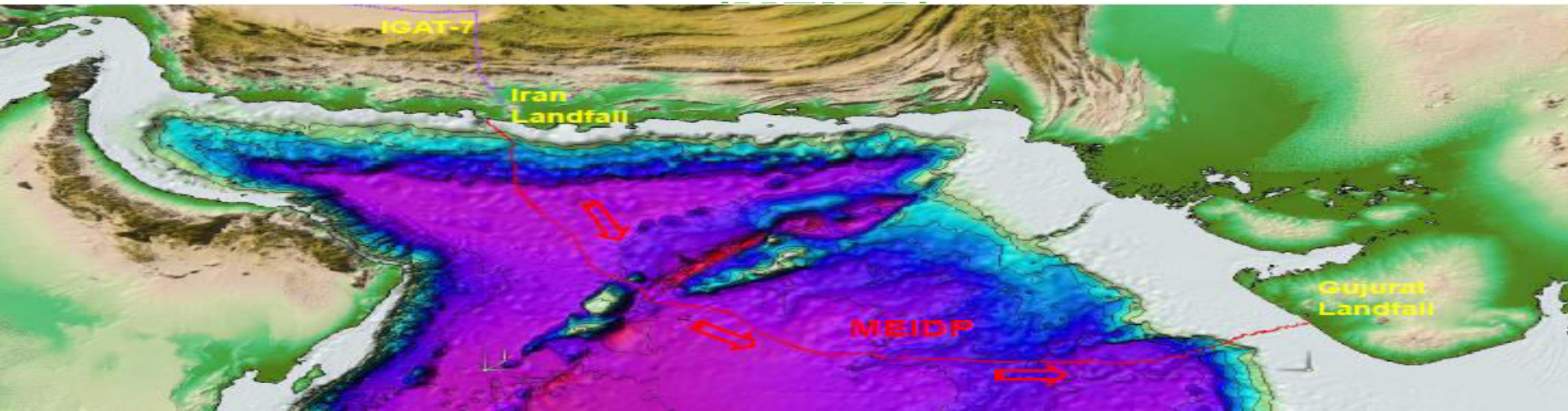


MIDDLE EAST TO INDIA DEEPWATER PIPELINE



SOUTH ASIA GAS ENTERPRISE



Mr. Raj Kishore,
Sr. Manager (Pipeline Engineering)

13th June, 2017

□ **SAGE**

- South Asia Gas Enterprise Pvt Ltd (SAGE), a joint venture lead by the Indian Siddhomal group, is actively considering building a deepwater, **transnational**, natural gas pipeline system from the Middle East to India.

□ **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. **Qatar, Iran and Turkmenistan**.
- **Iran** having over **1000 TCF** reserves is eager to export gas and looking forward for export solutions.
- The deepwater route across the Arabian Sea is the **shortest secure distance** between middle east reserves and the rapidly developing industry of India and is too short for LNG to be an economic transportation option

□ **A pipeline across the Arabian Sea**

- The current work builds on the extensive study of the deepwater route of the Oman to India Pipeline that was carried out in the early Nineties.
- SAGE with expertise of M/s Peritus (UK based Project Consultant), having extensive deepwater engineering knowhow, have undertaken feasibility studies for this Project.

THE SAGE PROJECT VISION



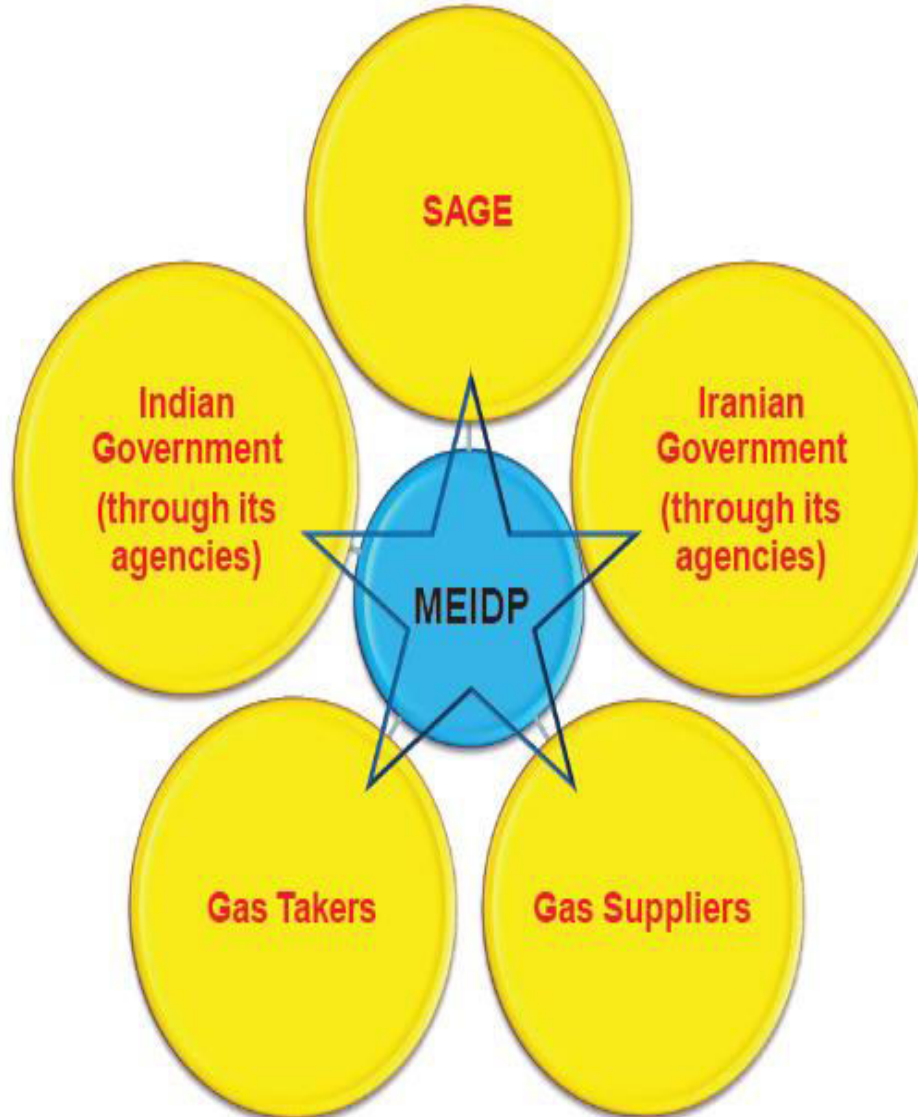
The Project

- 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.
- 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**].

STAKEHOLDERS



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



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

WORKING WITH PARTNERSHIP



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"> ▪ Welspun (India) ▪ Jindal SAW (India) ▪ Tata Corus (UK) ▪ PCK (China) ▪ JFE (Japan) ▪ Europipe (Germany) ▪ NSSMC (Nippon Sumitomo) (Japan) ▪ Bao Steel (China) 	<ul style="list-style-type: none"> ▪ Allseas, Switzerland ▪ Saipem SpA, Italy ▪ HMC, Netherlands 	<ul style="list-style-type: none"> ▪ NIGEC (Iran) ▪ IOCL ▪ GAIL ▪ GSPC ▪ Oman Ministry of Oil & Gas 	<ul style="list-style-type: none"> ▪ Peritus International Ltd. (UK) ▪ Engineers India Ltd. ▪ Intecsea ▪ FUGRO ▪ SBI Caps ▪ Ernst & Young (EY)
	Certification Bodies		
	<ul style="list-style-type: none"> ▪ DNV-GL, Norway 		

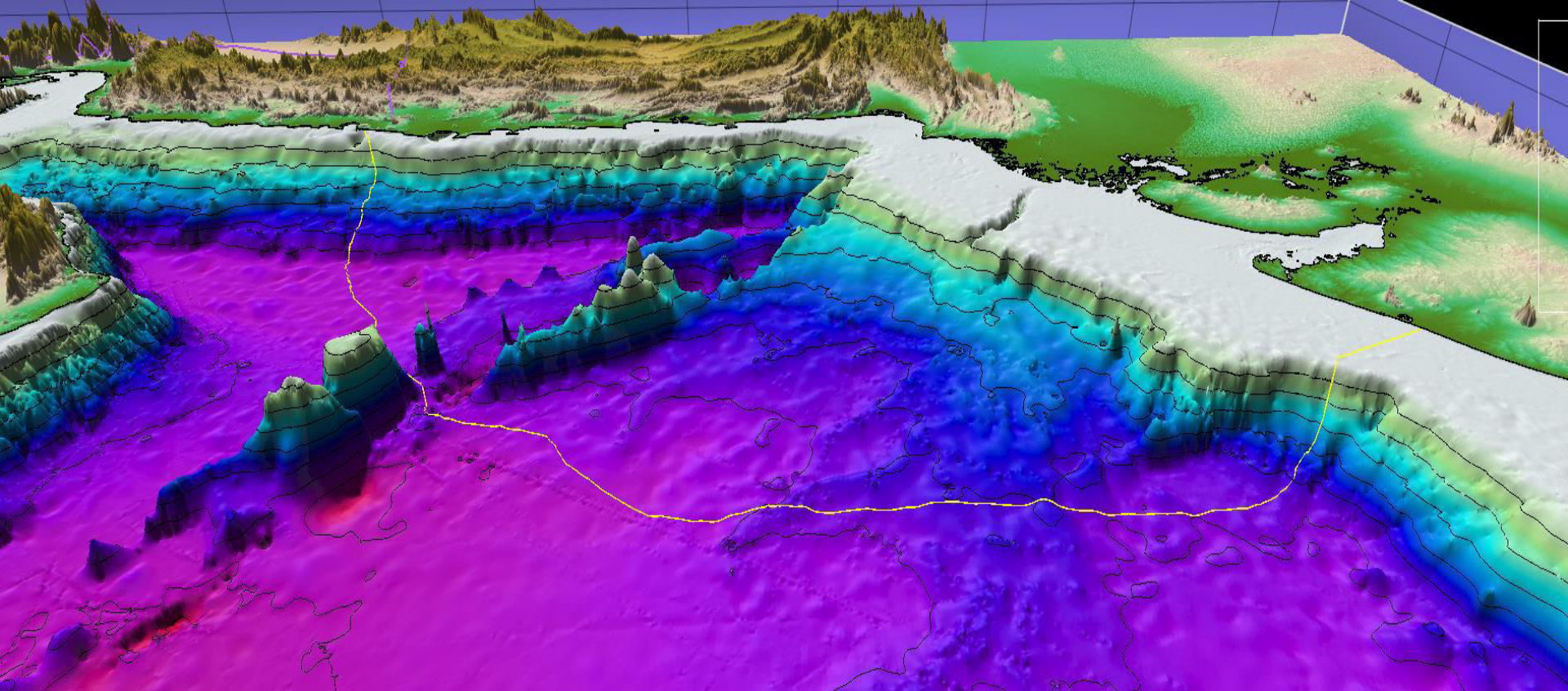
MEIDP PROJECT FEATURES



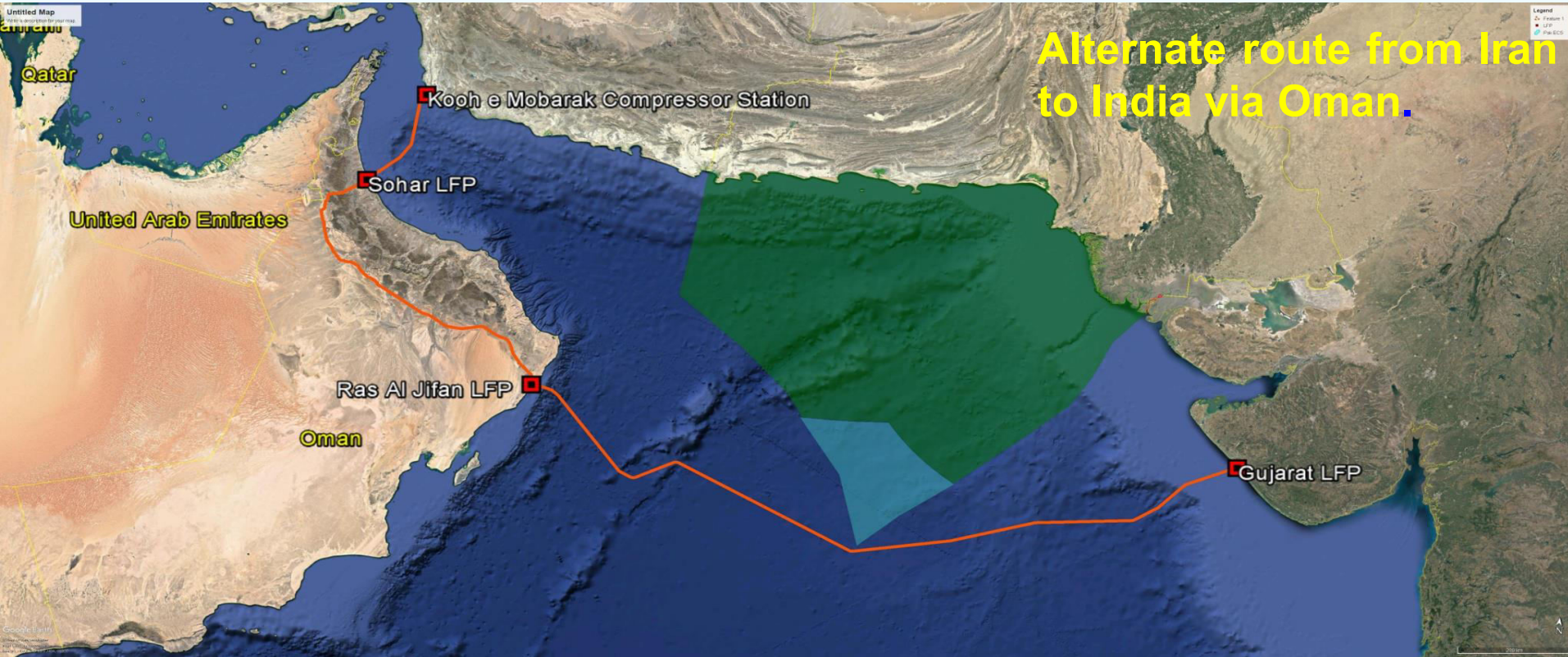
- Potential Start Points : Chabahar, Iran
- End Point : Near Porbandar (Gujarat), India
- Outside Diameter : 27.2”
- **Design Pressure** : **400 bar (g)**
- Design Temperature : 60°C (max.) & -10°C (min)
- Flow Rate : 1.0 BSCFD (**31.1 MMSCMD**)
- **Maximum Depth** : **3450 meters**
- **Offshore length** : **1300 kilometers**
- Total Project Duration : 5 year (Fast Track)
(including 2 years construction)
- **Project cost (approx.):** **5.0 billion USD**

MEIDP ROUTE TO INDIA

SAGE
Middle East to India
Deepwater Gas Pipeline

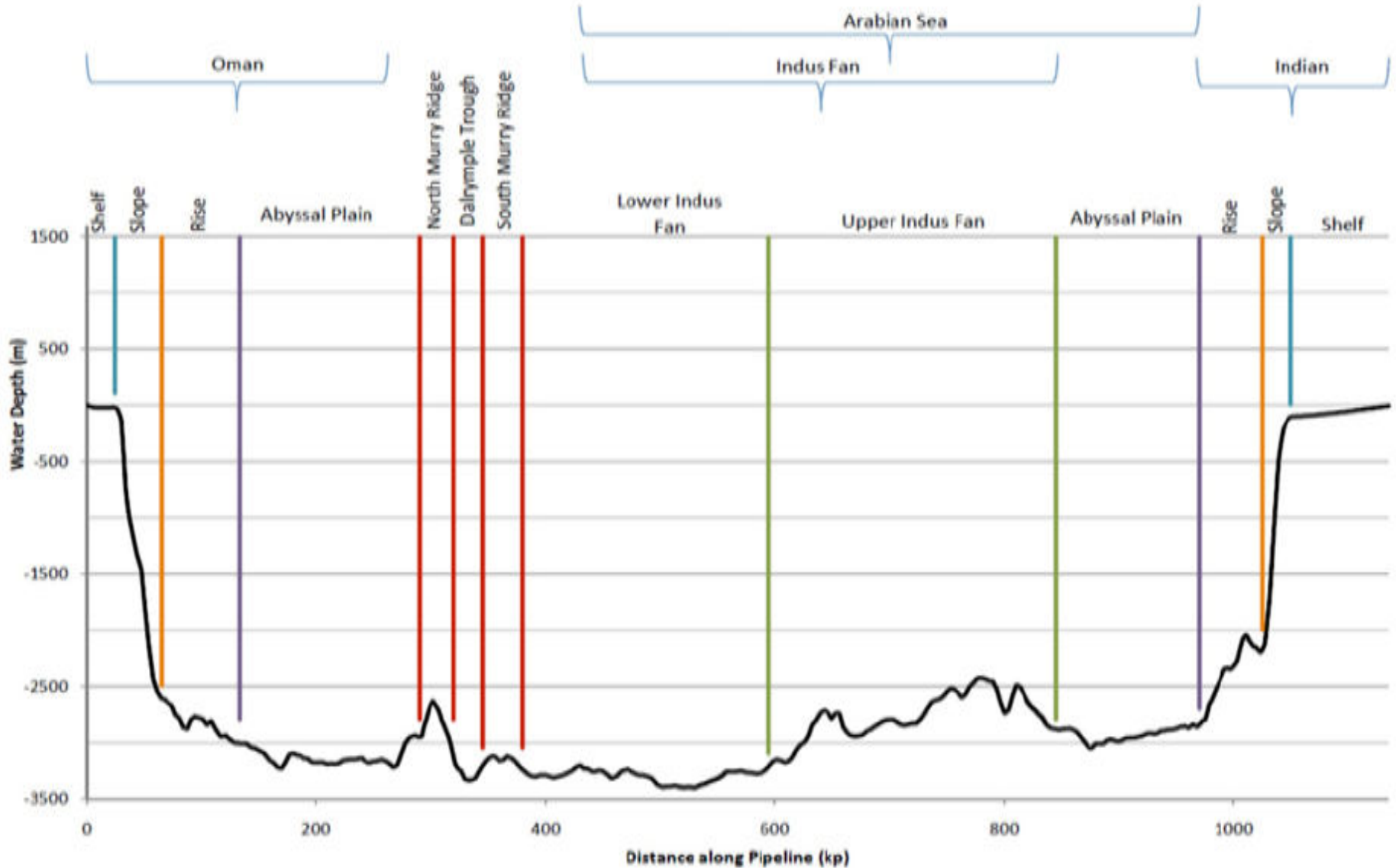


MEIDP ROUTE TO INDIA

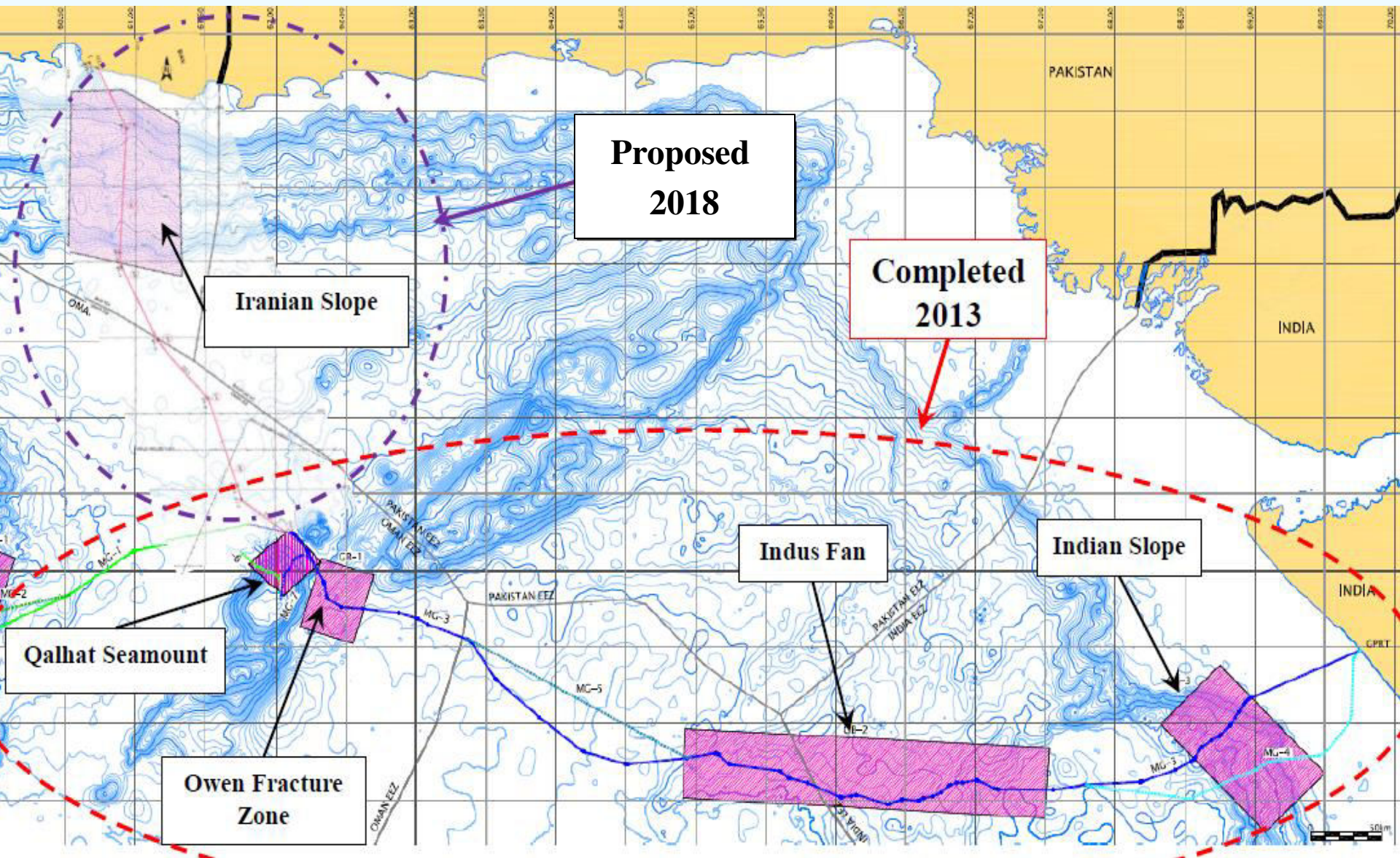


- ❑ **Technical feasibility this Optional route is being carried out by EIL.**
- ❑ **Preliminary desktop study of this route is completed**
- ❑ **Possible synergy with Iran Oman pipeline is being explored.**
- ❑ **SAGE has MOU with Oman Ministry of Oil and Gas since many years.**

MEIDP ROUTE TO INDIA



RECONNAISSANCE SURVEY STATUS



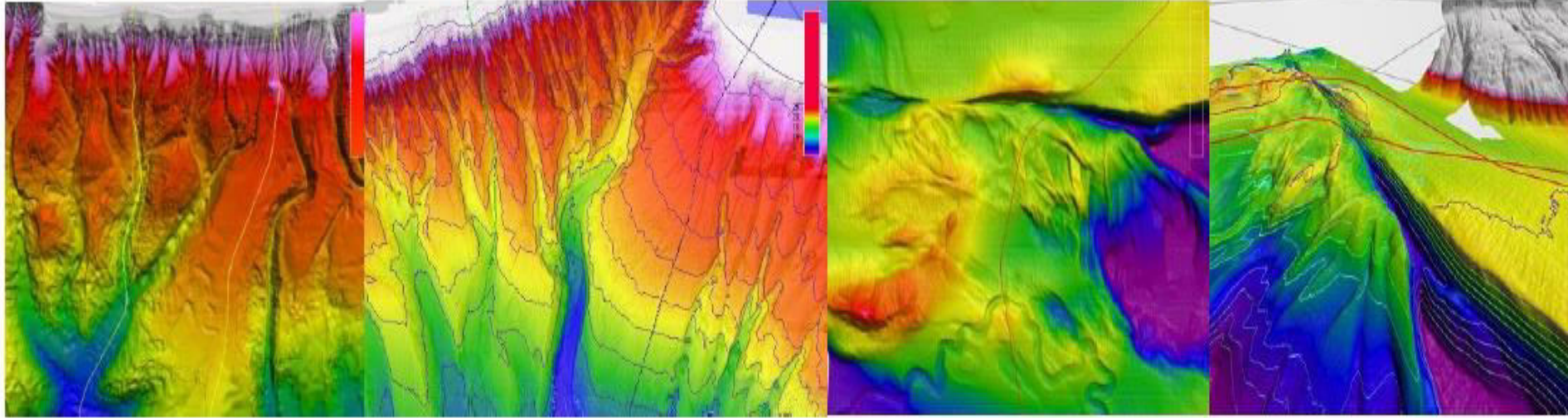
2013 SURVEY HIGHLIGHTS



Oman Continental Slope

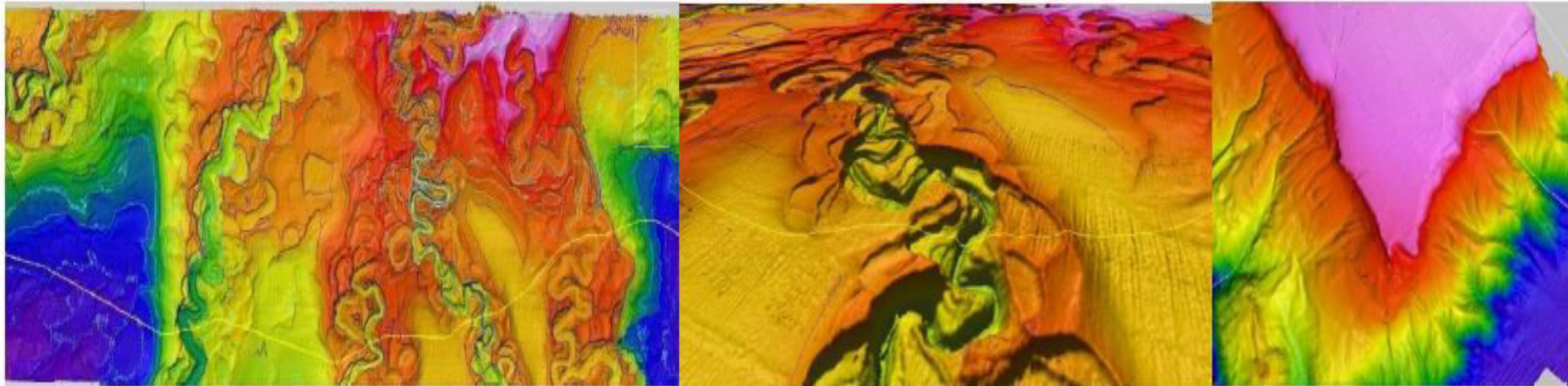
Indian Continental Slope

Owen Fracture Zone



Indus Fan

Qalhat Seamount



MECHANICAL DESIGN OF PIPELINE



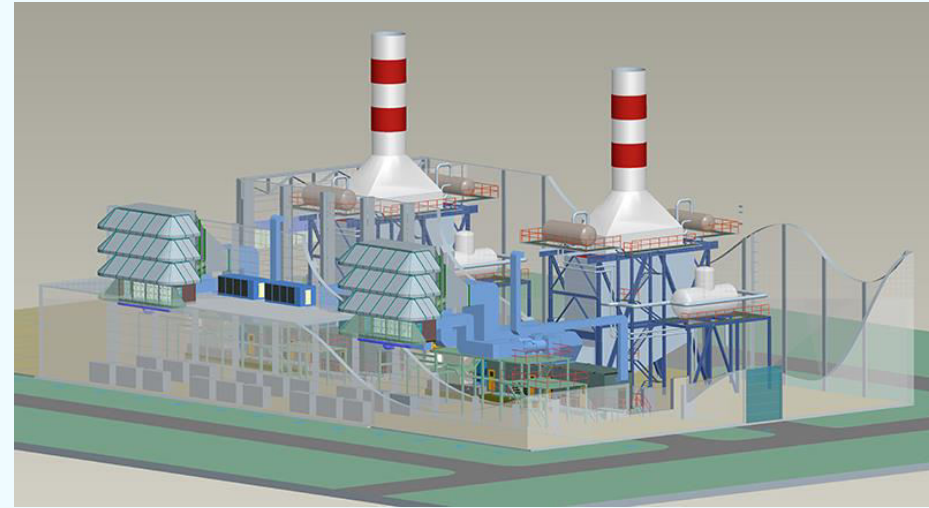
Design Code	:	DNV-OS-F101, 2013
Inside Diameter	:	610 mm (24 inches)
Outside Diameter (max.)	:	691 mm (27.2 inches)
Wall thicknesses	:	32.9 mm/ 36.6 mm/ 40.5 mm
Tonnage	:	800,000 MT (approx.)
Material Grade	:	DNV SAWL 485 FDU (API 5L Gr. X-70 equivalent) line pipes
Starting material	:	TMCP Plate (fully killed and fine grain)
Manufacturing Process	:	UOE/ JCOE, Single Longitudinal Seam, double submerged arc welding process
Coating	:	3LPP
Buckle Arrestor Thick	:	70 mm

COMPRESSOR STATION



Project have two compressor stations:

- **Chabahar (Iran)**
- **Porbandar (India)**



SAGE in discussion with two (2 nos.) compressor manufacturers:

- 1) **Nuovo Pignone (Italy)**
- 2) **Siemens (Germany)**

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.



Pipe Mills capable of making MEIDP Line pipe

S. No.	Pipe Manufacturer	Manufacturing Process
1.	Welspun (India)	JCOE
2.	Jindal SAW (India)	JCOE
3.	PCK (China)	JCOE
4.	JFE (Japan)	JUOE
5.	Europipe (Germany)	UOE
6.	Tata Corus (UK)	UOE
7.	Bao Steel (China)	UOE (Under Review)



- **Six (6 nos.)** pipe mills responded to budget queries about the production of MEIDP line pipe, out of these **three (3 nos.)** mills stated they **can produce the full range**.
- Two pipe mills (**JINDAL SAW & PCK**) manufactured line pipe in presence of SAGE team specifically for SAGE to **MEIDP dimensions and specification**.

Pipe Mills gone through SAGE test program involving **collapse test** and **compression test**.

- PCK, China is currently undergoing “Ring Collapse” test Program, witness by SAGE team. Preliminary results are successful.
- **JFE & Europipe** are about to embark on a similar production and testing trial.



VESSEL STATUS & INSTALABILITY



Five vessels are capable of installing the MEIDP empty pipeline in the maximum water depth

Company	Vessel Name
Allseas	Pioneering Spirit
SAIPEM's	S7000
	Casterone
HMC's	Balder
	Aegir

Company	Pipelay Vessel	Tension Capacity (tonnes)	
		J-Lay Mode	S-Lay Mode
Allseas	Pioneering Spirit	n/a	2000
	Solitaire		1050
Saipem	S 7000	750 with tensioners 2000 with friction clamps	n/a
	Castorone	2500	750 tonnes upgradeable to 1050
Heerema Marine Contractors	Aegir	1500 static 2000 dynamic	n/a
	Balder	1210 static 1270 dynamic	

MEIDP CAPABLE PIPELAY VESSELS



Operational



CastorONE (Saipem)

Operational



Aegir (HMC)

Operational



Pioneering Spirit (Allseas)

Operational



S7000 (Saipem)

PROJECT PROGRESS DE-RISKING



Working with
leading global
technical
consultants &
contractors

Identifying
technology
challenges & Risks

Route Survey and
evaluation

Developing
Engineering
solutions

Independent
Review

Technical Consultancy:

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

Pipe Mills:

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

Certification Bodies:

- DNV-GL

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 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:

- Engineers India Limited 2014

Route Optimisation:

- Peritus International (2015)

Design Basis definition:

- Peritus International (2010)

Flow Assurance Studies:

- Peritus International (2010 & 2016)

Mechanical Design:

- Peritus International (2010 & 2015)

Onshore Compression:

- Intecsea WorleyParsons (2011)

- Petrofac (2012)

Receiving Terminal:

- Petrofac (2012)

Installation Assessments:

- Allseas (2015)
- Saipem (2015)

Technical Feasibility Workshop:

- Peritus International, Intecsea (delft), DNV-GL, Saipem, Allseas, Prof Walker (2016)

Technical Readiness Study:

- DNV-GL(2017 Ongoing)

Technical and Commercial Feasibility Review Study:

- Engineers India Limited

2017 Ongoing)

- Engineers India Limited

- 2017 Ongoing)

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

PROJECT PROGRESS DE-RISKING



- ❑ Project Definition and preliminary technical studies carried out between 2010-2013.
- ❑ **Technical Viability Confirmed in 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 in 2014.
- ❑ Route options defined to **avoid Pakistan ECS** and updated flow assurance mechanical design performed in 2015/2016.
- ❑ **Cost Estimate and Project schedule updated in 2016.**
- ❑ **Technical Review Workshop Held in Norway in Aug-2016.**
(SAGE/ Peritus/ Intecsea/ EIL/ DNV-GL/ Saipem/ Allseas)
- ❑ Technical and Commercial Feasibility Confirmation by EIL is ongoing.
- ❑ Technical Readiness Confirmation by DNV-GL is ongoing.

PIPELINE REPAIR SYSTEM



DIVERLESS SUBSEA PIPELINE REPAIR SYSTEM (SIRCOS)

- Developed for deep water application
- It meets the requirements of Trans-Med (Tunisia – Sicily), Green Stream (Libya – Sicily), Blue Stream (across Black Sea)
- Suited to pipeline Size ranging from 20” to 32” in water depths of upto 2200 m.
- It is available under service contract agreement.

Saipem has stated that the system can be **uprated to 3500m** by change-out of buoyancy and control pod.

Saipem currently has its Work class ROV's rated to **4000m Water Depth**.





- Project will generate work for Indian Manufacturers
- ❑ Requirement of approx **1 million ton of steel pipes**.
- ❑ **Fittings & Flanges, assorted pipes** of high Pressure piping at Compressor Stations
- ❑ Various type of **Valves** (Ball, Plug, Check) etc.
- ❑ **Employment of manpower** during execution of the project.

Transportation pipelines are built for the purpose of transporting a liquid or gaseous commodity from points of production to process facilities, or from points of refinement to storage or end-use customers.

- Pipelines exist as alternatives to other modes of transport,
 - **Railroad**
 - **Trucks**
 - **Barge or ship**

BENEFITS OF THE PIPELINE



- Pipelines are ***lifelines of the global oil/gas industry***, providing most convenient, eco-friendly, efficient and economical mode of transportation for oil and natural gas
- Pipelines are one of the ***most environment-friendly and the safest means*** for oil and natural gas transportation.
- Pipelines are being integrated in the components of ***national security***.
- ***Pipelines are underground highways*** which may involve higher cost initially but in the longer run pipelines provide the most economic, safe and reliable means to transport products from one place to another.



- ❑ Currently India is the **4th largest energy consumer** in the world.
- ❑ Major chunk of energy comes from fossil fuels, **primarily from coal (57%)**.
- ❑ Sustainable growth can be ensured by cleaner and greener fuel i.e. natural gas, renewable energy etc. Natural gas is a **clean fuel** and being seen as the **fuel of the 21st century**.
- ❑ To ensure adequate availability of domestic as well as imported gas, the **transnational pipelines are the 'need of hour'** for importing gas from the nearby countries.
- ❑ Transnational gas pipelines are expected to increase the share of natural gas from 7% to 20% in the Indian Energy Mix by 2025.
- ❑ It is high time for India to move forward and to **realize at least one transnational natural gas pipeline** in the next few years, in order to generate confidence of the investors and **fast-track Industrial growth of the country**.

Deepwater and Long distance Pipelines with Emergency Repair Systems



Project	Location	Year	Water depth (m)	Length (km)	Size	Product	Repair System
Trans Med	Mediterranean	1983	503	155	20	Gas	Saipem SirCoS
Zeepipe/Franpipe	North Sea	1993	120	840	40"/42"	Gas	Technip EPRS
Europipe 1 & 2	North Sea	1999	350	658	40"/42"	Gas	Technip EPRS
Asgard	North Sea	2000	300	707	42"	Gas	Technip EPRS
Greenstream	Mediterranean	2004	1100	540	32"	Gas	Saipem SirCoS
Bluestream	Black Sea	2005	2150	396	24"	Gas	Saipem SirCoS
Petronius	GOM	2005	1116	32	12"/14"	Gas/Oil	Oil States PRS
Mardi Gras	GOM	2006	1950	512	16"-28"	Gas/Oil	Oil States PRS
Langeled	North Sea	2007	385	1166	42"/44"	Gas	Technip EPRS
Dolphin	Persian Gulf	2007	55	364	48"	Gas	Subsea 7
Medgaz	Med	2008	2155	210	24"	Gas	Saipem SirCoS
NordStream	Baltic	2012	210	1222	48"	Gas	Technip EPRS
Polarled	Norway	2015	1265	480	36"	Gas	Statoil EPRS
Ichthys	NW Shelf	2015	1350	890	42"	Gas	Subsea 7

Recent & Planned Deep water Projects



Project	Location	Year	Water depth (m)	Length (km)	Size	Product
Canyon Express	GOM	2002	2200	180	12"	Gas
Bluestream	Russia-Turkey	2003	2150	385	24"	Gas
Mardi Gras	GOM	2006	2150		16"-30"	Gas
Medgaz	Algeria - Spain	2008	2155	210	24"	Gas
Cascade Chinook	GOM	2009	2680	19	9"	Oil
Perdido	GOM	2009	2961	10	10"	Oil
Jack St.Malo	GOM	2013	2200	220	24"	Gas
South Stream	Russia - Bulgaria	2015	2200	925	32"	Gas
Galsi	Algeria-Italy	-	2800	565	26"	Gas
Eastern Med	Israel - Greece	-	3200	2200	24"-28"	Gas

The MEIDP pipeline:

- Provides an **economically competitive** method of gas supply to the Western coast of India.
- Enhances the **security and diversity of energy supply** for Indian subcontinent.
- **Promotes competition** in the Indian energy markets and will assist in determining **Market Prices**.
- Will contribute significantly towards the implementation of sustainable development strategies of an **integrated energy plan** for the Indian Subcontinent.

CONCLUSION



- ❑ Design methods for **ultra-deepwater pipeline** and pipelines in seismic zones are well established.
- ❑ Pipe mills can and **have made pipes** to meet MEIDP requirement.
- ❑ Pipe **laying vessels are available in the market & can install the pipeline.**
- ❑ Project will add to **energy security by diversification.**
- ❑ Provides an **economically competitive** method of gas supply.
- ❑ The project is **commercially and financially viable** as per the study performed by SBI Capital Markets Ltd.
- ❑ Long Term contracts and surety of supply, will facilitate new projects in India which utilise the Gas (eg., **Power / Fertilizer Plants**).



Thank you!