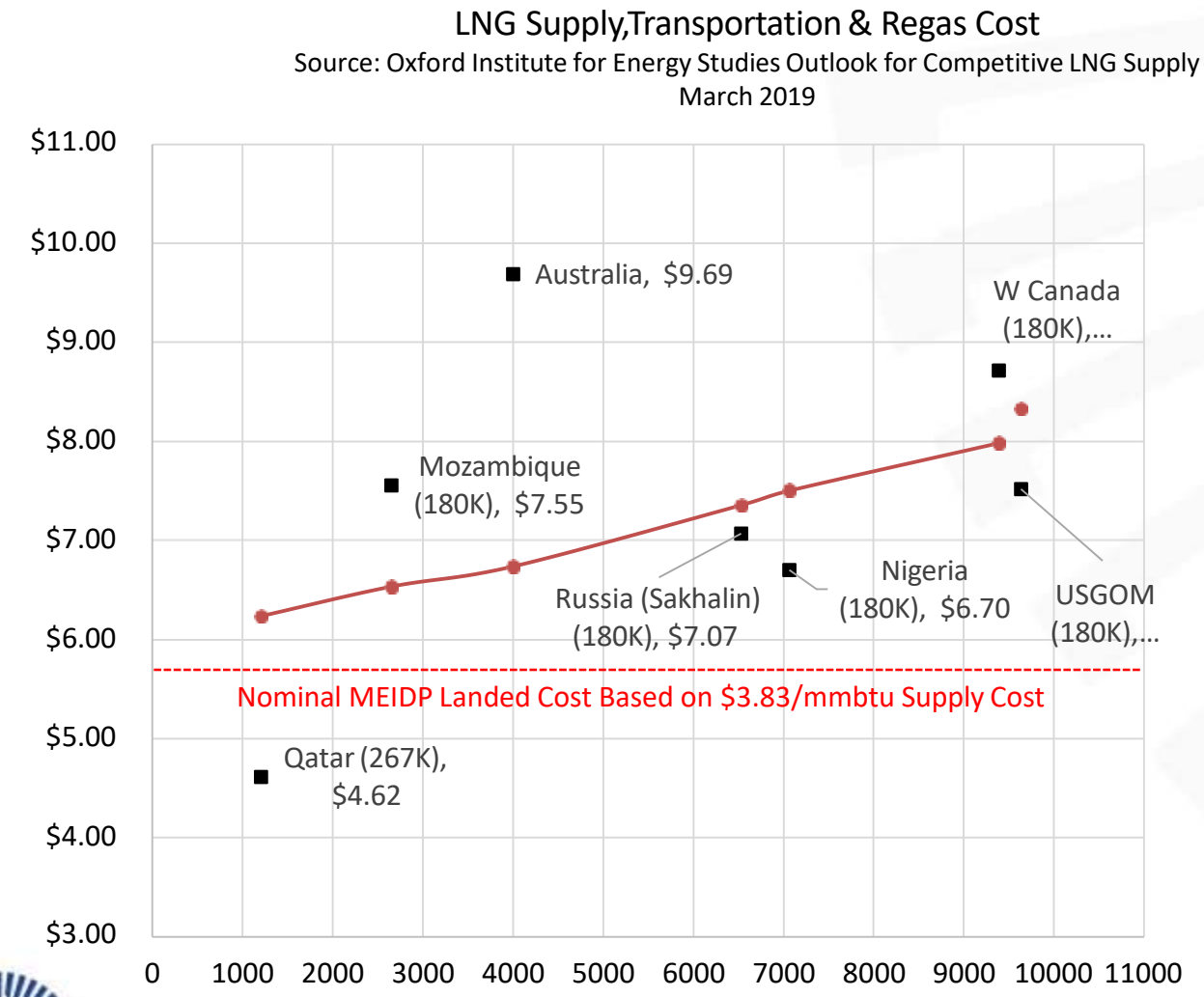
➢ For a gas price of USD 3.83/mmbtu at the inlet of MEIDP Pipeline, the landed price is USD **$5.69/mmbtu,** with delivered price of gas for end user in India is estimated to be **USD $7.92/mmbtu.**

Particular	Value ($)
Landfall price-Iran	**3.83**
Pipeline Tariff	1.86
Landed Cost-Indian Port	**5.69**
Custom Duty	0.30
Other Taxes & Duties	0.93
Local Transport	1.00
Delivered Cost-End User	**7.92**

Tariff Calculation by SBI Cap

**Levelized Tariff based on Project IRR of 12% (post-tax) Project CAPEX $4.5b, 50yr life*

Competitiveness of Pipelines v's LNG



LNG Shipping Cost 2025	Gas Supply	Liquifaction Plant Cost	Distance to Market	Shipping Cost	Regas Cost India (assumed)	Delivered Cost
	$/mmbtu	$/mmbtu	NM	$/mmbtu	$/mmbtu	$/mmbtu
Qatar (267K)	2	1.69	1210	0.43	0.50	4.62
Mozambique (180K)	2.54	3.79	2653	0.72	0.50	7.55
Australia	2	6.26	4000	0.93	0.50	9.69
Russia (Sakhalin) (180K)	0.5	4.52	6528	1.55	0.50	7.07
Nigeria (180K)	2.63	1.88	7063	1.69	0.50	6.70
W Canada (180K)	2.54	3.5	9390	2.18	0.50	8.72
USGOM (180K)	2.25	2.25	9631	2.52	0.50	7.52

MEIDP – Working Partners

SAGE

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

Pipe Mills	Installation Contractors	Suppliers & Takers	Engineering & Consultancy
• British Steel (TAT Corus) • Welspun • JindalSAW • PCK (China) • *JFE* • *Europipe* • *NSSMC (Nippon Sumitomo)* • *Bio Steel*	• Allseas • Saipem SpA	• Indian Oil Co • GAIL • GSPC • Oman Ministry of Oil and Gas • NIOC (NIGEC)	• Peritus International Ltd. • Engineers India Ltd. • Intecsea • FUGRO GeoConsulting Ltd. • SBI Caps • Ernst & Young (EY)
	Certification Bodies • DNVGL		

MEIDP - Technical Summary

PIPELINE

- **Start Point:** Ras al Jifan, Oman
- **End Point:** Near Porbandar (South Gujarat), India
- **Throughput:** 10.3BSCM/yr (Averaged Annual) 11.3BSCM/yr (Max)
- **Inlet Pressure:** 400barg
- **Diameter:** 24” I.D. (27.2” O.D.)
- **Wall Thickness:** 32.9-40.5mm WT (DNVGL ST-F101)
- **Steel Grade:** DNVGL SAWL485 FDU (X70 Equivalent)
- **Maximum Depth:** 3,450m
- **Length:** 1,200 km
- **Steel Tonnage:** 800,000tonnes
- **Project Duration:** 5 years (as Fast Track)
- **Pipeline Construction:** 2 years

Primary Design Code

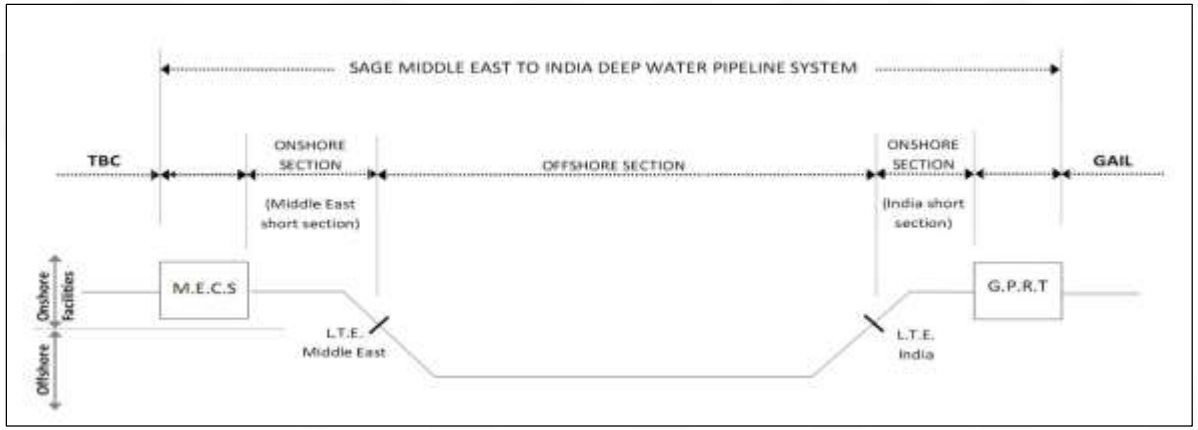
- Offshore - DNVGL, Offshore Standard DNVGL-ST-F101, Submarine Pipeline System :2017

MECS

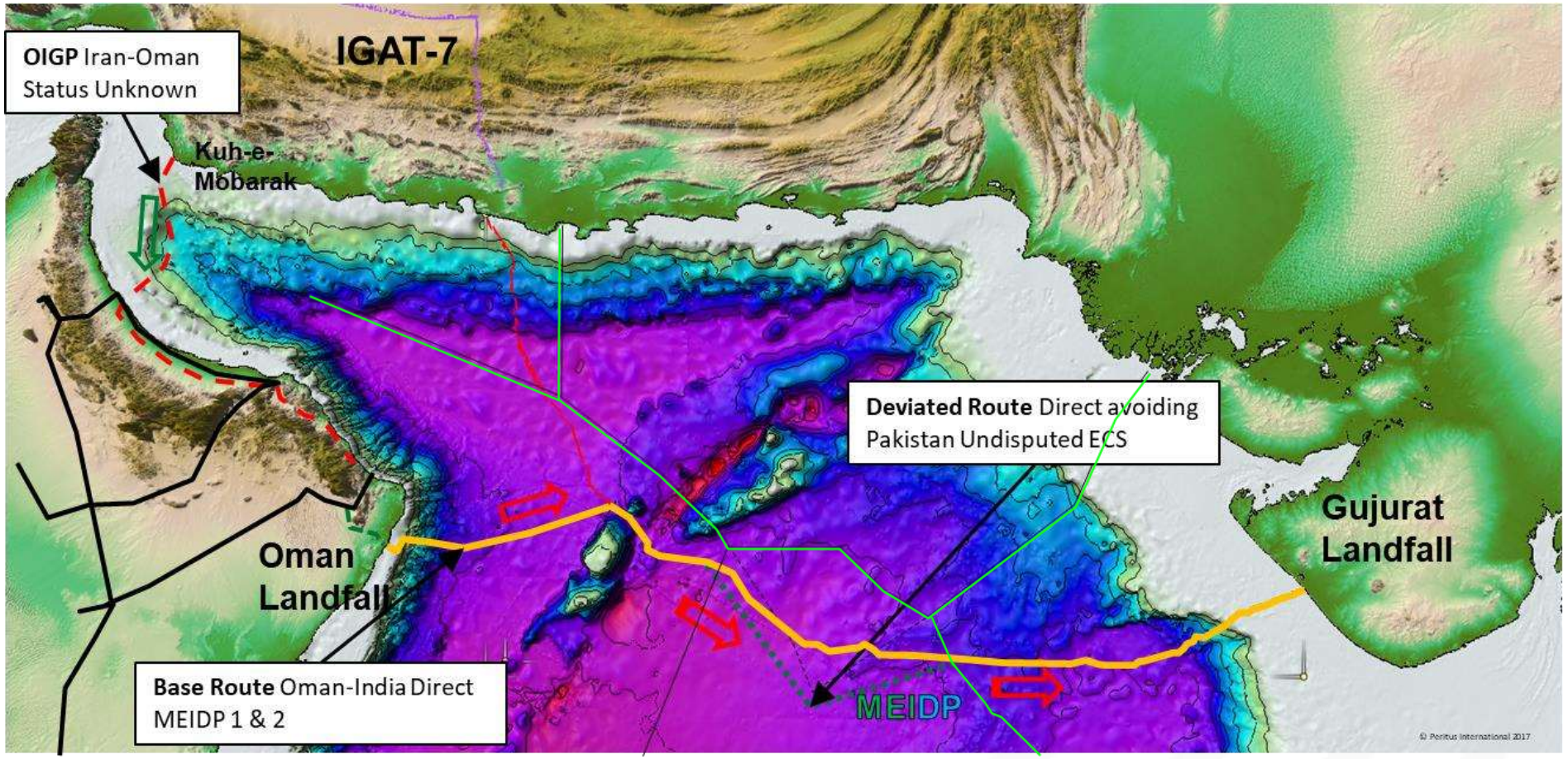
- 1.0BSCFD (annual Average)
- 1.1BSCFD Nominal flowrate
- Sales Quality Natural Gas
- Dehydrated at MECS (<47mg/Sm³)
- Inlet pressure 50 – 100 Barg
- Outlet pressure 400 Barg
- Cooling

GPRT

- 1.0BSCFD (annual Average)
- 1.1BSCFD Nominal flowrate
- Inlet at 50 Barg
- Compression to 90 Barg
- Heating/Cooling

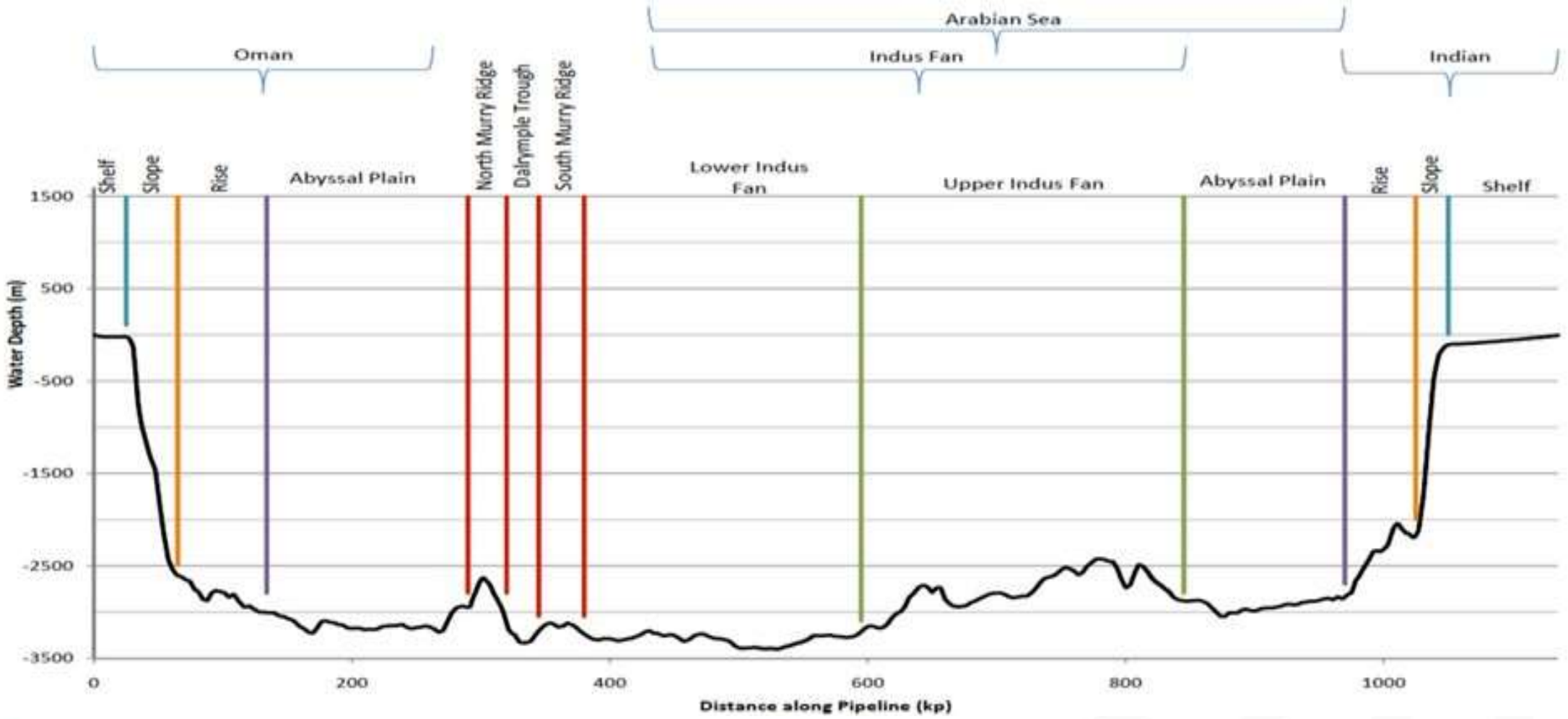


MEIDP ROUTE- Oman to India (via Arabian sea)

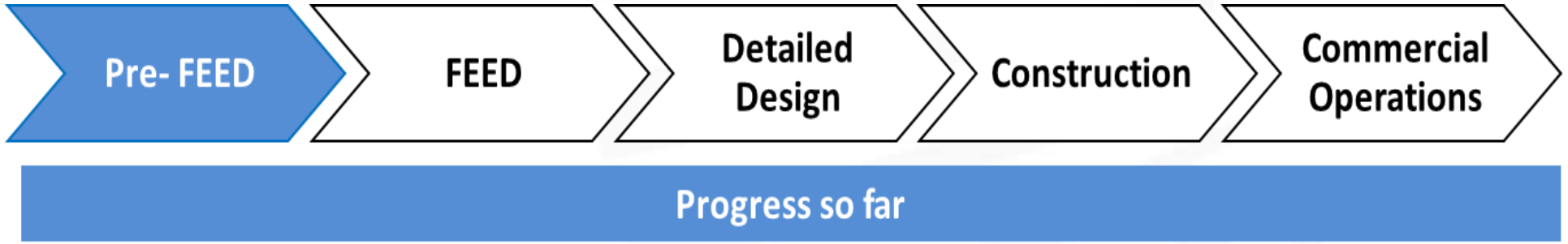


Oman-India Route Length 1200km, Max WD 3500m
Deviation adds 50km, Max WD 3500m

MEIDP - Middle East to India Route Profiles



MEIDP - Present Status



- Engaged DnV, Norway as a Technical Consultant (Confirmation of Feasibility and Approval of Technical Qualification Plan)
- Feasibility and Pre-FEED completed- by Peritus International Ltd
- Feasibility Confirmed by Engineers India Limited (EIL)
- Financial Advisory Services- by SBICap (Project financing and Tarrif)
- Indian Gas Market Assessment- by CRISIL
- Reconnaissance Survey (Oman to India)completed (2013) - by FUGRO
- ~ USD 15-20 million have been invested by SAGE and its Technology Partners (in R&D)
- Successful Pre-Qualification Trials conducted by Indian and Chinese pipe mills. European and Japanese Mill Pre-Qualification is ingoing.
- Installability of MEIDP confirmed by Allseas and Saipem
- Presentations made by SAGE to MoEA, MoPNG- GoI, NITI Aayog

MEIDP - Established Technical Feasibility

Pre- FEED → FEED → Detailed Design → Construction → Commercial Operations

Capable Installation Vessels

✓ Three vessels are capable of installing the pipeline in the maximum water depth of the MEIDP Project.

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

Allseas will present details of the recent completion of Turkstream 2200m, WD 900km, 32”OD

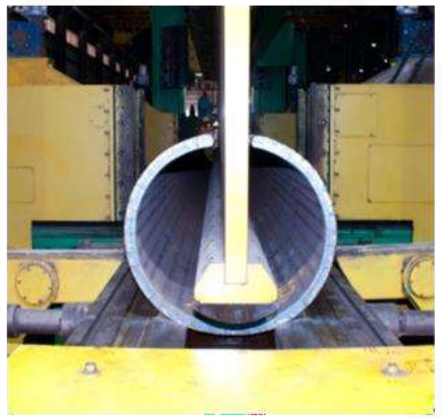
“With the right vessel as you go deeper it gets easier”

MEIDP - Established Technical Feasibility

Pre- FEED → FEED → Detailed Design → Construction → Commercial Operations

Capable Pipe Mills

- ✓ Two pipe mills (JindalSAW & PCK) have manufactured pipeline specifically for SAGE to MEIDP Dimensions and Specification. (24”ID, 40.5mm WT, α_{Fab}=1.0)
- ✓ Three pipe mills (JindalSAW, WELSPUN & PCK) have successfully completed prequalification and ring collapse testing trials.
- ✓ JFE and Europipe are currently undertaking similar production and prequalification/testing trials.



MAKE in INDIA - India can make a substantial part of the 800,000tonnes of Pipe required.

MEIDP – Feasibility Confirmed / Qualification Plan Endorsed

DNV·GL

ENDORSEMENT OF QUALIFICATION PLAN

Middle East to India Deepwater Pipeline

DNV·GL

STATEMENT OF FEASIBILITY

Statement No.: 2017-0553

This is to state that

Middle East to India Deepwater Pipeline

has been evaluated in accordance with DNVGL-RP-A203 /1/ as reported in DNV GL Technical Report 2017-0553 /3/. DNV GL considers the technology required to successfully execute the project to be feasible as defined in DNVGL-SE-0160 /2/ and thereby the project is suitable for further development and qualification.

Owner:	South Asia Gas Enterprise PVT. LTD.
Description:	Deepwater Pipeline from Middle East to India
Involvement:	DNV GL has been involved in the qualification process as required in /2/ and has facilitated and documented the technology qualification process as described in /3/.
Limitations:	The statement of feasibility is limited to this projects and its qualification basis.
Reference documents:	/1/ DNVGL-RP-A203, Technology Qualification, June 2017 /2/ DNVGL-SE-0160, Technology qualification management and verification, 2015 /3/ DNV GL Report no. 2017-0553, Technology Qualification of Middle East to India Deepwater Pipeline

The qualification process is in progress and new sources of uncertainty might be discovered as qualification progresses. Attention is drawn to the iterative nature of the technology qualification process /2/.

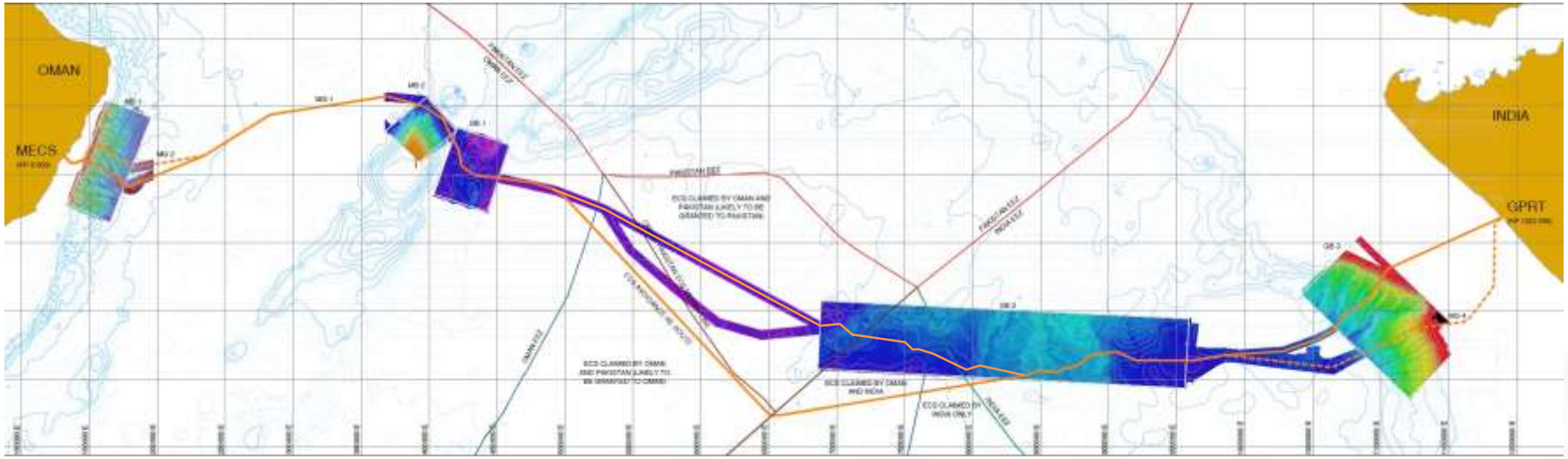
Issued at Høvik on 2017-09-11

for DNV GL AS

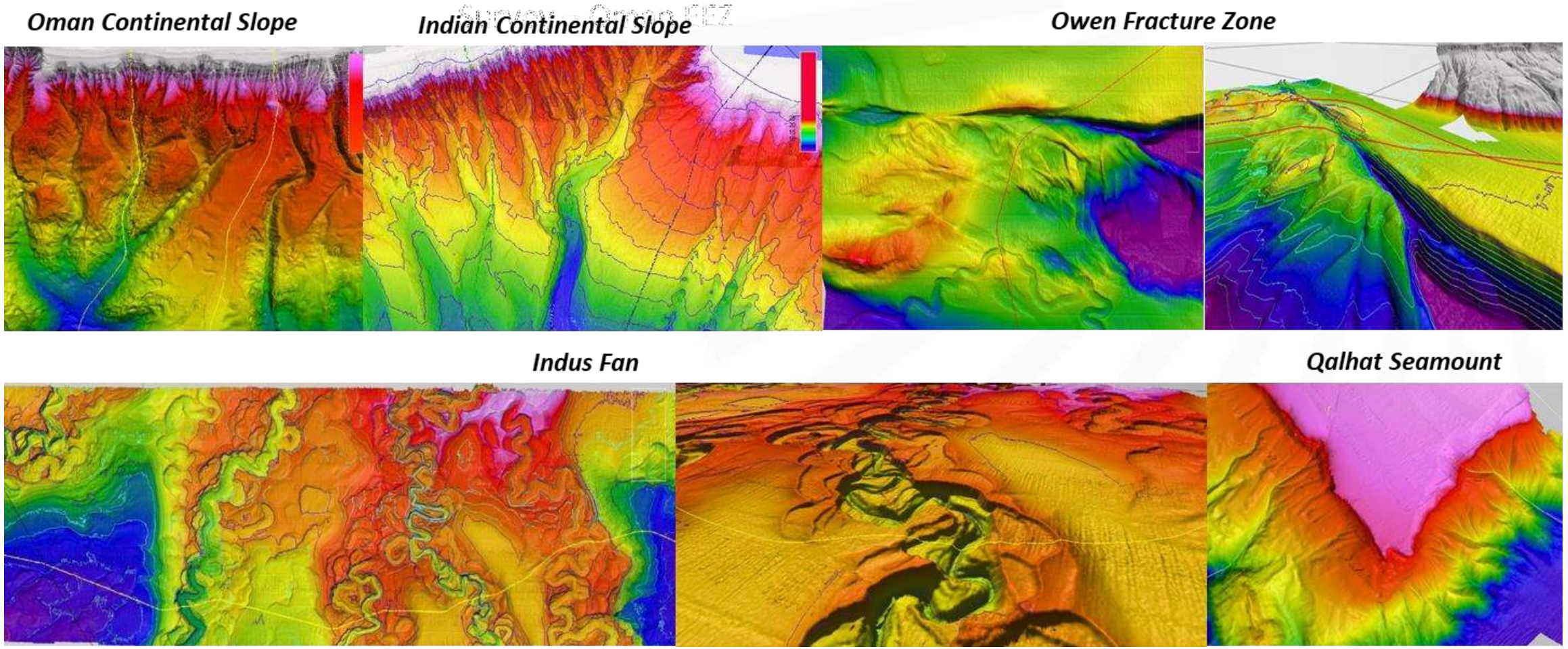
Olav Aamlid
Senior Principal Specialist

Olav Fyrileiv
Technology Leader

MEIDP - 2013 Reconnaissance Survey

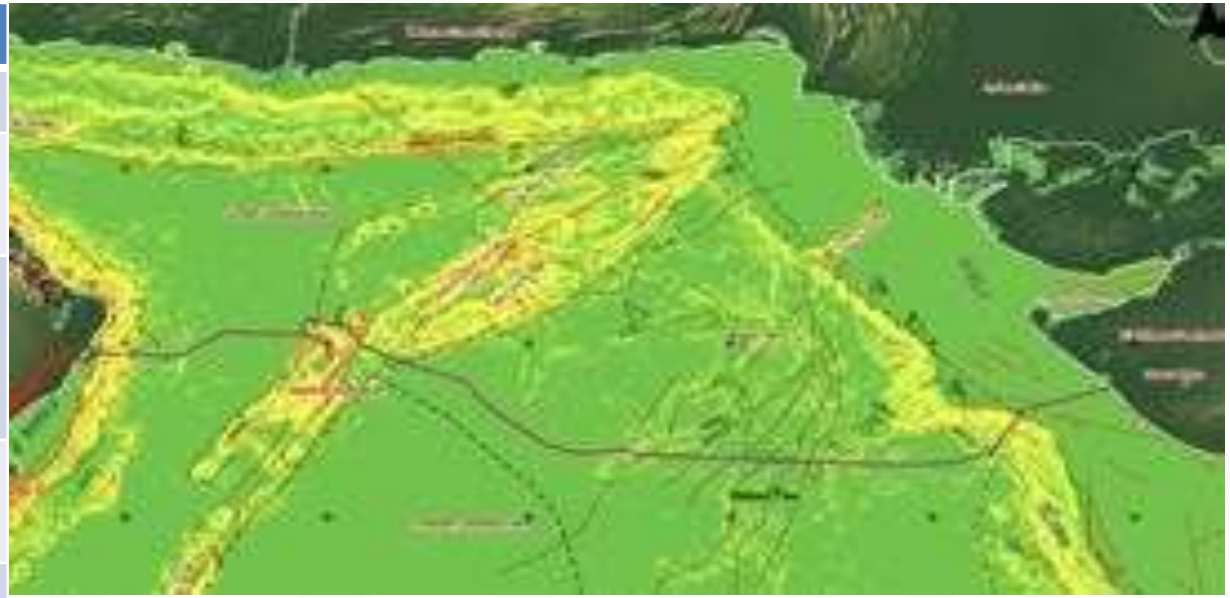


MEIDP - 2013 RMS Highlights



Geohazard Challenges

Geohazard	Location
Tsunami	Oman and Indian coastline
Steep slopes	Oman and Indian continental slopes and the Qalhat Seamount
Seismic activity	Northern Oman, Kathiawar Peninsula (Gujarat, India) and along the Owen Fracture Zone
Fault displacements	Faults of the Owen Fracture Zone and the Indian shelf and slope
Liquefaction	Oman and Indian (inner) shelf
Slope failures	Oman and Indian Continental slope, Qualhat Seamount, channels of the Indus Fan
Turbidity currents	Indus Fan

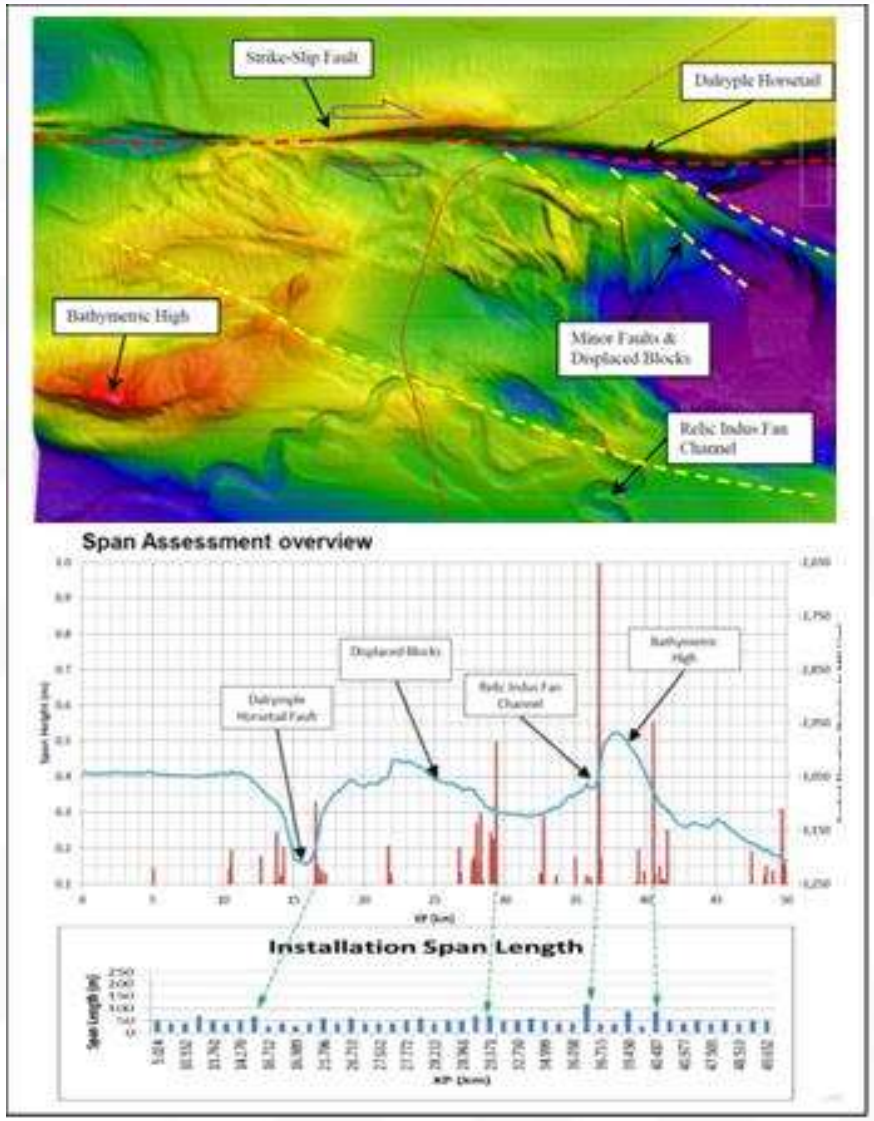


Owen Fracture Zone (OFZ)

The OFZ in the region of the MEIDP route has significant seismic activity. SAGE Seismic hazard studies indicated that earthquakes of magnitude Mw >7.0 were possible and large seafloor movements could result.

In order to understand the possible implications of large strike-slip right lateral seabed movements at the OFZ, SAGE has performed pipe stress assessments on the 3D seabed with a forced 7m movement along the line of the fault, approximately equivalent to 1000yrs of accumulated movement in one event.

The assessment showed that the current routing of MEIDP could accommodate this movement without overstressing the pipeline and with only a small increase in pipeline spanning condition.



The Indus River Abyssal Fan

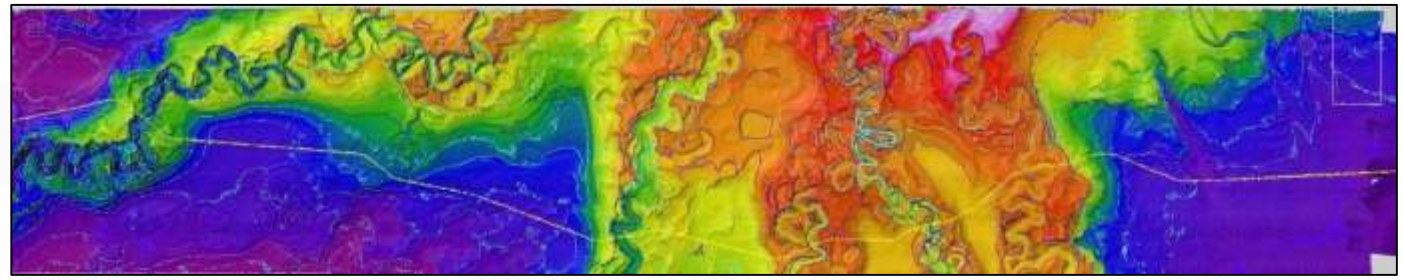
80 to 100m long freespans, Stresses and freespan VIV found to be acceptable

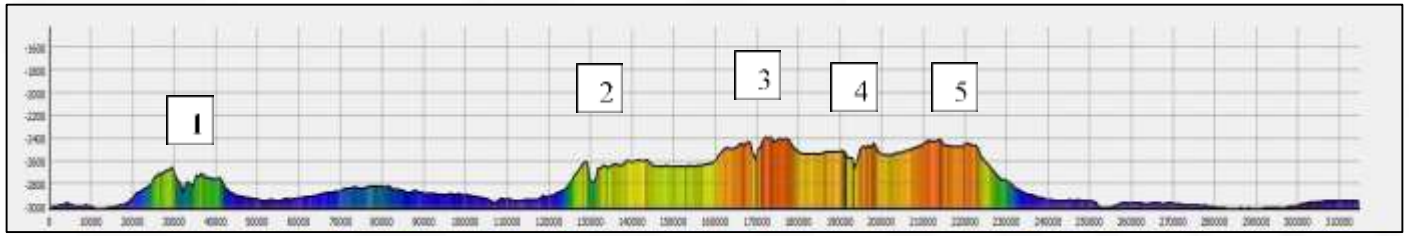
VIV analysis carried out using a combination of Abaqus to assess the natural frequency of the span, associated mode shapes, and fatigue damage

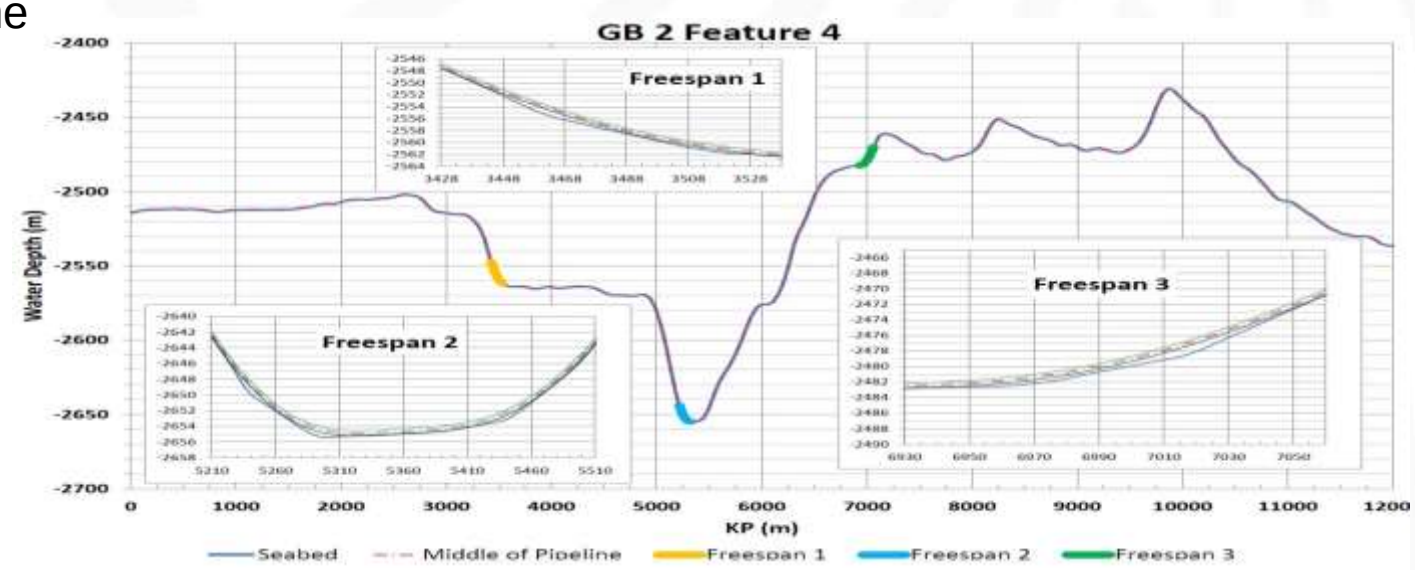
Turbidity currents had final effect of moving pipeline within the channels laterally by 60m

The additional tension introduced into the pipeline by the movement increased an 80m freespan in length to 220m

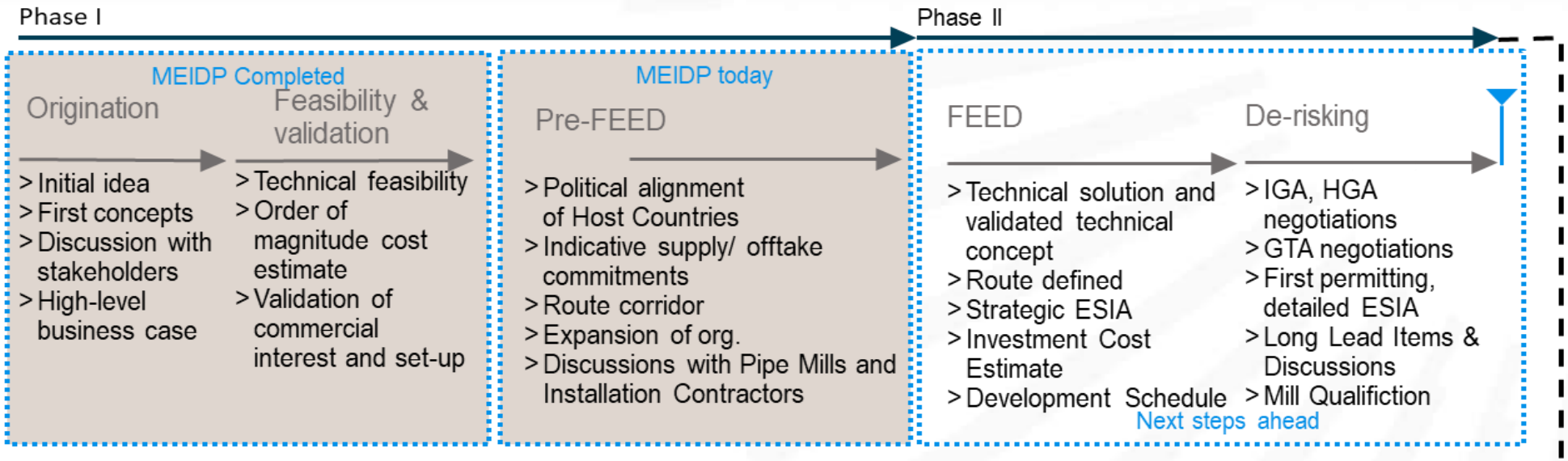
Freespan VIV assessment found acceptable fatigue damage of 1.0% compared to 0.3% for 80m span





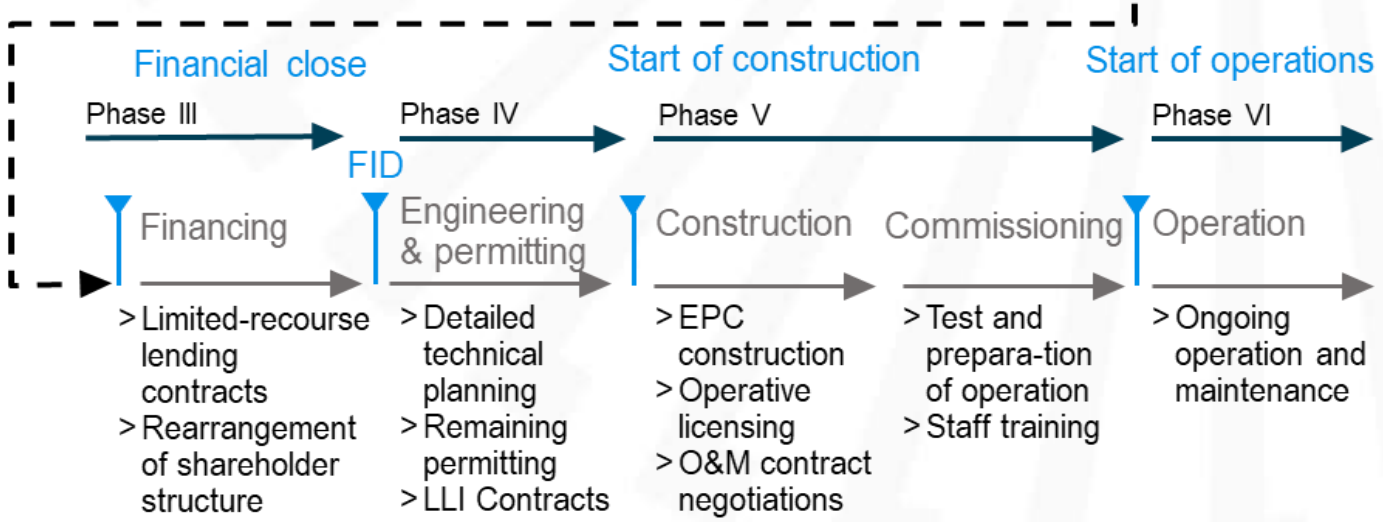


MEIDP - The Way Ahead



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

Political alignment of Host Countries is outstanding

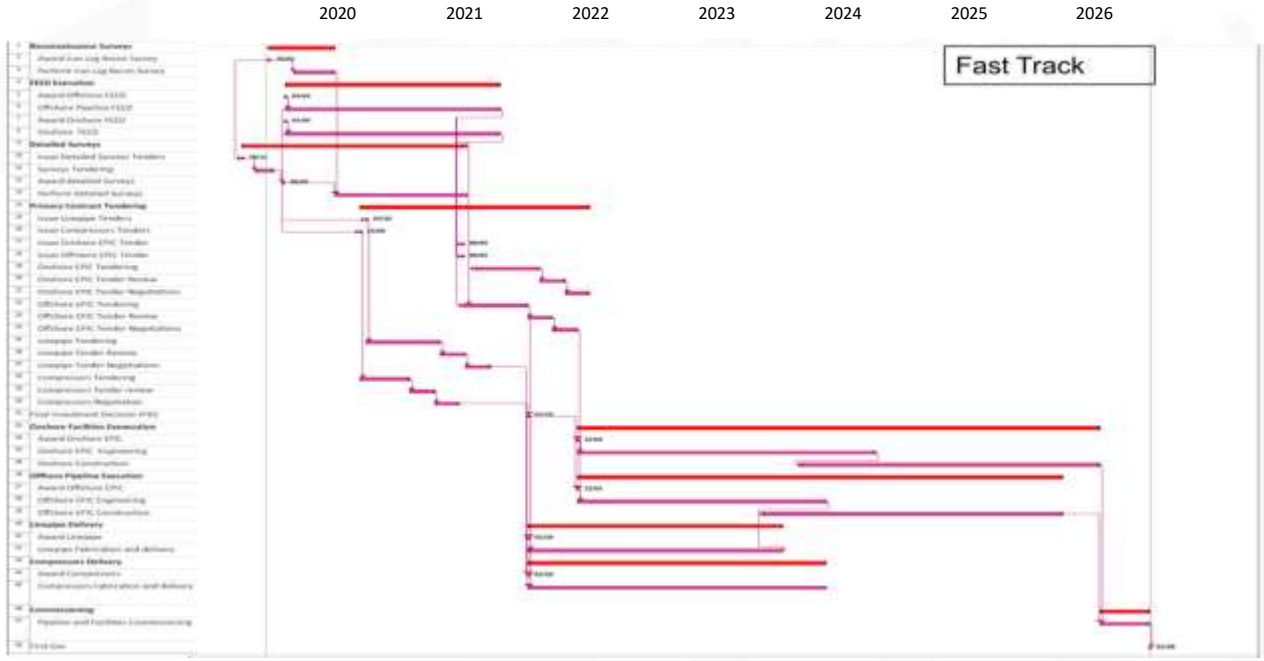


MEIDP - Schedule (provisional timeline)

Event	Date
Award Reconnaissance and Metocean Surveys	Feb 2020
Commence Reconnaissance Survey (For Deviation)	Apr 2020
Commence Metocean Survey	Apr 2020
Award Onshore & Offshore FEED	Jan 2020
Award Detailed Surveys	Apr 2020
Final Investment Decision	Dec 2021
Award Linepipe Contract	Dec 2021
Award Onshore & Offshore EPIC	Jun 2022
Start Offshore Construction	Oct 2023
Start Compressor Station Construction	Apr 2024
Complete Offshore Construction	Apr 2026
Complete Compressor Station Construction	Jun 2026
First Gas	Dec 2026

Nominal Project can be executed in a 5 years Post FEED 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 3 year period



MEIDP - Conclusions

- Technical feasibility of the MEIDP Project has been confirmed
  - DNV GL, Norway has confirmed the Feasibility for MEIDP Project
  - Engineer India Limited (EIL) has prepared ‘Pre-feasibility Report’ and estimated the Project Cost
  - Feasibility and Pre FEED Studies completed- by Peritus International Ltd
- 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.
- To meet Government aim of 15% Energy mix by 2040 their will be a shortfall of 950mmscmd which will require at least 4 transnational gas pipelines and all the LNG that India can get! (i.e India’s future requires BOTH LNG and Transnational Pipelines)
- Oman and/or Saudi Arabia (via Oman) has 31 mmscmd gas for MEIDP. Iran has also confirmed it can supply 2 Pipelines (after US Sanctions lifting).
- MEIDP Project will add to India’s energy security by diversification.
- Provides an economically competitive method of gas supply and promotes completion in Indian energy markets.

MEIDP - Conclusions

- Indian Mills are both capable and keen to supply the high quality linepipe required for MEIDP. Supporting GoI MAKE in INDIA policy.
- The technology to undertake the design, manufacture the linepipe and lay deep sea pipeline is available NOW.
- Long Term contracts and surety of supply, will facilitate existing projects and new greenfield projects in India which utilise the gas especially Power & Fertilizer Sectors.
- As with all transnational gas pipelines the MEIDP Project needs strong diplomatic & political support from Omani and Indian Governments

Acknowledgements / Thank You / Questions

Peritus International
4th Floor, Dukes Court
Duke Street
Woking
Surrey, UK
GU21 5BH
Tel: +44 (0) 1483 312 800
Email: enquiry@peritusint.com
www.peritusint.com

South Asia Gas Enterprise (SAGE)
A-6, Connaught Place,
New Delhi
110001
India
Tel: +91-11-23324245
E-mail : subodh.jain@sage-india.com
www.sage-india.com