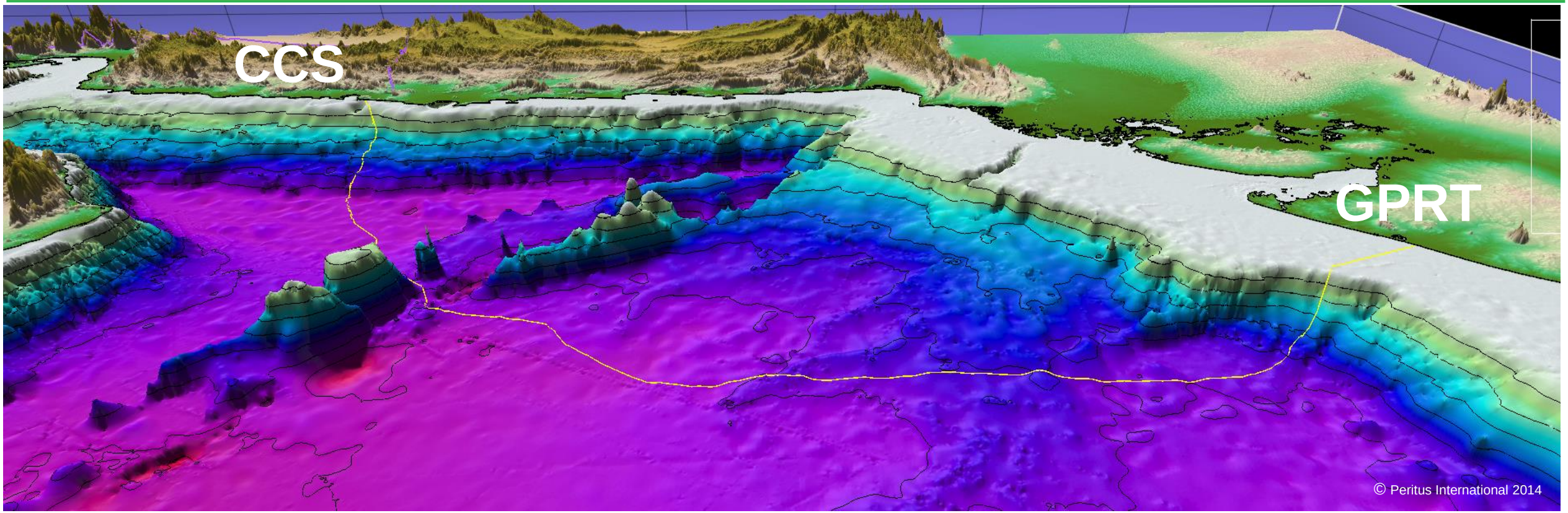
Middle East to India Deepwater Pipeline

MEIDP an Opportunity for India



15th Annual Conference on Gas in India
Trends & Outlook; Issues & Opportunities
New Delhi, 18-19 November 2015

Subodh Jain
South Asia Gas Enterprise Pvt Ltd..
New Delhi, India

Ian F. J. Nash
Peritus International Limited.
Woking, Surrey, UK

Overview

- India Gas Supply and Demand
- Competitiveness of Pipelines v's LNG
- Gas Price expectations for India
- SAGE VISION
- MEIDP Technical Details
- MEIDP Cost Details
- Summary

MEIDP an Opportunity for India

SAGE

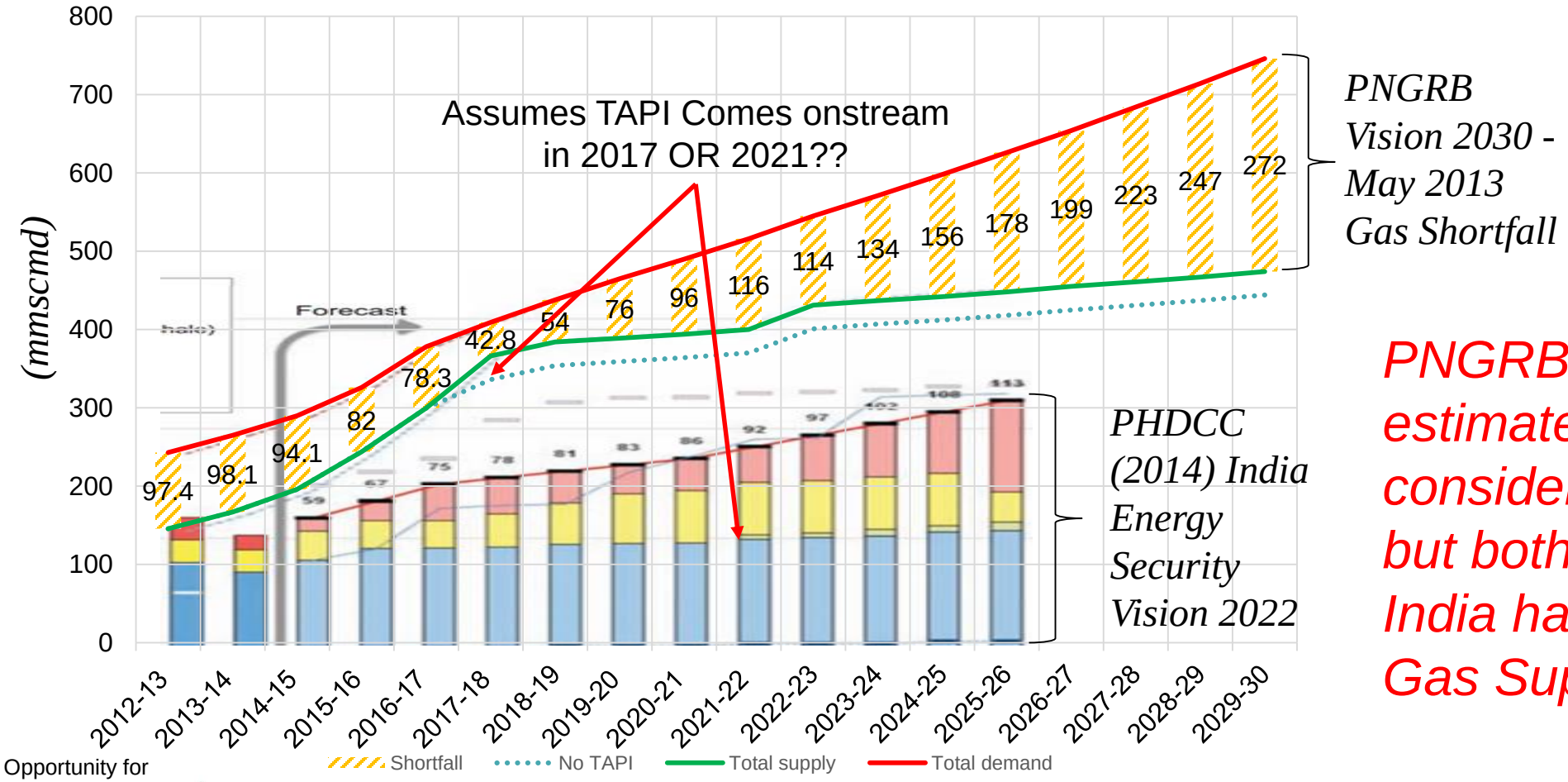
- South Asia Gas Enterprise Pvt Ltd (SAGE), a consortium lead by the Indian Siddhomal group, is actively considering building a deepwater, transnational, natural gas pipeline system from the Middle East to India

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 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

India's Demand Supply Balance

PNGRB Vision 2030 - May 2013 *PHDCC (2014) India Energy Security Vision 2022*



PNGRB and PHDCC estimates are considerably different but both agree that India has a shortfall in Gas Supply

MEIDP an Opportunity for India, Ian Nash, Nov 2015

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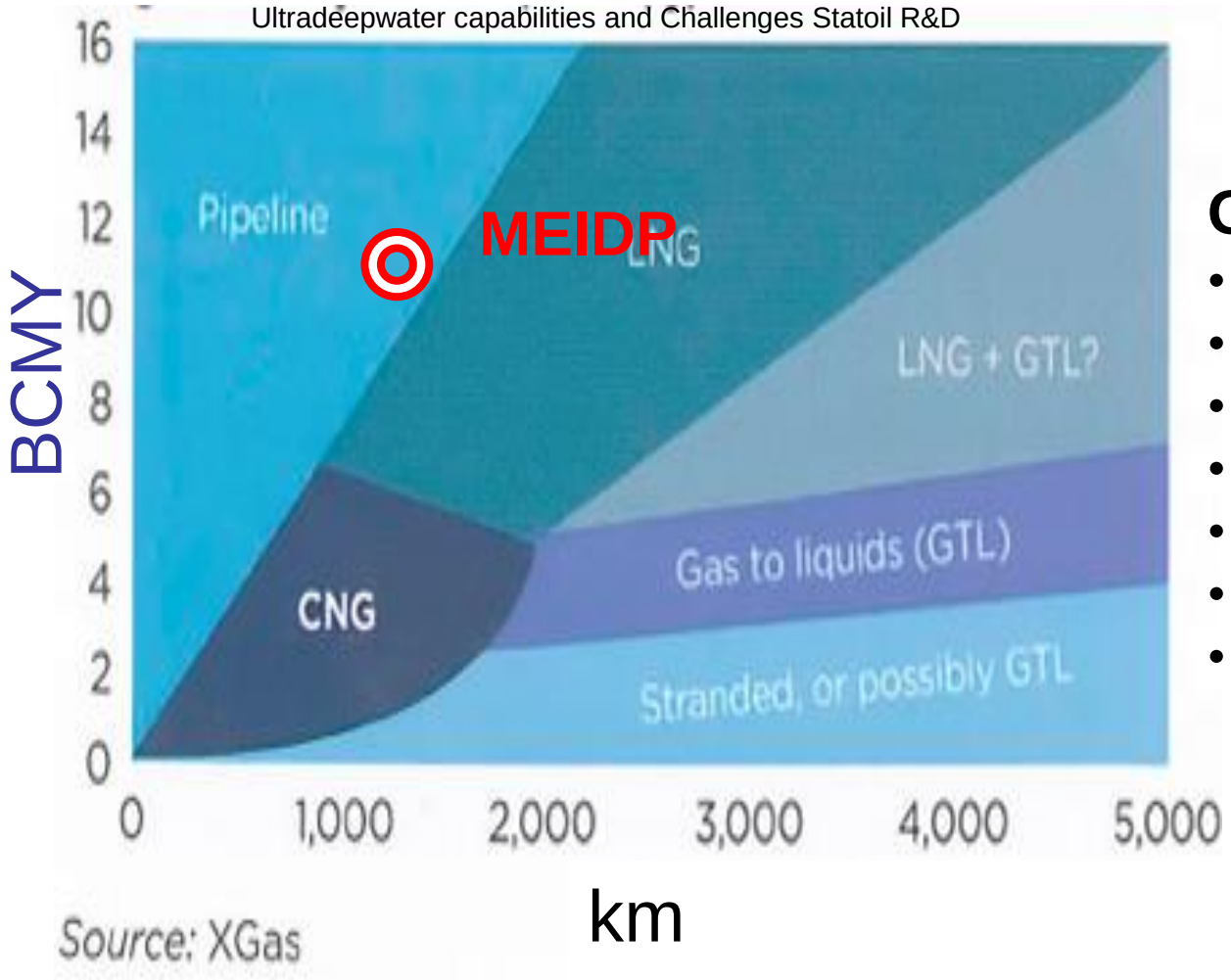
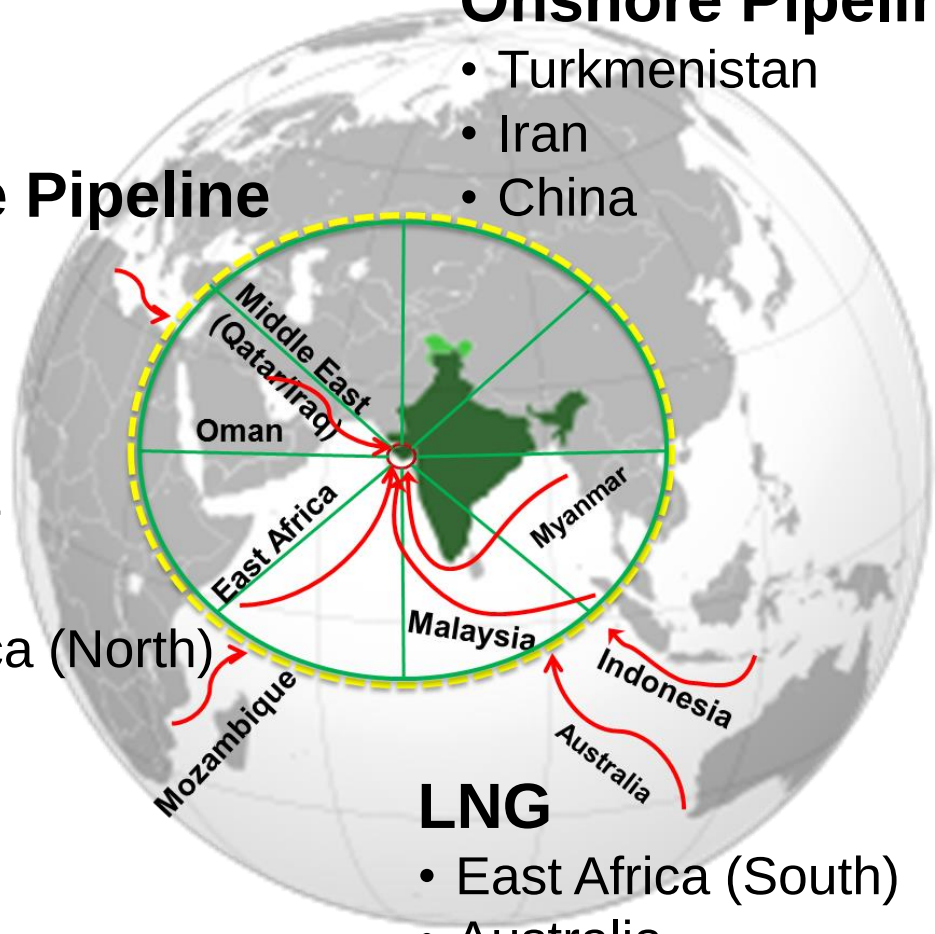
Competitiveness of Pipelines



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

Onshore Pipeline
- Turkmenistan
- Iran
- China



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

Economic Limit of Pipeline Gas to India is ~2000km

MEIDP an Opportunity for India, Ian Nash, Nov 2015

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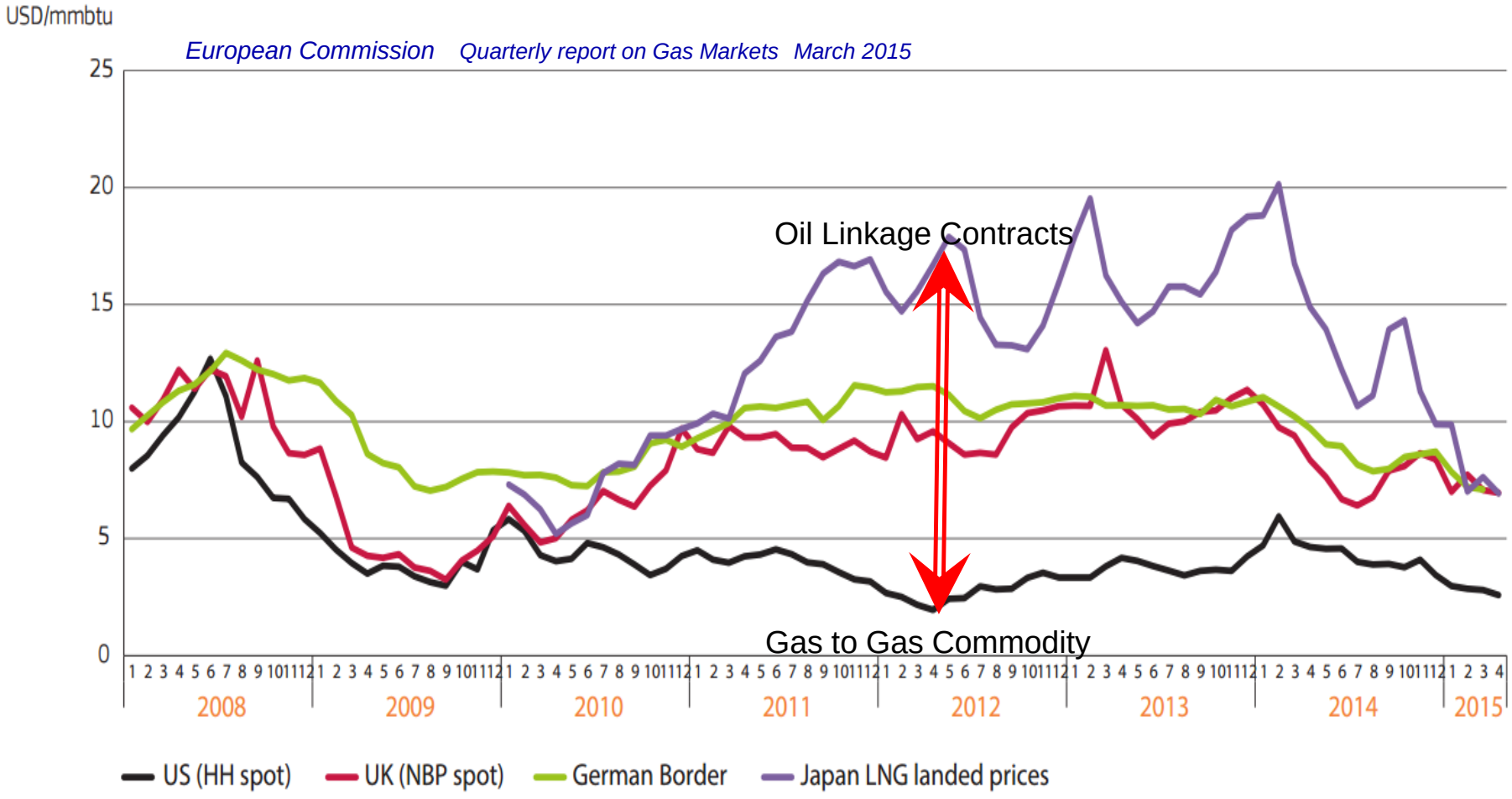
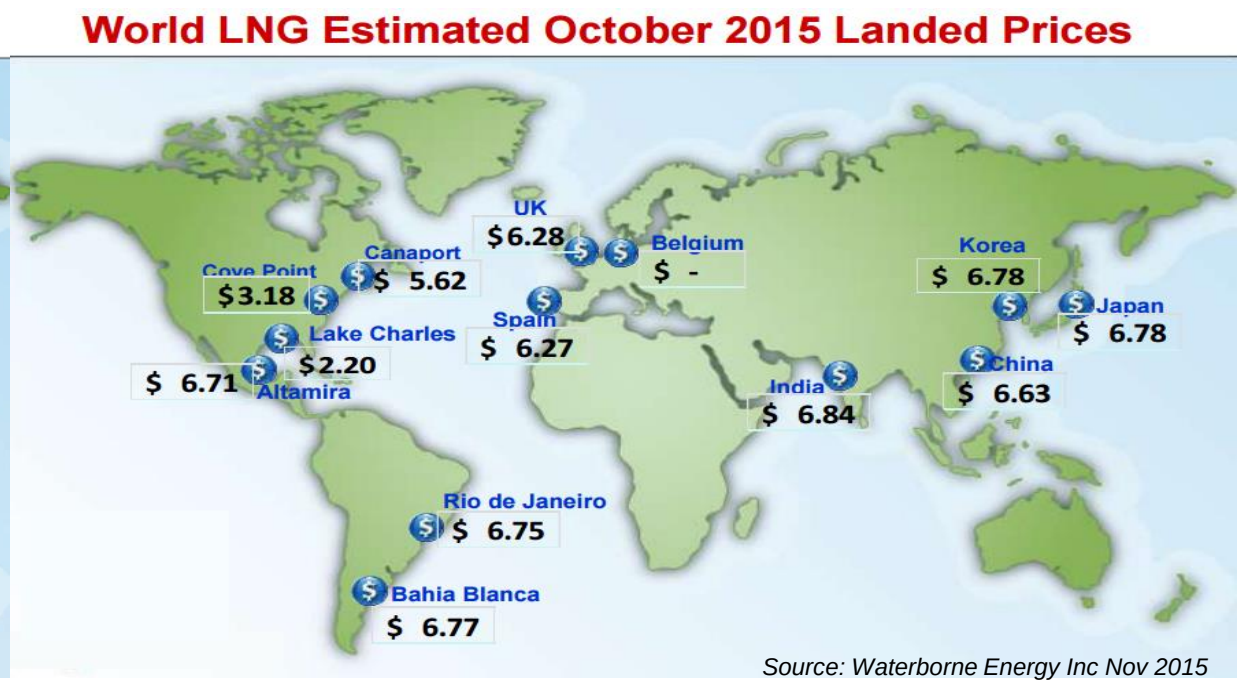
Regional Gas Price Behaviour Since 2007



International Hub Prices 1Q2015

- U.S. Henry Hub < $3.0
- Alberta $2.6
- UK NBP $7.0
- UK Pipeline $6.0
- German Waidhaus $7.0
- Japan Spot LNG $7.0
- Japan Long LNG $9.0

Worldwide Landed LNG Prices 2013 & 2015



- LNG US GOM (as Liquid) - $3.01 → $2.20
- LNG UK (as Liquid) - $9.94 → $6.28
- LNG India (as Liquid) – $15.70 →$6.84
- LNG Japan(as Liquid) - $19.75 →$6.78

Landed Cost of LNG as per existing Contracts for Gorgon Australia, Ras Gas, Cheniere-US are:

- PLL Dahej - $13.0
- PLL Kochi - $9.0
- GAIL Cheniere - $10.0

} Consistent with Japan Long Term Pricing

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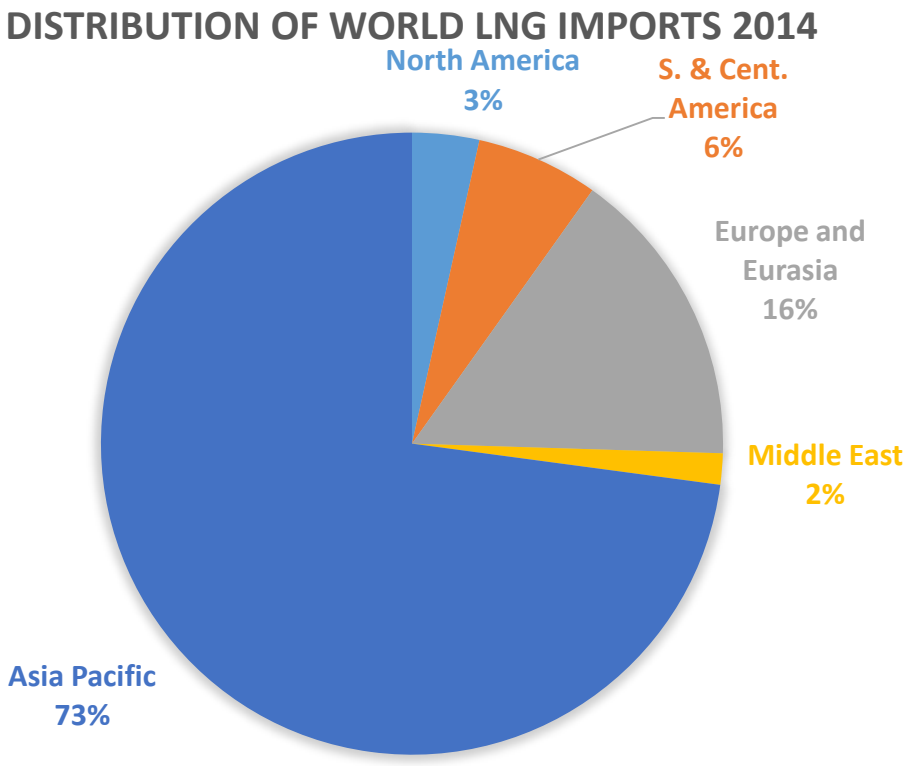
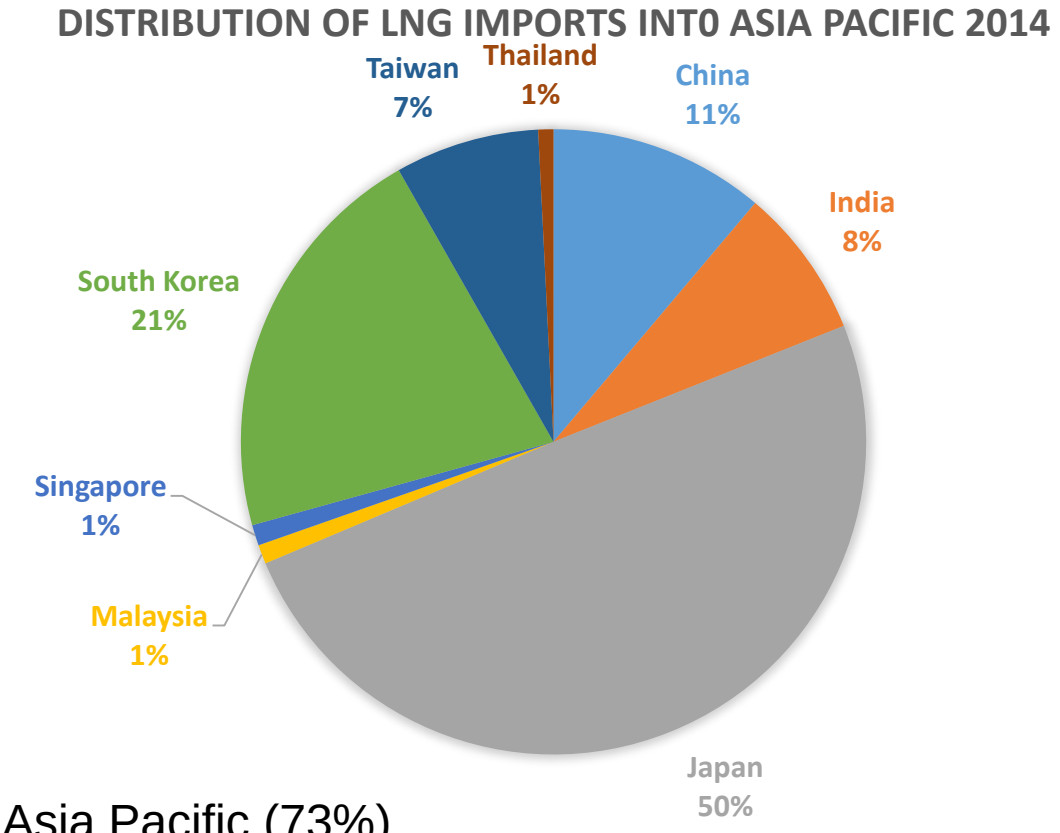
Worldwide LNG Imports 2014





BP Statistical Review of World Energy June 2015

LNG World Market is dominated by Asia Pacific (73%)
Asia Pacific Market is dominated by Japan & S Korea (71%)
Demand for Japan & S.Korea drives LNG pricing

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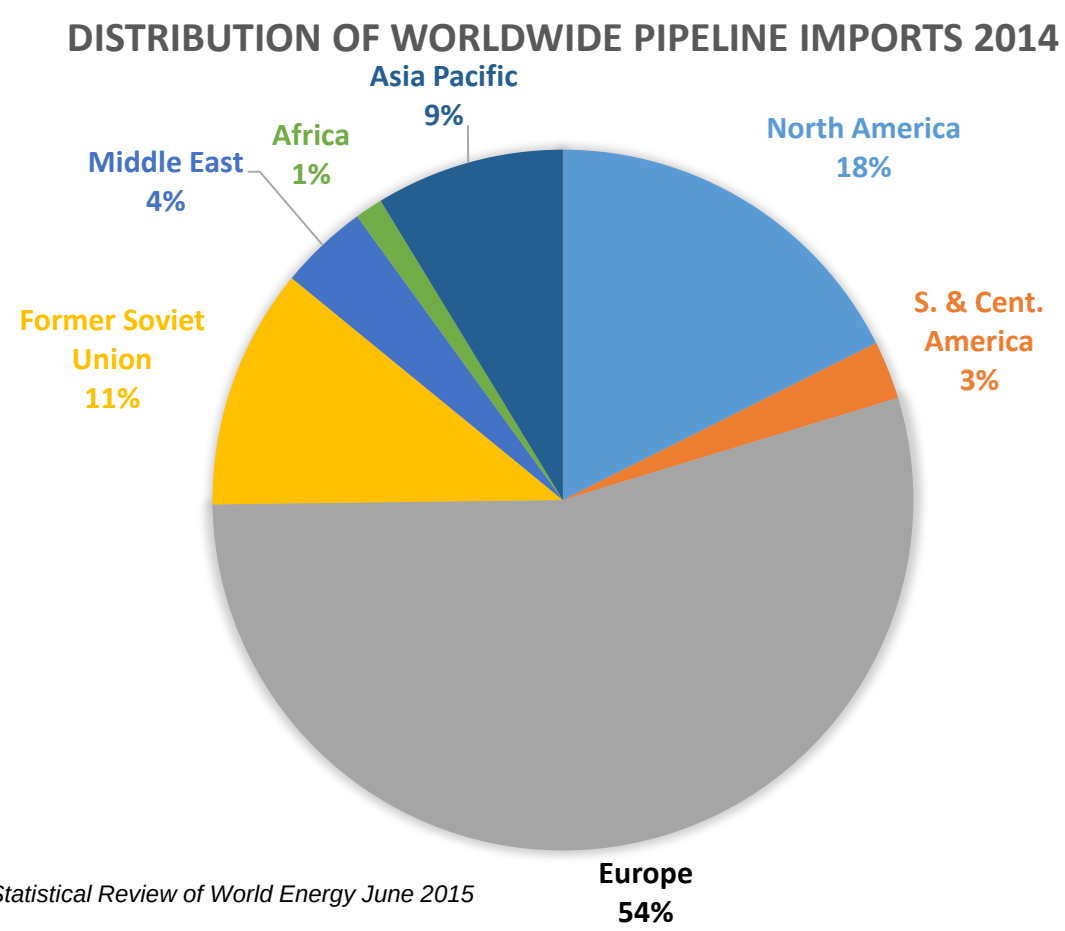
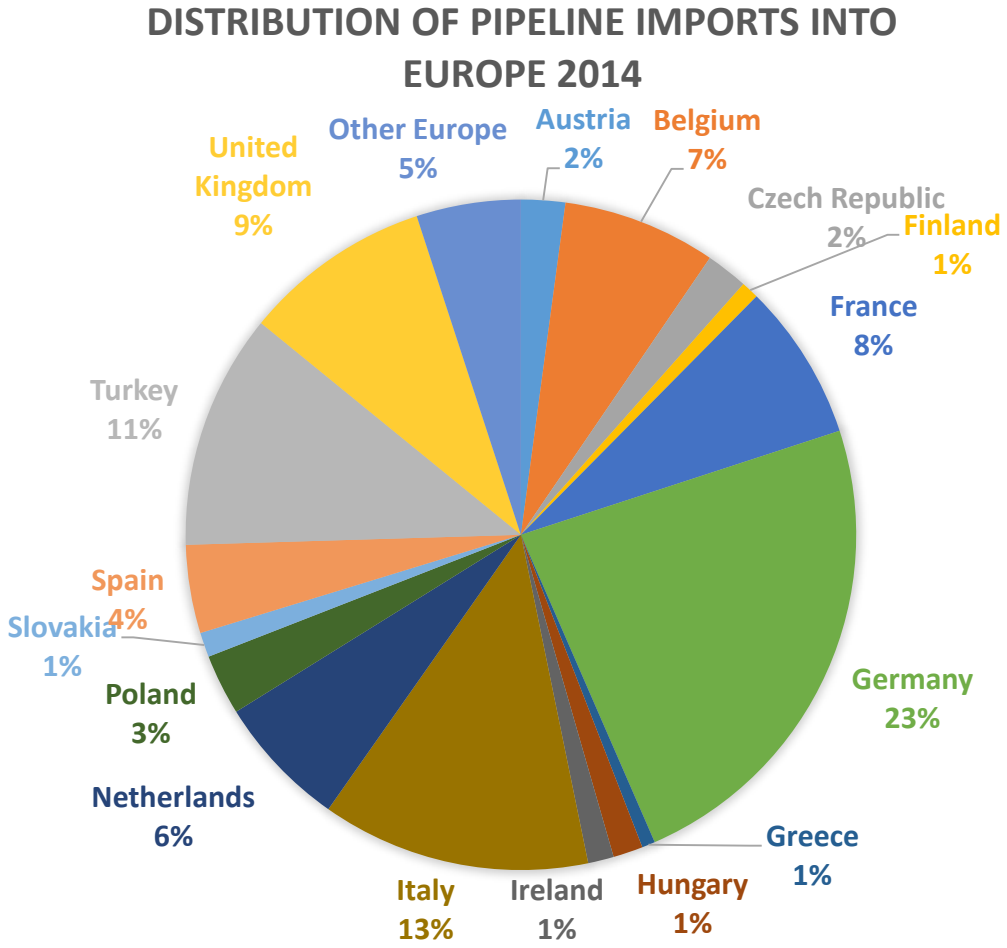
Worldwide Pipeline Gas Imports 2014

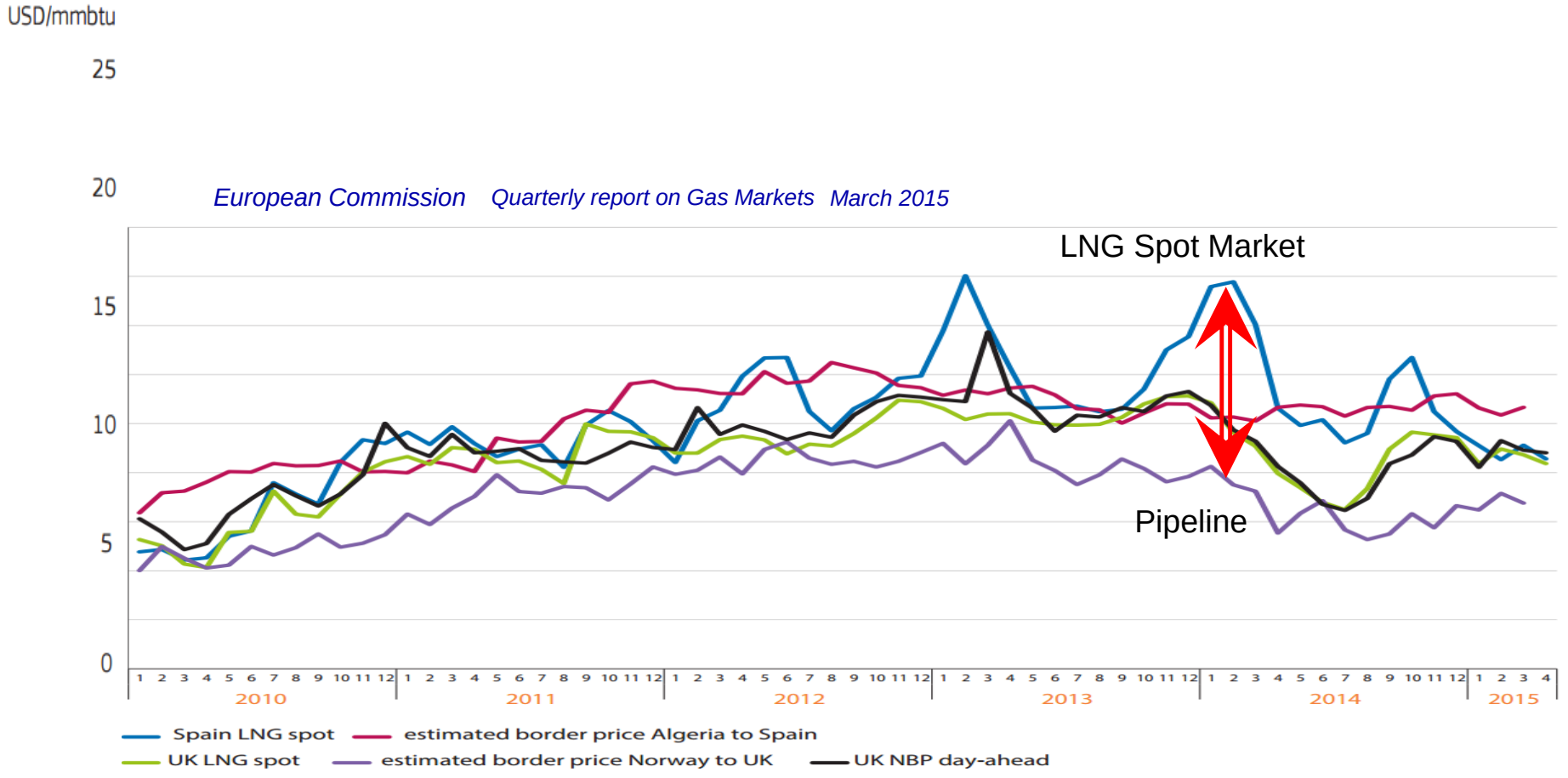


BP Statistical Review of World Energy June 2015



Europe has the majority of the Pipeline Gas World Market (54%)
No one country within Europe has a majority(23% max Germany)
Pipeline pricing is moderated by Multiple supply routes

European LNG Premium over Pipelines 2015



- LNG into UK NBP consistently $1.5/mmBtu over Pipelines
- LNG into Spain Seasonally dependent swing +3/-1.5 $/mmBtu over pipeline

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European Commissions View on Gas Pricing 1Q2015

European Commission *Quarterly report on Gas Markets* *March 2015*

- *"Most long-term LNG contracts continue to be indexed to oil and, in addition to the arrival of new supplies to the market, low oil prices should also keep LNG prices moderate. Asian oil-indexed LNG prices, which are typically lagged 3-4 months, have fallen significantly and are expected to reach a bottom in the summer at around 9 USD/mmbtu. This is still above Asian spot prices that were around 7 USD/mmbtu in the first quarter of 2015".*

- *"Weak demand in Asia and Latin America allowed European buyers to increase LNG imports. In the first quarter of the year, LNG deliveries significantly increased, particularly to Northwest Europe which has ample pipeline and LNG import capacities and therefore has a flexibility to **switch** between pipeline and LNG imports".*

LNG Delivery Costs to Asia

Project	Country	Delivered Cost to Asia ($/mmBtu)	Scheduled Start Date
Sakhalin	Russia	8.70	2009
Pluto	Australia	13.50	2012
Angola LNG	Angola	9.90	2013
PNG LNG	Papua New Guinea	10.50	2014
Queensland Curtis	Australia	10.80	2014
Australia Pacific LNG	Australia	11.20	2015
Gladstone LNG	Australia	11.40	2015
Gorgan	Australia	12.30	2015
Sabine	USA	9.90	2015
Ichthys	Australia	10.20	2016
Wheatstone	Australia	12.20	2016
Prelude	Australia	10.40	2017

- It is reasonable to assume that LNG price landed in India including regasification will be >$11/mmBtu
- Note US Shale Gas does not significantly effect this price
- HH Price in Feb 2015 <$3.0/mmbtu

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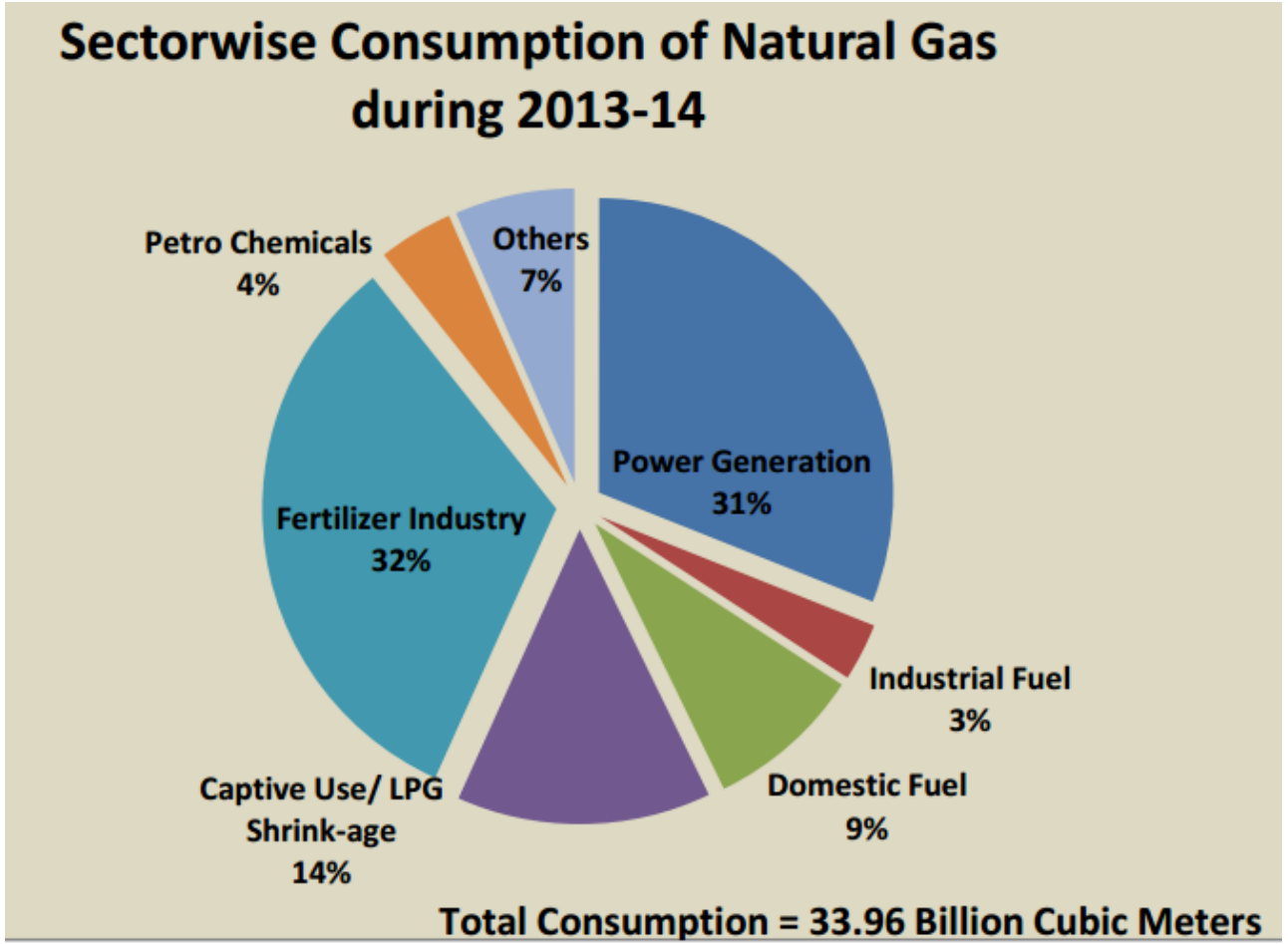
India's Gas Needs

- Subsidised Power Generation
- Subsidised Fertilizer Industry

- Can only survive with low cost pipeline gas.
- LNG based on Spot market is to volatile and is often unaffordable.



Post Shale Gas Reality

- Shale Gas and Oil (especially Oil) will become the swing determinant for prices in the short and mid term However:
- At prices less than $3.0/mmBtu Shale Gas becomes increasingly uneconomic
- US Major Shale plays are known and discovered. No new major Plays anticipated
- Shale Plays typically only last 2-3 years
- The lower the base price becomes the more significant the other costs become (Liquefaction, Regasification, Transportation) In a low gas price world Pipeline gas will be increasingly more competitive than LNG.

Climate Change Gas Reality

- Gas power stations can be constructed in 3-4 years
- Gas emits 54% of the CO_2 of an equivalent Coal facility
- Decommissioning “Dirty Coal” and replaced with CO_2 friendly alternative can only be achieved with Gas in the short to medium term.
- Climate Targets for CO_2 reduction need Gas in the short to Medium term to be the “Enabler”
- Most likely outcome of Paris Climate Conference will be increase use of Gas for power generation
- India should focus on Gas based Power Generation

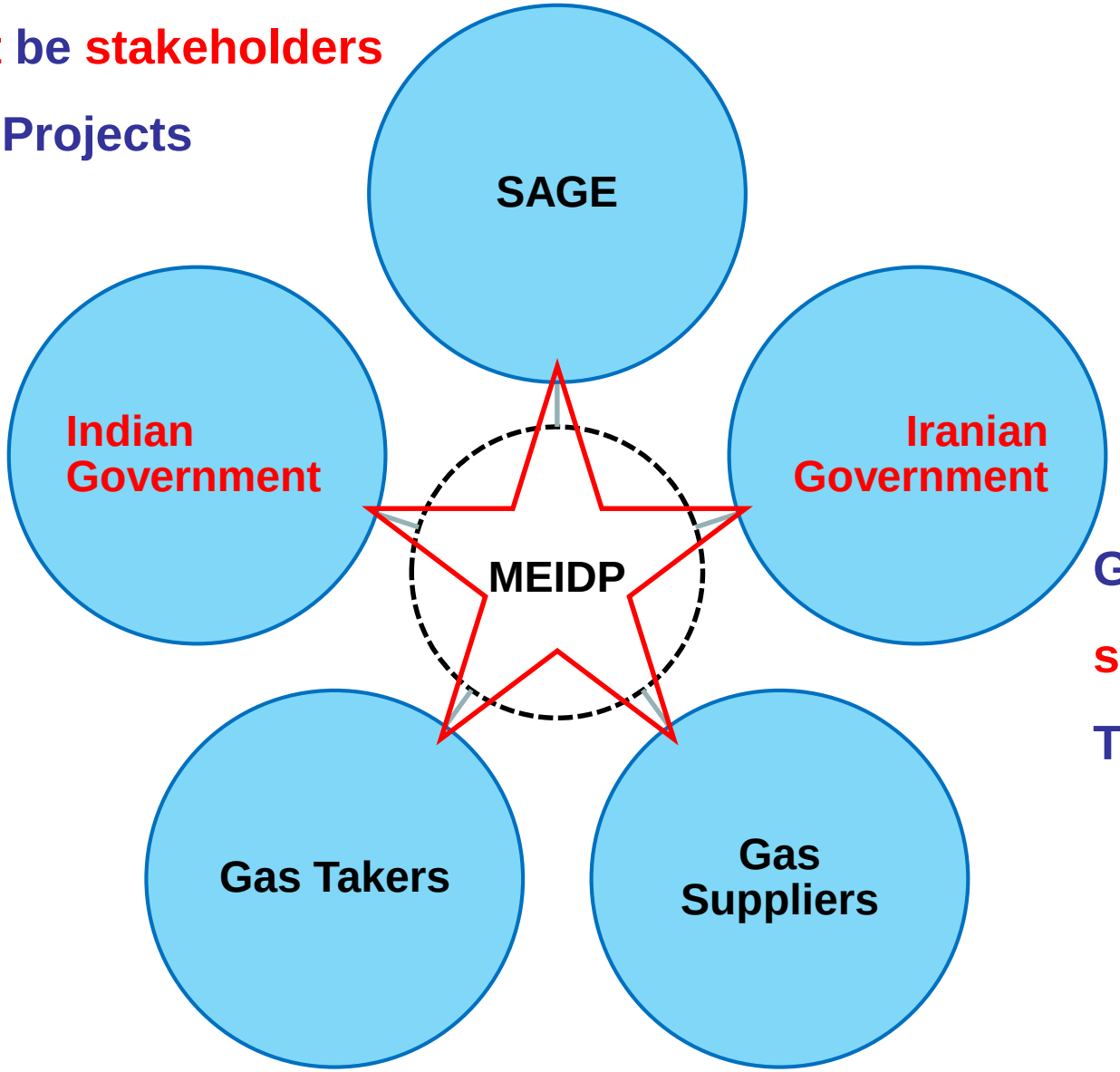
The SAGE Project Vision

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**]
- SAGE has been working on the Project for last 6 years, with Global Consortium
- The case for MEIDP has been strengthened by **recent development** work by SAGE and the deepwater **design and pipelay experience** from the last decade

MEIDP Stakeholders

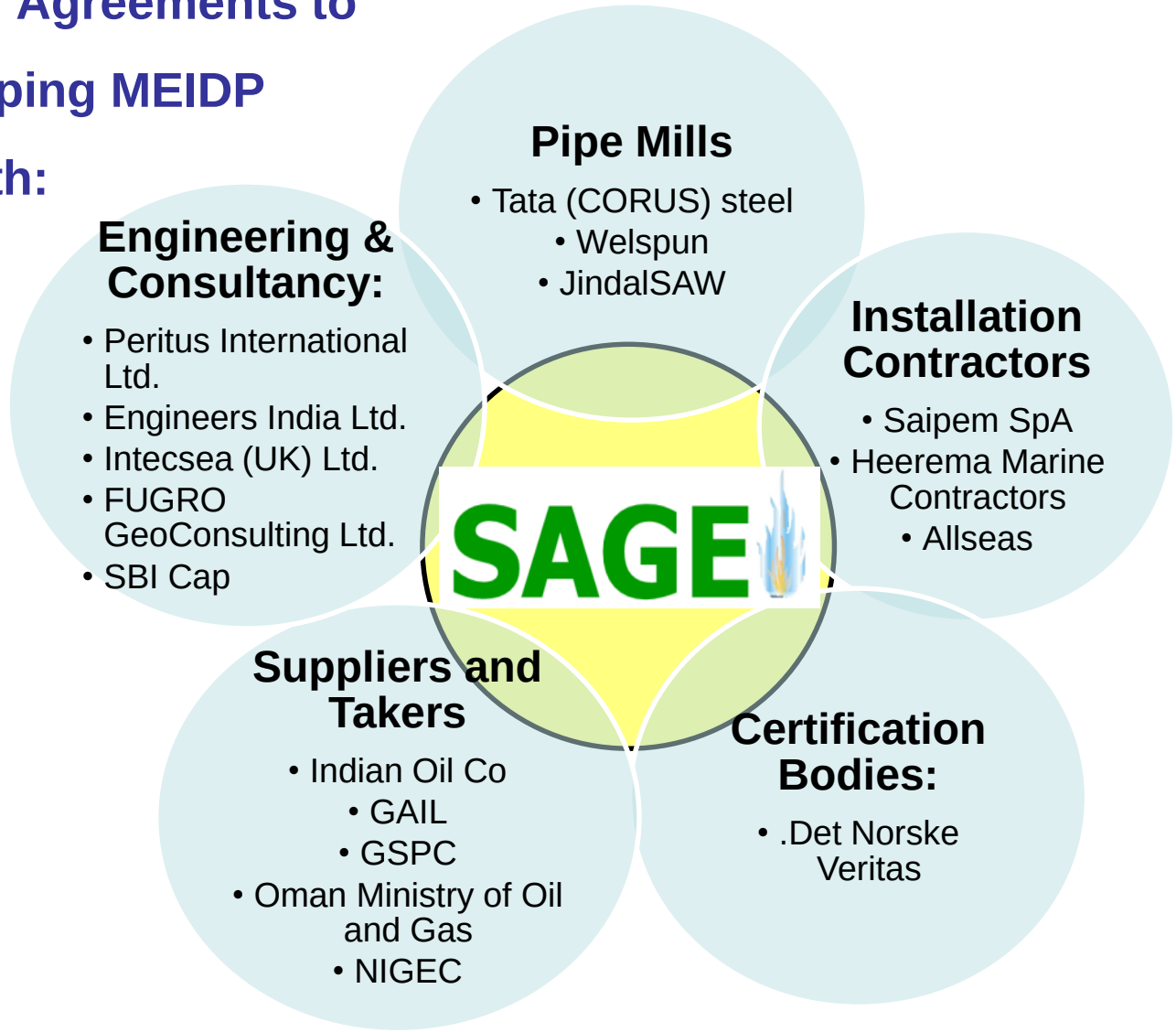
All interest parties must be stakeholders for Large Infrastructure Projects



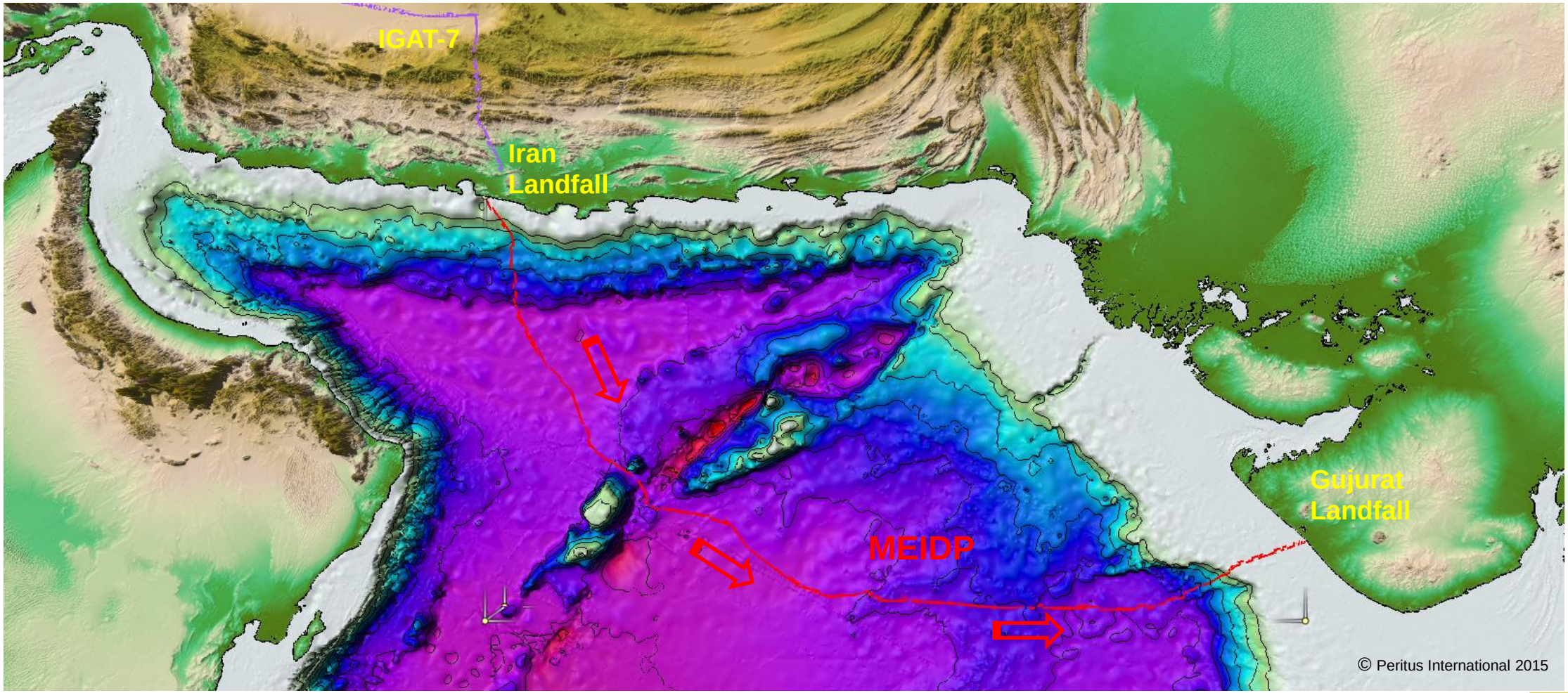
Governments must be stakeholders for Transnational Pipelines

SAGE Working in Partnership

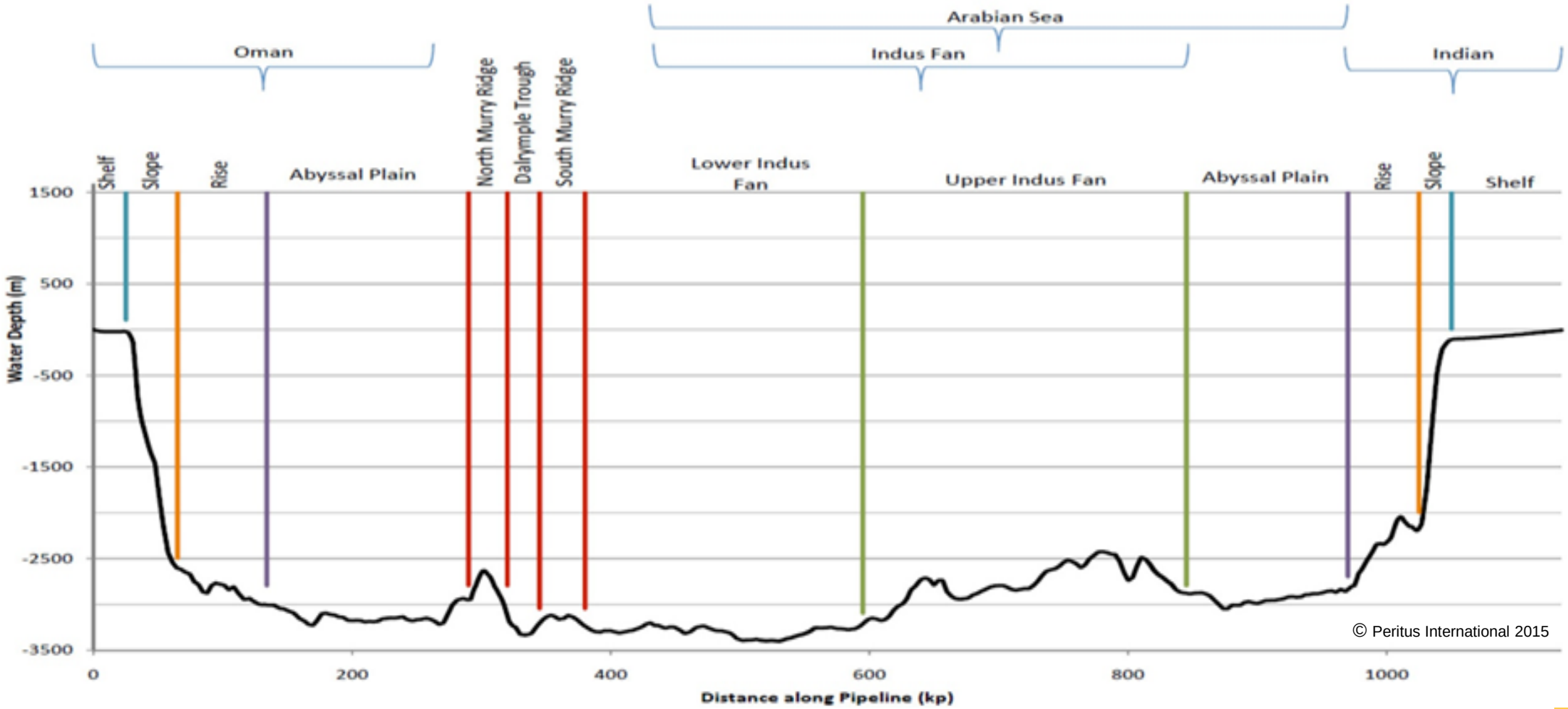
SAGE has MOUs and Agreements to Co-operate in developing MEIDP have been signed with:



MEIDP Route to India



MEIDP Route Profile



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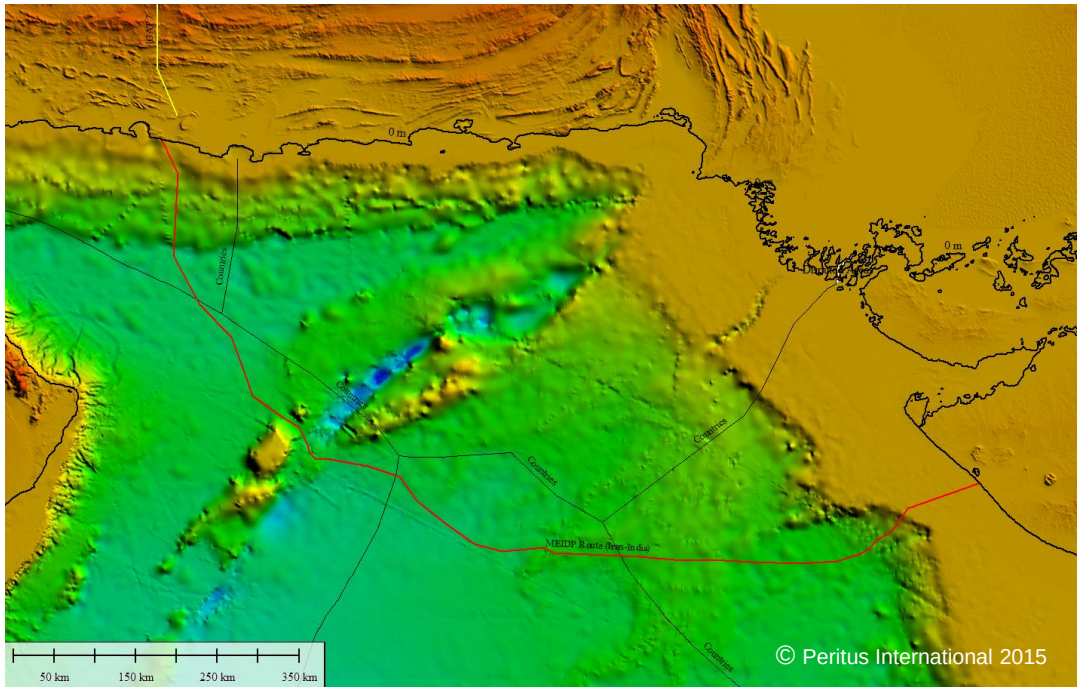
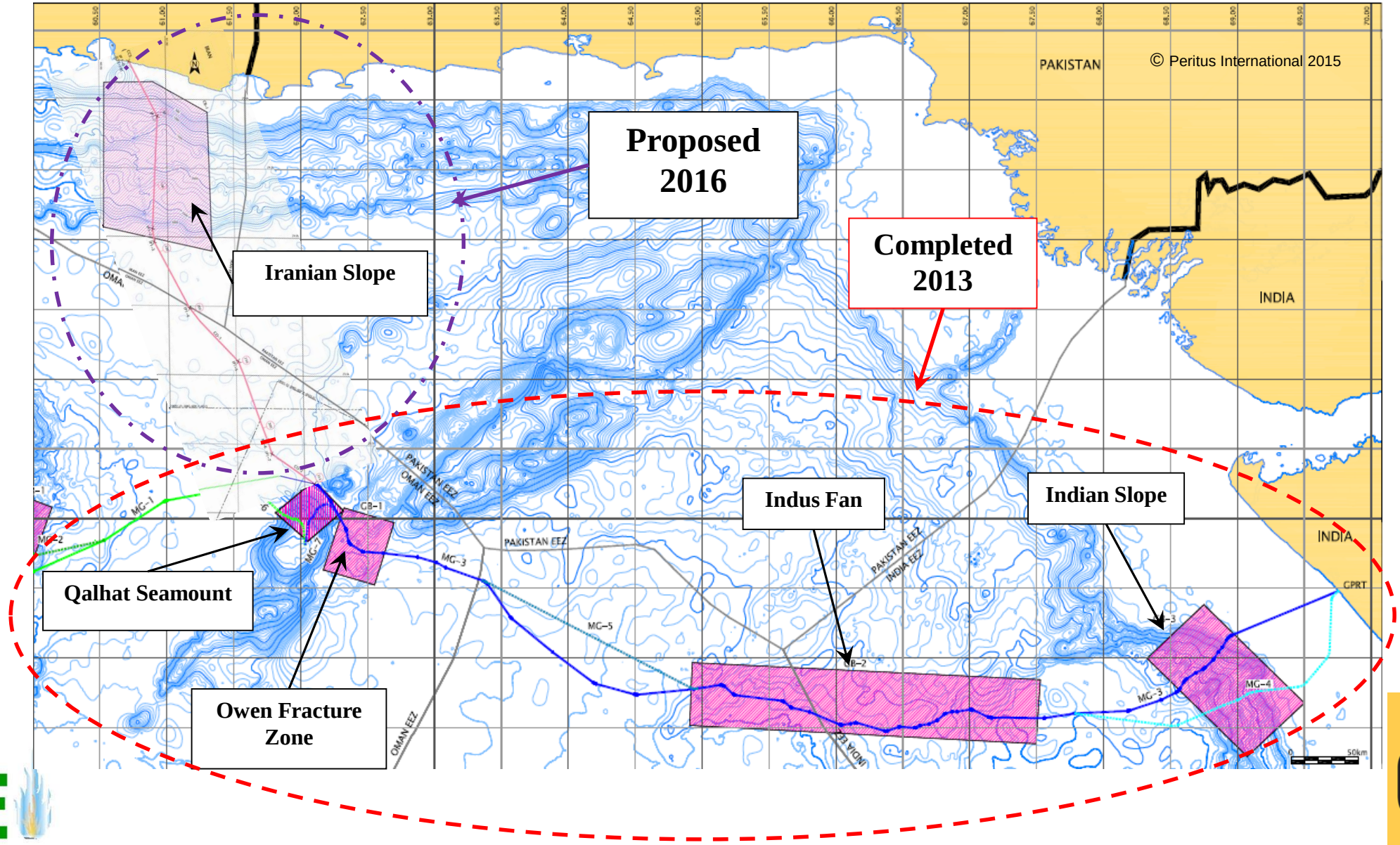
MEIDP Project Features

- **Start Points: -** Chabahar, Iran (IGAT 7)
- **End Point:** - Near Porbandar (South Gujarat), India
- **Flowrate:-** 1.1BSCFD (31.1mmscmd)
- **Inlet Pressure:-** 400barg
- **Diameter:-** 24” I.D. (27.2” O.D.)
- **Steel Grade: -** DNV SAWL485 FDU
- **Maximum Depth:** - 3,450 meters
- **Length:** - 1,300 kilometers
- **Project Duration:** - 5years (as Fast Track Project)
- **Pipeline Construction:** - 2 years



MEIDP Reconnaissance Survey Route



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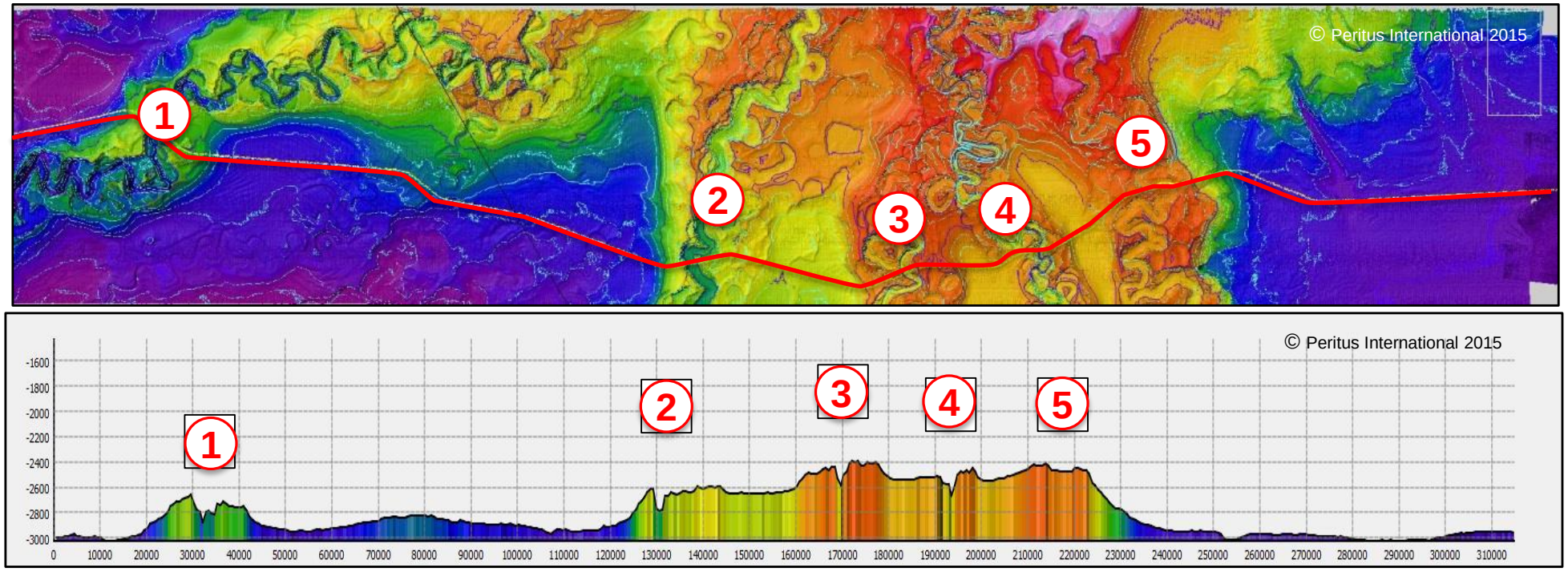
Indus Fan Characteristics



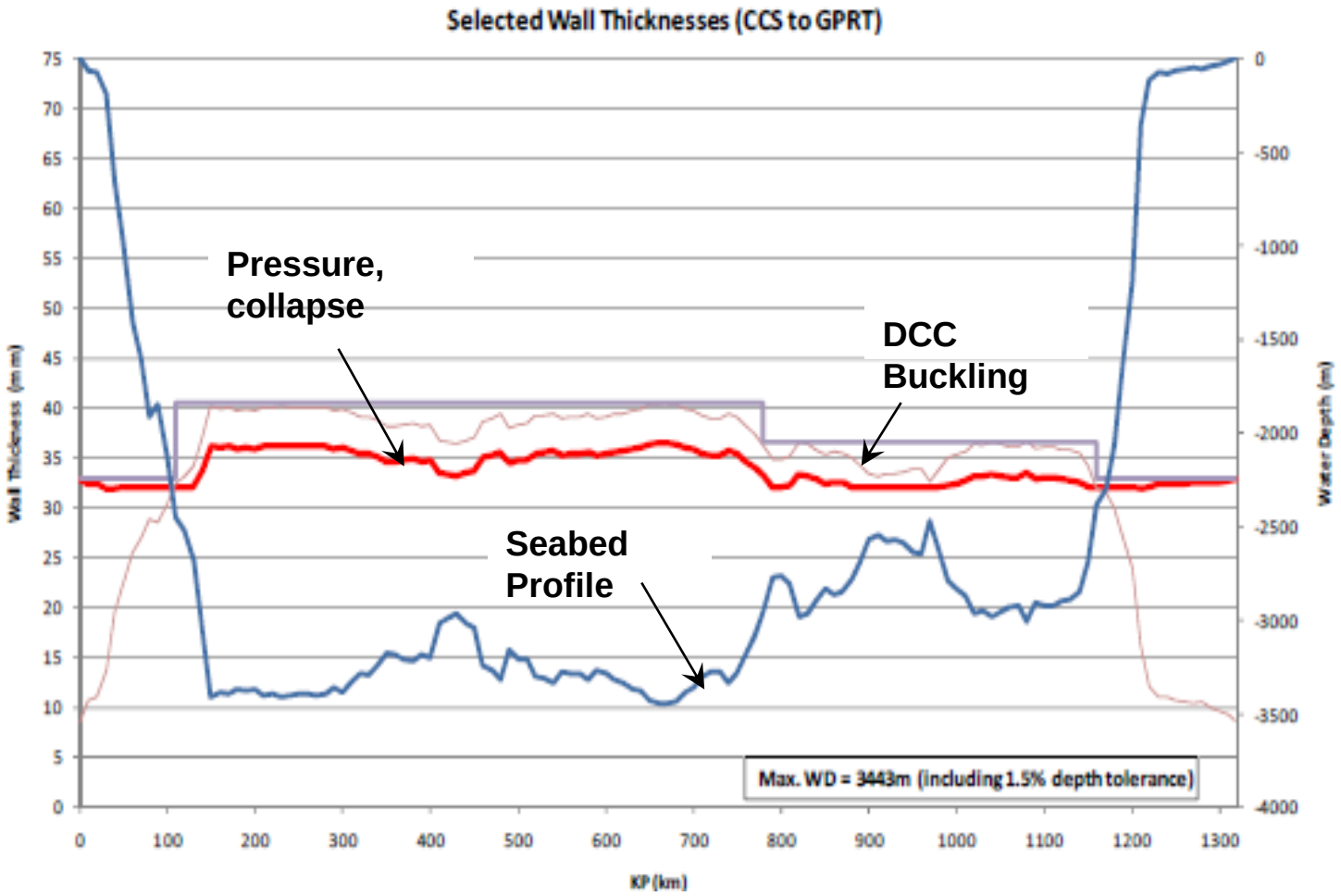
Indus River Abyssal Fan Route:-

- water depths between 2100m - 3200m
- crosses five turbidity current Channels
- Channels up to 200m deep with side slopes up to 35°
- channels follow a meandering flow pattern in N-S direction

MEIDP 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 and Europipe are capable vendors. Others want to Prequalify.
Lay Vessel	No Ultra Deep water vessel capability	Ultra Deep water vessels with adequate capability are available.	Casterone and Aegir are already available in the field. Pioneering Spirit is under commissioning.
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, Subsea 7, Technip and others. Currently work class ROV have been rated to 4000m depth.

MEIDP Wall Thickness Requirement



24” ID Selected WT’s
40.5mm, 36.6mm, 32.9mm
796,500 tonnes

Mills capable of making MEIDP Linepipe

- Welspun (India) - JCOE
- JindalSAW (India) – JCOE
- Tata (UK) - UOE
- Europipe (Germany) - UOE
- JFE (Japan) – UOE
- Others?

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MEIDP Pipe Manufacture in India

INTERNAL

- 48”ODx23.7 mm WT
- L555M PSL2
- Strain based design

SOUTH STREAM

- 32”ODx39 mm WT, L485 SFDU
- 33”ODx41.0 mm, L450 SFDU
- Offshore
- Deep water (2200 m)
- Sour service

GALSI

- 26”ODx37.1 mm WT
- L485 IFDU
- Offshore
- Deep water (2880 m)
- Sweet service

PETROBRAS

- 20”ODx9.05 mm WT
- L485 SFDU
- Offshore
- Deep water (1450m)
- Sour service

SAGE

- 26”ODx37.1 mm WT
- SAWL 485 FDU
- Offshore
- Deep water (3500 m)
- Sweet service

WELSPUN

Dare to commit.

JINDAL SAW LTD.

TOTAL PIPE SOLUTIONS

SAGE

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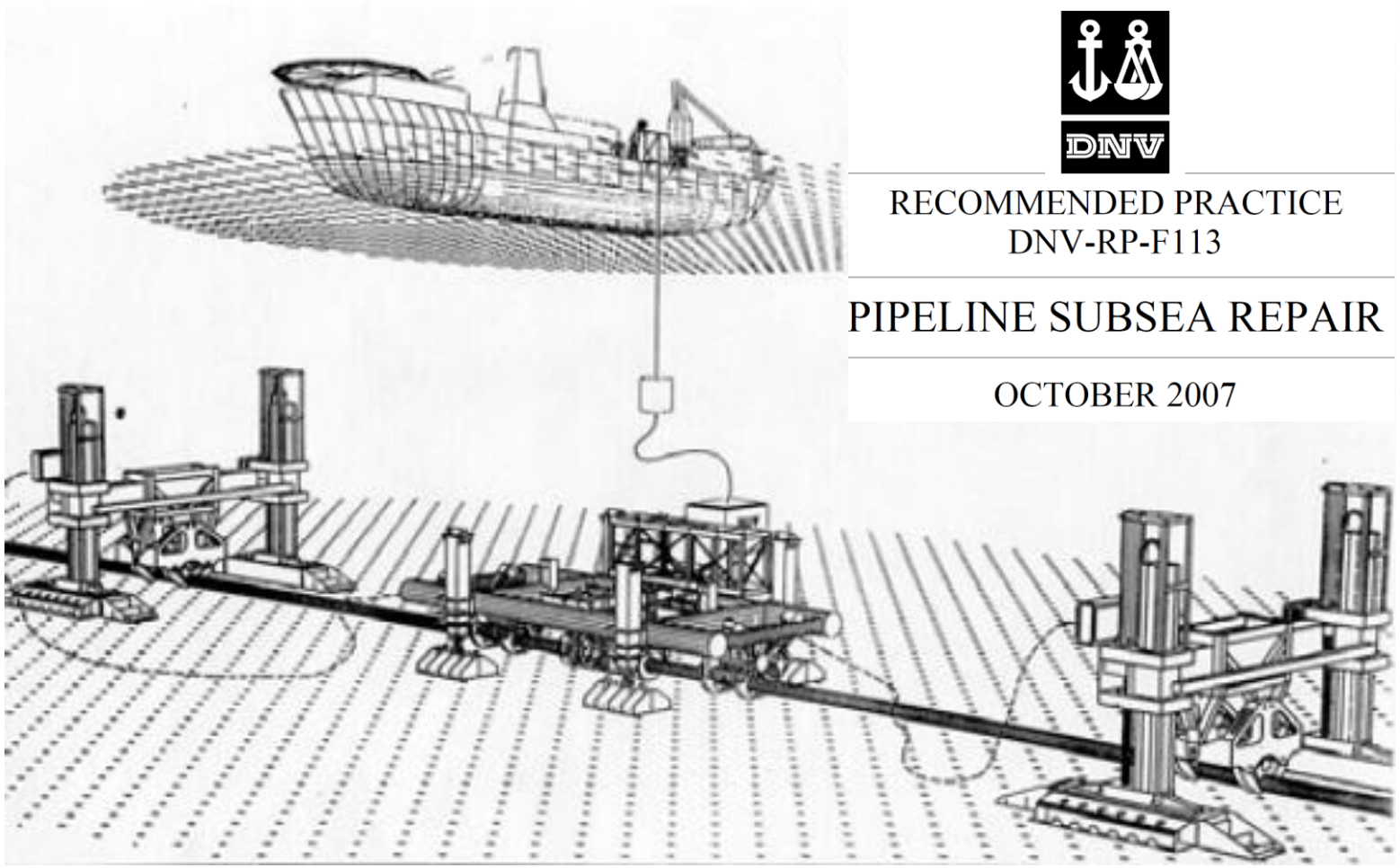
MEIDP Capable Pipelay Vessels

MEIDP Vessel Requirement
Tension Capacity 2000tonnes

MEIDP Emergency Pipeline Repair Systems

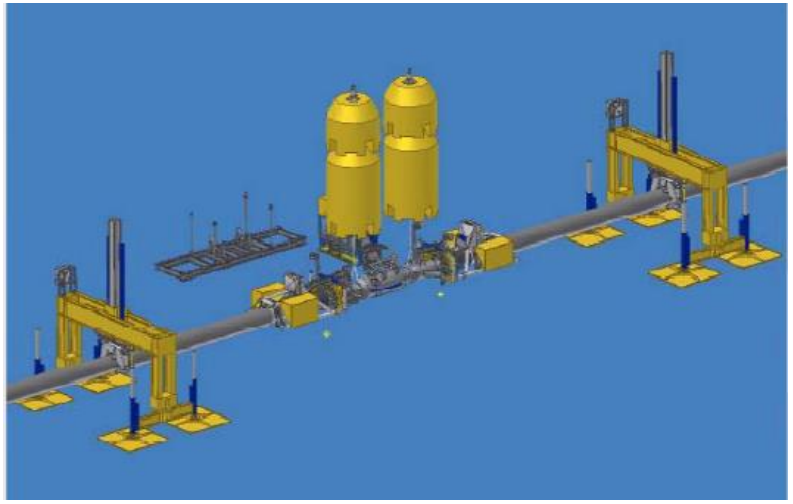


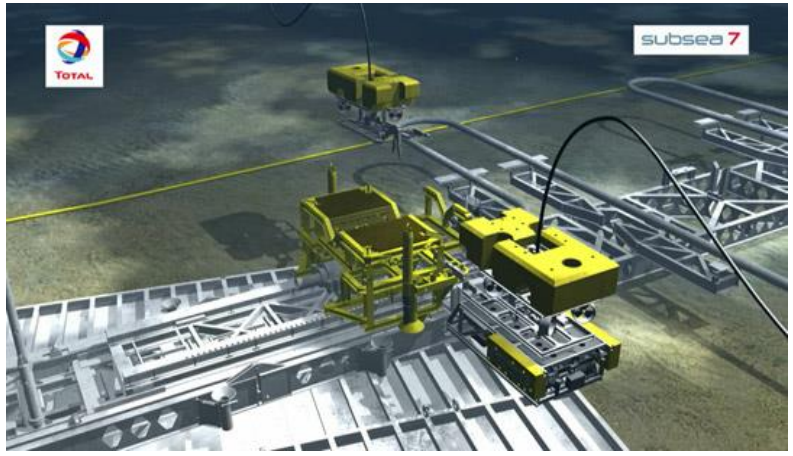
DNV

RECOMMENDED PRACTICE
DNV-RP-F113

PIPELINE SUBSEA REPAIR

OCTOBER 2007





MEIDP an Opportunity for India, Ian Nash, Nov 2015

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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

Emergency Pipeline Repair System

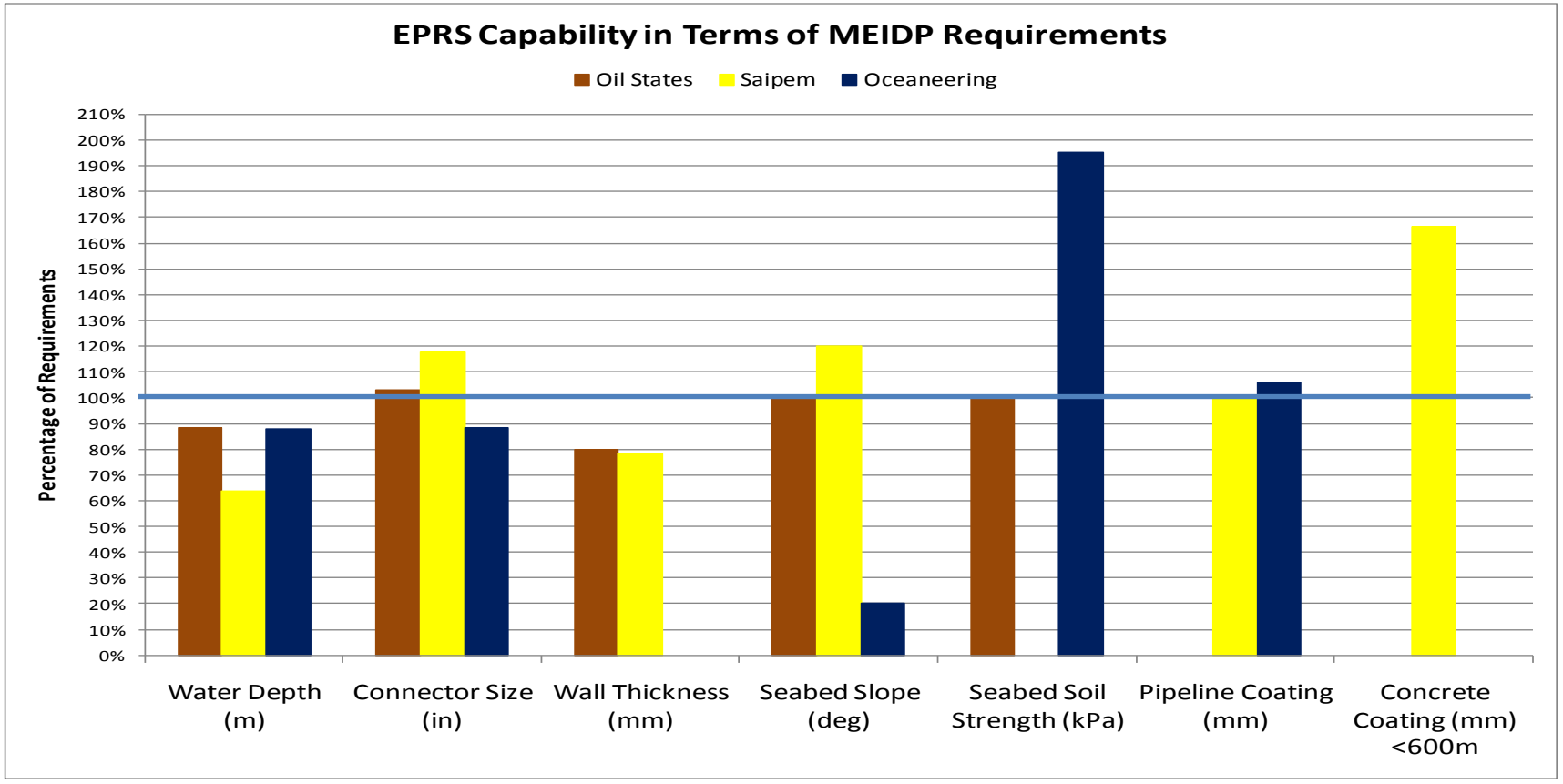
The functional requirements identified for an MEIDP emergency repair system are:

- Operable at water depths up to 3500m
- Operable on 24” internal diameter pipelines
- Operable with steel wall thickness up to 40.5 mm and associated coatings
- Operable on seabed soils of very soft clay and silt
- Operable on seabed slopes of up to 28 degrees
- Capable of providing a repair capability extending from minor dents to replacement of multiple pipe joints

While not mandatory, it is advantageous if the system(s) and equipment also exhibit the following characteristics:

- Modular and/or lightweight
- Minimum number of components
- Incur minimal shut down and/or reduction of operation
- Minimum CAPEX investment

Candidate Systems Capability



- Saipem system (SirCOS) - Currently Rated to 2200m – Can be upgraded to 3500m
- Oceaneering system – Currently rated to 3000m - Can be upgraded to 3500m
- Oil States system – Currently rated to 3000m – Can be upgraded to 3500m

MEIDP Completed Activities

- Design Basis definition
- Flow Assurance Studies
- Mechanical Design
- Onshore Compression Station
- Offshore Compression Station Definition & Review
- Receiving Terminal Definition
- Quantified Risk Assessment
- 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
- Reconnaissance Survey Completed
- Landfall point identification in India

MEIDP Current and Planned work

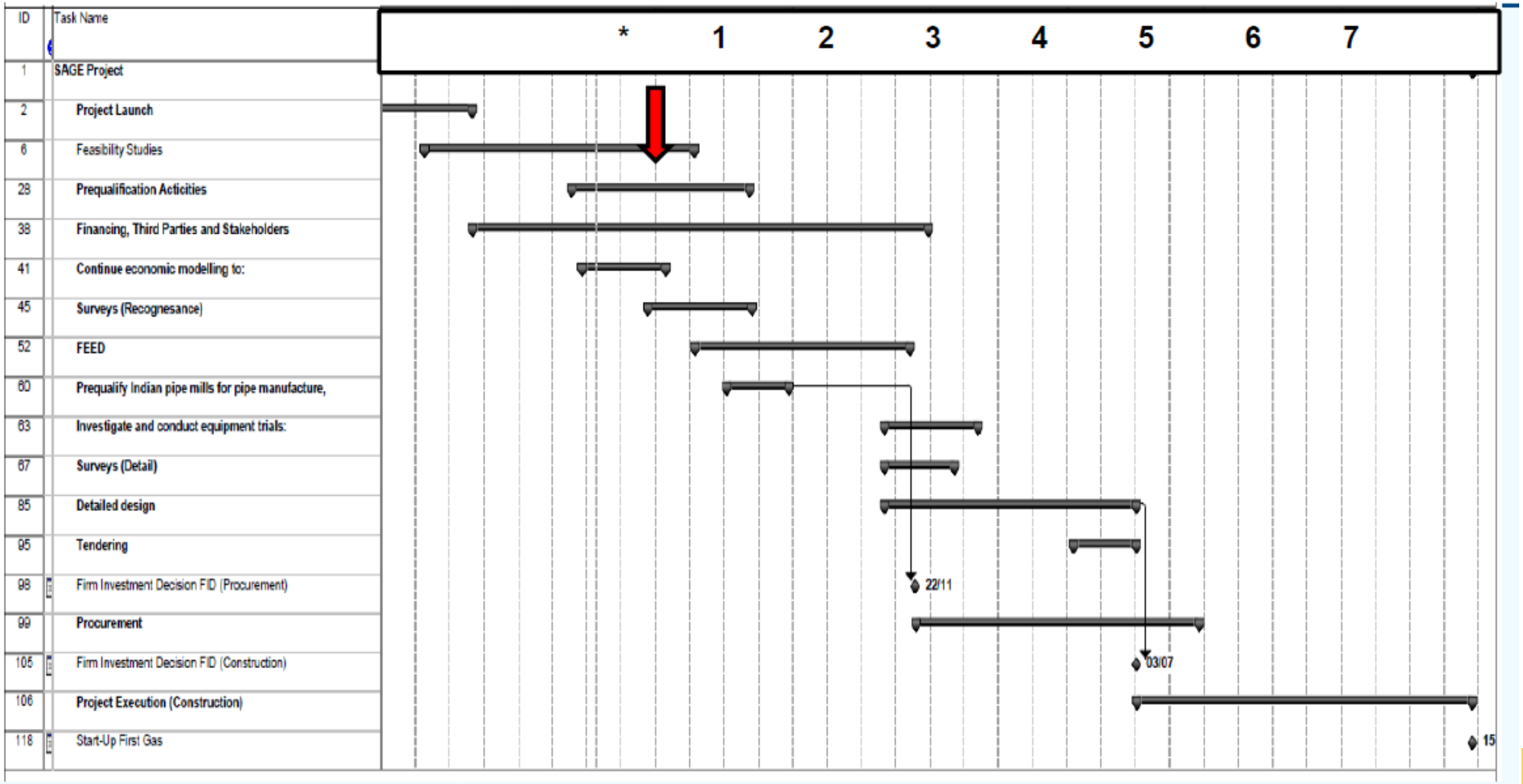
Ongoing Work

- Conceptual Design Update
- Master Project Schedule Update
- Cost Estimate Update
- Route Review and Refinement

Planned Work

- Iran Leg Reconnaissance survey
- Intervention optimisation at the Continental Slopes, Owen Fracture Zone and Indus Fan
- Metocean Data Collection on Site
- Environmental Statement & Survey
- Detailed Geophysical & Geotechnical Surveys
- Offshore Pipeline and Onshore Facilities FEED's (2 off)

MEIDP Project Development Schedule



- Pre-FEED to 1st Gas is a 7yr undertaking
- On Fast Track FEED to 1st Gas can be 5yrs
- Offshore Construction Period 2 yrs

Indicative Project Cost

- Indicative Project Cost $4 Bn
- Cost Estimate currently being updated
- Project Cost Break down

($Mn)

Particulars	Offshore Segment	Iran Onshore Segment	India Onshore Segment	CCS	GPRT	Total
Material Procurement	1,324	12	54	204	100	1,693
Construction	584	10	15	197	118	923
Pre- Commissioning& Commissioning	25	-	-	8	5	38
Engineering & Project Management	125	8	11	50	40	233
Insurance and Certification	48	0	1	10	6	65
Contingency (45%)	948	14	36	211	121	1,328
Total Hard Cost	**3,054**	**44**	**117**	**680**	**390**	**4,280**
Interest during Construction period						200
Total Project Cost	**3,054**	**44**	**117**	**680**	**390**	**4,480**

Financial Highlights

- Project Cost: USD ~$4.5 Billion (Iranian – Indian)

- SBI Capital Markets recommended various feasible financing options
  - Cost of equity in the range 2% to 10%.
  - Debt at 5%
  - Debt to Equity Ratio 2.33:1
  - Project Internal Rate of Return (IRR) of 12-14%

- A SAGE cost estimate gives a gas transport tariff between $2.0/MMBTU - $2.25/MMBTU

MEIDP Indicative Overall Economics Today

IPI Agree Gas price was $4.93/mmbtu at Pakistan Boarder!! *Russia – China Gas Agreement was ~$9.9/mmbtu at China Boarder*	Costs $/mmBtu				
	Pipeline from Iran Direct	Pipeline Via Oman	LNG from Iran	LNG from Asia	LNG from USA
Assumed price of dry gas at port	5	5	5	6	4
Liquefaction Cost			3	3	3
Transit Fee 3rd Part Country		0.5			
Transportation cost	2.25	2.25	0.5	1	2.25
Re-Gasification			1	1	1
Total costs gas landed in India West Coast	7.75	8.25	9.5	11.0	10.25

CONCLUSION: MEIDP will save $2/MMBTU in transportation costs over LNG and possibly more.

MEIDP Conclusions

- 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 supplying a **2nd SAGE Pipeline**
- Project will add to energy **security of energy supply by diversification**
- Contribute significantly towards **sustainable development** and an **integrated energy plan** for the Indian Subcontinent
- Provides an **economically competitive** method of gas supply and **Promotes competition** in the Indian energy markets
- Enhances the **security** for Indian subcontinent
- The **technology** to design and lay deep sea pipeline is available **now**.
- The project is **financially** and **technically viable**

MEIDP An Opportunity for India

- The Project will provide **billions of Dollars** of opportunities to Indian Companies. to participate in the supply of equipment & services

- Long Term contracts and surety of supply and lower costs, will facilitate **new projects in India** which utilise the Gas (eg., Power / Fertilizer Plants)

- India will become a world leader in Long distance Ultra deep Gas transmission Pipelines

What An Opportunity for India!

Thank You

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